Across time, across the body

Transversal temporal gestures

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Talk about time is commonly accompanied by co-speech gesture. Though much recent work has looked at how time is construed as space in the languages of the world, few studies have examined *temporal gestures* in any detail. Our focus is on a particular pattern among American English speakers — transversal temporal gestures — in which time is conceptualized as moving from left to right across the body. Based on numerous examples elicited in a controlled observational paradigm, we suggest a classification of American English speakers’ transversal temporal gestures into five types — *placing, pointing, duration-marking, bridging,* and *animating* — and provide examples of each type. Discussion focuses on the following three topics: the usefulness of quasi-experimental approaches for the study of gesture; variation in temporal gestures across cultures; and how temporal gestures fit into a broader understanding of metaphorical gestures.

*Keywords:* time, temporal gesture, space, metaphor, conceptualization, pointing
Among American English speakers, transversal gestures are a commonplace accompaniment to talk about time and they take several forms. Consider the following stretch of discourse, which is taken from a recent academic lecture on the computational modeling of human decision-making processes:

Example (1): 10;25

1 Intuitively, when you believe the world is changing quickly then
2 you should discount [the past] quickly, right?
3 You should just forget about [that past] and only look at maybe the [last
4 trial] if you believe change is happening rapidly.
5 If you believe that change is happening slowly, so that [alpha is close to
6 one], so [probably changing is] very small, then you should take in
7 [longer] - take into consideration [longer time-time constants].

In just over ten seconds of talk, this speaker produces a number of gestures that are intimately related to how she is conceptualizing time. As she says “the past” in line 2, she points with the index finger of her left hand, her arm fully extended off to her left. She repeats the gesture while saying “that past” in line 3, but now with a full-hand morphology. As she mentions the “last trial” (lines 3 and 4), she produces a downward stroke with her left hand slightly to her left. As she describes different rates of “change” (lines 4–6) she twice makes lateral sweeps of her left hand from left to right and slightly outward from her body. Each sweep is punctuated by downward strokes of small amplitude. Finally, as she describes the “longer time constants” (lines 6 and 7) she extends both arms fully outward, implying a long swath of time running across her body. Are this speaker’s gestures one-off motor actions, or do they belong to a systematic class of time-related gestures? If so, how is this class structured?

Example (1) above — as well as similar naturalistic data — hints at a degree of systematicity in English speakers’ temporal conceptualizations. To explore this systematicity, and to more thoroughly characterize the phenomenon of temporal gestures, we conducted a quasi-experimental investigation of how English speakers reason about and communicate temporal concepts in conversation. In our paradigm, participants tell each other a version of the history of the universe. The paradigm yields discourse that is densely packed with temporal reasoning and transversal temporal gestures. The findings of this on-going study suggest that the phenomenon of temporal gesture is both more textured and more pervasive than previously appreciated. In what follows, we have three aims: first, to briefly review recent research on temporal conceptualization and temporal gestures; second, to characterize in detail English speakers’ transversal temporal gestures by presenting a classification of the most common types; and, third, to use the phenomenon of temporal gestures to open up a set of theoretical questions about methodology, cross-cultural variability, and metaphorical gesture.
Time as a domain is paradigmatically abstract — in psychologist J.J. Gibson’s phrase time is “the ghost of events” (Gibson, 1975, p. 299). Yet temporal concepts are of enormous everyday importance. They are deployed in routine activities like baking cakes, making plans, and sharing stories. The human cultures studied thus far have all addressed this problem in the same way: by talking about time in terms of a more concrete domain, space (Clark, 1973; Evans, 2003; Fauconnier & Turner, 2008; Lakoff & Johnson, 1999; Moore, 2000, 2007; Núñez, 1999; Núñez & Sweetser, 2006). Speakers use a vocabulary from the domain of physical objects — and certain aspects of this domain, such as motion, length, orientation, and relative position — to talk about temporal entities and temporal relations. For example, in English events can be said to “go slowly” (motion), take a “long time” (size), and occur “before” other events (position). At least at the linguistic level, there is a systematic mapping between entities and relations in the domain of time and corresponding entities and relations in the domain of space. This is not just a matter of a limited set of conventional expressions. In addition to linguistic data, there is an ever-growing body of experimental literature suggesting that people reason about time in situ using spatial reasoning abilities (Boroditsky, 2000, 2001; Boroditsky & Ramscar, 2002; Matlock, Ramscar, & Boroditsky, 2005; Núñez et al., 2006; Teuscher, McGuire, Collins, & Coulson, 2008; Torralbo, Santiago, & Lupiáñez, 2006). Indeed, even evidence from entirely non-linguistic tasks makes it clear that temporal and spatial reasoning are deeply interconnected (DeLong, 1981; Casasanto & Boroditsky, 2008).

Convergent evidence for the idea that humans conceptualize time as space can be found via another method: naturalistic observation of what speakers do with their hands and bodies when reasoning about time in conversation. Only a handful of studies have looked specifically at the gestural evidence for spatial construals of time (for an earlier review, see Kendon, 1993; for a review of spatial construals of time in sign language, see Engberg-Pederson, 1999). Perhaps the most complete discussion of time-related gestures to date is offered by Calbris (1990, pp. 85–93). In her study of French gestures, she observes that the future is in front of the speaker or off to the right; the past is behind the speaker or off to the left; and the present is at the speaker’s feet. Reference to past, present, or future time can thus be made by motions of the head or forefinger in the correct directions. After laying out these basic patterns, her discussion proceeds to describe gestures that accompany expressions of succession, continuity, and interval, among other temporal notions. With these observations, Calbris describes in broad strokes the French pattern of temporal gestures, and her observations generalize with few exceptions to English speakers.

However, what Calbris describes as a single system of temporal gestures we separate into two distinct patterns — sagittal gestures and transversal gestures —
which are rooted in different metaphorical construals of time as space. In their study of the Aymara people of the Andes, Núñez and Sweetser (2006) develop the distinction between sagittal and transversal temporal gesture patterns and analyze the metaphorical construals underlying each. Their particular focus is on the Aymara sagittal pattern, which we discuss in further detail below. In the English version of the *sagittal pattern*, the ego is construed as the reference point: the past is mapped behind the ego, the present is mapped to a spot collocated with the ego, and the future is mapped in front of the ego. In other words, the gesturing body is construed as a locus of movement through space and time such that the present is where one currently stands, the past is where one once stood, and the future is somewhere up ahead where one will stand. This sagittal pattern is similar to the one described by de Jorio. Our focus instead is on the *transversal pattern*, in which the unidimensional trajectory of time runs, at least among English speakers, from left to right. Thus later events are located to the right of earlier events. A crucial difference is that the sagittal pattern most often takes the ego as its reference point, whereas the transversal pattern does not necessarily involve any ego. To sum this idea up intuitively, it may be said that the sagittal pattern is anchored to the deictic “now”, the moment of speech. The transversal pattern is not anchored in this way, but construes events relative to each other. Thus, in using the transversal pattern to talk about two events that occurred in the past, e.g. the two World Wars, the speaker may gesturally locate one to the left and the other to the right.

There has been little interest in the particular temporal gesture habits of English speakers. In an important early paper on metaphorical gestures, Cienki (1998) noted a tendency for speakers to gesturally project events onto an imaginary timeline running from left to right, such that earlier events are positioned to the left and later events are positioned off to the right. Interestingly, Cienki makes no mention of the sagittal pattern described by Calbris, Núñez and Sweetser, and others. A key observation to come out of Cienki’s discussion is that metaphorical gestures in general — but also temporal gestures in particular — are often *unaccompanied* by metaphorical language. In such cases, the gestures provide the analyst privileged backstage access, as it were, to the imagistic and spatial properties of conceptualization. Such tacit metaphoricity is common in the data we present below. Expressions for events (e.g., “the New Year”) or specific times of day (e.g., “1:30 pm”) are not intrinsically metaphorical, but they can be said to be metaphorical insofar as co-speech gestures *spatialize* them.

While the studies above attest that a left-to-right transversal pattern exists in English, they do not address in any detail how this pattern is constituted across different instances of temporal gesture. Questions abound. Are all transversal temporal gestures the same? If not, in what ways does one temporal gesture vary from another? In what ways is variation in temporal gestures related to variation...
in the accompanying speech? After all, what does it mean, exactly, for a speaker to produce a gesture that is consistent with a left-to-right temporal trajectory? Detailed analysis reveals that temporal gestures are not fully conventionalized, but reflect variation in morphology, dynamics, and use of gesture space — in short, they show variation along the same parameters as other co-speech gestures. The pre-analytical intuition that the meaning of such gestures is obvious is no substitute for careful analysis of how this putative obviousness is achieved.

The present study intends a detailed characterization of the phenomenon of transversal temporal gestures in English. Such a characterization involves both zooming in on the microdynamics of form-meaning relations in specific gestures and zooming out to appreciate how different temporal gestures together constitute a domain of embodied knowledge. Given all this zooming, it is important to make clear the different analytic levels that are — and are not — important for our investigation. The first, discussed above, is the level of pattern — that is, whether a temporal gesture is sagittal or transversal (or, perhaps some other pattern not yet described). A second is the level of directionality — that is, whether a transversal gesture is consistent with a left-to-right or right-to-left pattern. In our English speaking participants, left to right is by far the more common direction. Taking a cross-cultural perspective, however, the directionality of temporal gestures is an interesting puzzle, and we take it up in discussion. Our analytic focus in this paper is a third level, the level of typology. The level of typology illuminates the systematic pairing of certain types of gestures with certain types of temporal concepts. A fourth and final level, which we will touch on to a much lesser degree, is that of morphodynamics — that is, how the microlevel details of handshape, hand orientation, use of gesture space, and motion partner with the spoken utterance. Within the different types of temporal gestures we identify, there is always variability on the level of morphodynamics, but a full investigation of this variability will have to await further study.

In the next section, we outline our quasi-experimental observational methods, which allow us to control certain features of a storytelling setting, while still approximating a naturalistic conversational situation. We then present a typology of temporal gestures with examples of each type, arguing that English speakers’ temporal conceptualizations are motivated by a shared and highly systematic body of conceptual knowledge and imagery. In the general discussion we then: (1) briefly review the advantages of the methodology used here, suggesting it may be a useful one for studies of metaphorical gesture in other domains; (2) consider variation in temporal gestures across cultures; and (3) explore implications of our data for gesture classification and the study of metaphorical gestures.
Methods

The observational paradigm in this study is similar to that used by David McNeill and collaborators in their groundbreaking gesture studies (see McNeill, 1992, p. 374 for methods discussion). On all recruitment materials and consent forms, our specific interest in gesture was deliberately concealed, and participants were not told anything about the content (e.g., history of the universe) of the stimulus materials before beginning the task. Participants were told that the investigators were studying storytelling. Unlike McNeill’s earlier studies, we chose to manipulate select aspects of the stimulus while holding other aspects of the observational set-up constant. These manipulations do not bear on the questions discussed in the present study, in which we focus on transversal temporal gesture types that were observed across all of the studies.

Materials

The primary stimulus used was an image depicting the history of the universe. It measured 36 by 9 inches. The image was printed on a single sheet of paper, laminated, and mounted on foam board. It was presented approximately at eye-level to a first participant (P1) on a tripod. The tripod-based mounting device for the stimulus was used as a means of controlling how the stimulus was viewed.

On the far left of the image is a depiction of big bang and at the far right a depiction of a satellite in space. Various major events in the earth’s history — for example, the formation of life in the oceans and the construction of Stonehenge — are shown in between. The image is continuous but there is an implicit segmentation of the narrative into approximately ten events. In addition to the images, there are two timelines. The first timeline, which runs across the top of the image, pegs the events to times on a digital clock. It begins above the image of the big bang (12:00 am) and is introduced with the words, “If the history of the universe were compressed into a single day …”. The second timeline, which runs across the bottom of the image, positions the events with respect to today (e.g., 300 million years ago), the system more frequently used in scientific and instructional contexts. On this bottom scale, the big bang is tagged as having occurred 15 billion years ago. Participants were all familiar with the content of the story to some extent — indeed, the stimulus would not be intelligible otherwise.

Procedure

The first participant, P1, is presented with the graphical stimulus (as described below, an auditory version was also used in one study). P1 studied the stimulus for
as long as they chose and then it was removed. At that time, the second participant, P2, who had not seen the stimulus, entered the observational room. P1 then told P2 the story. When both participants were confident in P2’s understanding of the story, P1 left and P2 moved to the “narrator’s stool” (i.e., the stool formerly occupied by P1, left position in all examples). A third participant (P3) — who, again, had not seen the stimulus — entered the room, and P2 then told their version of the story. Both narrative sequences — P1 to P2 and P2 to P3 — were videotaped. After the second story had been completed, all of the participants were given a brief questionnaire to better understand their handedness and language background.

A few details about the participants’ written instructions are worth mentioning. P1 was instructed to pay attention to details and to take as much time as needed. They were also instructed to tell the story “as the image depicts it”. This phrase was included to deter subjects from trying to flesh out the story from their own knowledge base. Also, both P1 and P2 were told in their instructions that P2 would have to retell the story later on. Finally, it should be noted that P2 was explicitly encouraged to ask questions in order to promote lively interaction.

We reasoned that the bodily actions of both P1 and P2 (and of P2 and P3 in the second narrative sequence) would be of interest, so they were both given equal space on the film. Stools were used to allow maximal range of motion and to discourage participants from finding a natural resting pose (though some examples below are taken from pilot studies involving swivel chairs).

Participants

In total, 50 people participated in the study (26 males; 24 females). Participants were undergraduate and graduate students from a major university who participated either voluntarily or in exchange for course credit. All were native speakers of English. 20 groups were recorded in all, yielding 38 separate narratives sequences.

Overview of five studies

Five different versions of the study were carried out, each involving a different version of the stimulus or paradigm. Each version of the study was designed to answer specific questions about temporal reasoning — many of which we do not take up specifically in the present paper. We offer the details of these different studies here not only in the interest of experimental transparency, but also to make the crucial point that, at the level of typology, the temporal gestures we observed transcended the specifics of different tasks and stimuli. Study #1 used the standard
size stimulus described above; study #2 used a mirror image (right-to-left) of the standard stimulus; in study #3 there was, in addition to the primary narrative task, a second narrative task in which participants told a condensed version of their life story; in study #4 a miniaturized version of the standard stimulus was used; and study #5 used an auditory-only version of the stimulus. While participants produced specific types of gestures across all studies, their gestures did vary by study at other analytic levels. For instance, there was interesting variation in directionality in studies #2 and #3. The nature of this variation is a matter of ongoing research.

Types of temporal gestures

In this section we report on five types of temporal gestures produced frequently by our participants in all the above versions of the study. According to what criteria should temporal gestures be classified into types? We understand temporal gestures as parts of composite conceptualizations — that is, multimodal cognitive acts that include at least motoric action, speech, and mental imagery, and which are situated in a meaningful setting (cf. Engle, 2000). But since the analyst has no direct access to mental content, we must present taxonomical divisions that consider only: 1) the morphology and dynamics of the gesture; and 2) the particulars of the accompanying speech. Note that by “temporal gesture” we do not mean that the gesture is morphologically specialized for the domain of time. In terms of morphodynamics, the temporal gestures we describe are similar to — and in certain cases indistinguishable from — gestures produced in other domains. Rather, temporal gesture types are systematic pairings of certain gestural forms with certain verbal expressions, pairings which constitute recurring conceptual wholes.

It should also be noted that the overwhelming majority of temporal gestures in our data set followed the transversal pattern. The only common sagittal gestures were downward points associated with expressions like “now” and “today”, and even these were rare. The observed imbalance between sagittal and transversal gestures is almost certainly due to the specifics of our paradigm, and we return to this issue in the discussion. While the temporal gesture types presented here are in principle abstract enough to apply to either sagittal or transversal gestures, they were developed on the basis of examples of transversal temporal gestures.

Placing

A placing gesture is one in which a named event or time (e.g., “the big bang”) is gesturally located in a speaker’s peripersonal space. The location of the placement be-
comes the referent, such that it is possible to refer back to it in later discourse. Events can be placed absolutely, or they can be placed relative to other previously or concurrently placed events. In terms of morphodynamics, a placing gesture can involve any number of handshapes, but most often involves a downward stroke. There is a strong possibility — which we note here as a hypothesis awaiting future empirical validation — that different handshapes used for placing gestures enact subtle variations of meaning. For example, while a floppy, open handshape might be used to locate a vague temporal region (e.g., the beginning of the universe), it is unlikely that such a handshape would be used to locate a specific time of day (e.g., 4:15), or any similarly focal event. Conversely, it would be unlikely that a well-articulated, cutting-edge handshape would be vigorously downstroked to place a non-focal event (e.g. the early part of the century). Examples below — as well as throughout the gesture studies literature — support the idea that there are relatively fine-grained form-meaning relations between gesture and speech. The interesting question, of course, is at what level of specificity these relations can be shown to be systematic.

Because placing gestures involve downward rather than transversal or sagittal strokes, it is important to specify how any sort of temporal trajectory may be inferred from them. If a single temporal entity is placed in isolation, the temporal trajectory can only be inferred from the location of the gesture in the speaker’s gesture space. It is unproblematic to assume a left-to-right temporal trajectory if, for example, the speaker produces a placing gesture in her left peripheral space while saying “the beginning of time”. Of course, it is hard to infer temporal trajectory from absolute placing gestures that occur closer to the middle of the speaker’s body. Quite often, events are placed relative to other events in such a way that the earlier-than or later-than relation holding between the two is more foregrounded in the discourse than their absolute position on a larger time scale. Relative placing gestures such as these are thus more likely to occur in the speaker’s unmarked central gesture space. For example, a speaker may say “the dinosaurs were right after the jellyfish”, first placing the “dinosaurs” in slightly right middle space and then placing the “jellyfish” in slightly left middle space. In such cases, the temporal trajectory motivating relative placing gestures is inferred: the later event is placed to the right of the earlier event if a left-to-right trajectory is conceptualized.

Example (2): 09;28

1 P1: So, that was the history of the universe
2 From [fifteen] billion years ago till [today]
3 In- in twenty four hours

Example 2 is taken from Study #5 (auditory stimulus). Approximate locations of discussed gesture strokes are bracketed and bolded in the transcript. P1 produces two placing gestures in line 2. In the first, as she says “fifteen” she brings her
left hand down to her left thigh, with the palm oriented vertically as though in a chopping motion (see Figure 1a); in the second, as she says “today” she brings her right hand down to her right thigh in a similar chopping motion (see Figure 1b). The left-to-right temporal trajectory can be inferred from the relative position of the events in her gesture space.

**Pointing**

In certain cases, participants pointed to events or times as though they had concrete, visible locations. As with canonical pointing gestures to perceptible referents, temporal points project a line with some part of the body — usually the index finger, but also the whole hand, the head, or a held object — to a region of space. The difference between a temporal placing gesture and a temporal pointing gesture is analogous to such gestures in the context of concrete spatial description. A placing gesture actually positions a temporal entity in space; a pointing gesture, by contrast, projects a line in the direction toward which an entity lies (see Example 2 for comparison). There is a connection between the placing and pointing categories we suggest here and a related distinction made by Clark (2003). Clark considers the crucial difference to be that an act of placing offers an object up for the listener, while an act of pointing directs the listener’s attention to an object. However, Clark’s discussion considers placing as a broad class of actions beyond co-speech gesture, such as putting an item on the check-out counter. It can be hard for the analyst to make a definitive judgment at times between these two
possibilities, but pointing and placing presumably constitute cognitively different conceptualizations. Temporal points often occur after a speaker has already populated the space with an imaginary timeline, but they can also occur before any such population has occurred (see Haviland (2000) for discussion of presupposing versus creative pointing gestures).

This class of temporal gestures is most often distinguished by its handshape, with the index finger extended and the rest of the fingers curled back into a fist. Other morphologies were observed less frequently. For example, full hand flicks in the direction of entities were observed, as were, in rare cases, head and foot points. As with placing gestures, trajectory is inferred in two ways. Either more than one temporal entity is pointed to over a stretch of discourse, thus establishing their relative position, or the underlying temporal trajectory can be inferred from the location of the pointed-to entity in absolute peripersonal space.

Example (3): 08;19
1  P2: And then civilization happened
2       Wars et cetera
3  And then satellite[-] was the satellite at like [midnight] or
4       something?

Example 3 comes from Study #1 (standard stimulus). P2 is checking to make sure she has understood the story and produces two temporal gestures in line 3. First, just after she says “satellite” she points with both hands open and flat off to her
right (see Figure 2a); then co-timed with “midnight”, she extends her right hand off to her peripheral right space with a loose five handshape (see Figure 2b).

The satellite to which she refers marks the end of the story, which occurs at midnight. The first gesture is a robust bimanual temporal point; the second is another pointing gesture, though with a less articulated pointing handshape. From the absolute position of these gestures in space, it is again possible to infer that she is conceptualizing time on an axis running across her body from left to right.

**Duration-marking**

Duration-marking gestures express the length of time between two events, or the duration of a single event. We distinguish between two subtypes: (1) one that highlights the size of an interval; and (2) one that highlights the path traversed between two temporal entities. Morphologically, a duration-marking gesture of the first subtype involves the two palms held out at the midline and facing each other, such that the distance between them is demonstrated as though it were an object held between the hands. Here and elsewhere the human hand takes on an image-schematic structure: the palms evoke a filling-in of the space between them. This kind of filling-in may be involved in single-handed temporal gestures as well. For example, the expression “starting at” would be prototypically gestured with a left hand downward chopping gesture, with the right-facing palm tacitly evoking the time to come; the expression “up until”, by contrast, would be prototypically gestured with a right-handed lateral sweep gesture across her body, with the left-facing palm thus evoking the time gone by (for related discussion, see Calbris, 1990, pp. 90–92). These observations about the conceptual asymmetry of the hand are impressionistic and will require future research.

Markedly short durations can also be signaled with a single hand between the thumb and index finger. A speaker’s choice of bimanual or single-hand variants is motivated by features of the discourse context. For example, in our data the single-hand variant is repeatedly used to talk about “human existence” (see Example 5 below), which is vanishingly small in the context of the larger history of the universe. In other discourse contexts, however, a mention of “human existence” might be better accompanied by an outstretched two-handed variant.

For duration-marking (size) gestures, temporal trajectory is inferred in two ways: either the interval is set up in several steps (e.g., “between the Stone age and the present day …”); or, in single-handed cases, the temporal trajectory can be inferred from the position of the hand in relation to the speaker’s midline. Otherwise it is only speculatively possible to infer trajectory from the broader context of the speaker’s temporal gesture production.
Example (4): 09:07
1 P1: So my story is the history of the universe [compressed] into one single day
2 P2: The history of the universe compressed into one single day?
3 P1: One single day

Example 4 is taken from Study #4 (small). As she says “compressed” in line 1, P1 exhibits both hands, palms facing each other, and pulses them quickly inward (see Figure 3a).

Figure 3. (03;28 / 09;07)

She holds this duration-marking gesture until shortly after line 4, as if to maintain reference to the topic at hand. From this gesture alone it is not possible to make a judgment about the directionality of time, but it is clear that time is conceptualized transversally.

An interesting feature of the duration-marking (size) gestures is that they are sometimes held and then layered over with beats or other gestural “meta-comments”. For example, a single-handed duration-marking gesture may be brought higher in the gesture space, as if to show it to the listener, or close to the speaker’s own eyes, as if its diminutiveness requires further inspection.

Example (5): 04:24
1 P1: [All the human existence happened in that one minute] of [this]- the last one minute of that day
Example 5 is taken from Study #2 (mirrored stimulus). In responding to a question from P2 about how humans fit into the scheme of the narrative, P1 produces a series of duration-marking (size) gestures. As he begins to say “all the human existence” in line 1, he raises his left hand to just above waist level, with the thumb and index finger marking an interval (Figure 4a). He then moves this gesture up to his face as he says “that one minute” and bends his neck slightly toward his hand.
as if inspecting it (Figure 4b). In line 2, as he says “this” he brings both hands out in a large-scale duration-marking gesture (Figure 4c).

The effect of these temporal gestures in sequence is to emphasize the diminutiveness of human existence relative to the cosmic timescale provided by the story. The prevalence of such gestural “meta-commentary” within this type hints at a possible functional difference between duration-marking gestures and the other types of temporal gestures we describe.

A second subtype of duration-marking gestures is a variant in which the path of the duration is profiled rather than the length of the interval. The path is most often enacted by a lateral sweep of the hand across a verbally labeled duration. Because strokes in this subtype are lateral rather than downward, trajectory is easily inferred from the direction of motion.

Example (6): 05;27
1 P1: So the whole idea is that the [first] [morning] early
2 afternoon is just the galaxy

Example 6 features the same speaker from Example 3 (Study #4, small) at a later point in her narrative. P1 begins in line 1 with both of her hands clapped together off in her right space. She then quickly brings her left hand off to her left space in preparation, and then as she says “first morning early afternoon” she produces a lateral sweep of her left hand across her body to meet with her right hand (see Figure 5a and 5b).
The lateral direction of the stroke demonstrates that she is conceptualizing time as moving over the specified interval from left to right.

**Bridging**

A bridging gesture expresses a transition between two temporally ordered events. The events on either side of the bridge may or may not be marked gesturally. Bridging gestures are co-produced with expressions like “after that”, “right before”, “later”, “then”, and many others. The precise co-timing of the stroke relative to speech is essential in determining that the transition between events — and thus their temporal relation — is more conceptually salient than either of the events themselves. Morphologically, a temporal bridging gesture may involve a number of different handshapes, such as a pointing handshape that traces a transversal arc through the air, or a loose flick of the hand. Again, since the stroke trajectory is invariably lateral, temporal trajectory is inferred from the direction of motion.

Example (7): 07;18

1 P1: And then about seven hundred million years ago
2 So [already] not that long ago
3 We start to get the first complex life forms coming out of the
4 ocean

Example 7 comes from Study #1 (standard). In line 2, as she says “already not that long ago”, P1 brings her left hand in first, in preparation, to touch her right hand and then laterally leftward. The gesture enacts a bridge between two temporal entities, the implied now and the “not that long ago” marked in speech. Though the stroke of the gesture is transversal from right-to-left, it is possible given the accompanying speech to infer that she is conceptualizing time as moving from left to right.

**Animating**

A final class of temporal gestures is those that are co-produced with the word “time”, e.g., “Time moves on from there”, or some comparable expression, e.g. “And things continued from there”. In these gestures, the hand enacts — or animates — the idea of time as an agent with a motion of its own. These gestures are somewhat rare in our data and vary morphologically. Trajectory is inferred from the direction of motion.

Example (8): 10;18

1 P1: That’s how much- the beginning of the universe where
2 nothing really much happened
Example 8 comes from Study #5 (auditory). Though P1 produces several temporal gestures in this sequence, we focus on lines 4–5. Co-timed with “moves”, P1 moves both hands from left to right across his waist in a lateral trotting motion (see Figure 6). He thus animates time — or “development” — as itself a trajector that moves from left to right.

![Figure 6. (09:28 / 10:18)](image)

**Discussion**

Time offers an important case study in the human capacity for abstract thought. After all, temporal reasoning is basic and universal; temporal concepts are everyday concepts. Temporal reasoning and temporal gestures go hand-in-hand. In addition to being of intrinsic interest to gestures studies, then, temporal gestures provide an indispensable source of data to cognitive scientists about everyday — but culturally variable — temporal reasoning processes. A number of questions remain about temporal gestures, and many of these questions intersect with ongoing controversies in gesture studies and cognitive science more generally. Only a handful of these questions are taken up below.
A methodological middle way

Researchers have long recognized the importance of the face-to-face situation in the study of language use and human sociality (Clark, 1996; Goodwin, 2000; Segrifoff, 2006). Face-to-face interaction is also an important site for the study of conceptualization. Conceptualization is often treated as a private act par excellence, something done in a person’s own cognitive theater. Here we consider conceptualization as it takes place on an interactive stage, subject to the same recipient design pressures and emergent exigencies as all communication. Gestures are commonly a part of such conceptualization-in-interaction.

The present study thus offers a methodological middle way between, on the one hand, rigorously controlled experimental studies that tend to denature conversation and, on the other, ethnographic studies that offer beautiful specimens but do not always disclose general trends. Ideally, ethnographic investigations and controlled observational studies would be pursued in parallel. Data from both sources can be compared against each other, and can be used to generate and later sharpen analytic distinctions. The true measure of our temporal gesture typology is in how well it fits with future naturalistic observations of English conversation. As gesture studies moves toward consideration of gesture in all of its rich discursive, socio-cultural, and conceptual variation, we suggest that this middle way will prove increasingly valuable.

In particular, the quasi-controlled paradigm used here may prove especially useful for future studies of metaphorical gestures in well-circumscribed conceptual domains. Cognitive linguistics has long been in the business of investigating how specific languages treat specific conceptual domains. While there is no reason to suppose that all conceptual domains will show the same gestural systematicity as time, this is an empirical question worth further study. The present paradigm could be easily adapted to investigate how speakers of a given language reason about music, bodily experience, emotions, mental experience, and much else besides. Without carefully controlled tasks it is difficult to make strong inferences about the nature of the imagery motivating specific gestures, perhaps particularly in abstract domains. Thus, while we applaud the recent move to neuroimaging studies of gesture, it should be emphasized that there is no shortage of observational, hypothesis-generating work yet to be done.

Cross-cultural variation in temporal gestures

The literature on time-related gestures has noted considerable variability cross-culturally. This raises the general question: how do temporal gesture patterns emerge and stabilize in a community of speakers? As we have discussed, among English
speakers there are two predominant patterns: the *sagittal pattern*, which uses the back-to-front bodily axis, and the *transversal pattern*, which uses the left-to-right axis. Previous work has demonstrated that these two patterns are also co-present among French speakers (Calbris, 1990) and among the Aymara, an indigenous group in the South American highlands (Núñez & Sweetser, 2006). In the data collected for our study, involving native speakers of English, gestures conforming to the sagittal pattern were much less common. This was an entirely predictable finding, for a few reasons. A first reason is that our graphical stimulus materials (Studies #1 through #4) were oriented transversally. (Importantly, however, even those participants who never saw a graphical stimulus, e.g., P1s in Study #5 and P2s in all studies, still produced predominantly transversal gestures.) A second reason is that our task requires participants to reason on a cosmological time scale about the distant past. The task thus does not require — and possibly discourages — using the deictic “now” as an anchor point. A final reason is that the transversal pattern allows much more precision than the sagittal pattern, in large part because it is more visible to the interlocutor. Of course, informal in-the-wild sightings attest that the sagittal pattern is fully within English speakers’ gestural repertoire. What motivates an English speaker — or a French or Aymara speaker, for that matter — to adopt one or the other pattern? The answer probably involves disparate factors — pragmatic, cognitive, maybe even generational — and it will require further research to tease these factors apart.

The directionality of temporal gestures also varies from culture to culture. As discussed briefly above, a recent paper on the Aymara documents speakers’ use of a sagittal gesture pattern that is the reverse of the Western pattern (Núñez & Sweetser, 2006). In Aymara, the past is mapped to the front space and the future is mapped to the back space. Núñez & Sweetser (2006), relate this striking pattern to a number of linguistic and cultural facts, such as the prominence in Aymara culture of the metaphor of “knowing is seeing”. The past is known and the future is unknown. The importance of the “knowing is seeing” metaphor in Aymara is also attested by evidentials in the grammar. Just as there is nothing inevitable about the future in front and past behind sagittal pattern, then, there is nothing inevitable about the left-to-right directionality of the English transversal pattern. Kita, Danziger, and Stolz (2001) report on the tendency for speakers of Yucatec Maya to gesturally enact time as moving from right-to-left. Similarly, evidence suggests that speakers of Hebrew (Tversky, Kugelmass, & Winter, 1991; Fuhrman & Boroditsky, 2007) conceptualize time along a right-to-left axis. Finally, a recent study of Mandarin speakers demonstrated a pattern of conceptualizing time vertically from top-to-bottom (Boroditsky, 2008). In both the Hebrew and Mandarin cases, these time directions have been assumed to parallel the predominant writing directions.
in their cultures. Unfortunately, to date there are no published studies of naturalistic temporal gesture production in these cultures.

There is also provisional evidence of a temporal gesture pattern that is substantially different from those described above. Floyd (2008) reports that speakers of Nheengatú, an indigenous language of the Brazilian Amazon, make temporal reference on a diurnal scale by pointing upward according to an absolutely oriented east-to-west arc. This arc apparently parallels the path of the sun. They can thus make fine-grained temporal distinctions about times of day and durations in gesture — distinctions their spoken language apparently does not support. A related pattern of solar-temporal pointing has been described in the sign languages of the region (Kakamasu, 1958; Ferreira Brito, 1985). Further research is required to better understand how the Nheengatú system accommodates reference to longer time scales (e.g., months or years), or to more abstract temporal concepts, such as futurity and anteriority. What is most interesting about this pattern of temporal gesture is that not anchored to the ego in the way English speakers’ gestures are, but is instead anchored to the physical environment.

In developing an explanation of cross-cultural variation in temporal gestures, it must be emphasized that a gesture pattern is not an autonomous cultural practice. It is bound up with ways of conceptualizing space, ways of speaking, and ways of representing. As has been emphasized elsewhere (e.g., Cienki, 1998), reading and writing directions undoubtedly play a role in how Western speakers conceptualize time. But they are only one kind of representational practice in a sea of others. Consider also graphs, calendars, and timelines, all of which are most often represented from left to right in North America. It is possible, also, that gesture patterns constitute a kind of embodied representational practice. After all, certain facets of gesture such as quotables (Kendon, 2004) and pointing morphologies (Wilkins, 2003) are culturally shared and culturally transmitted. Temporal gestures are thus a reasonable candidate for consideration as a representational practice in their own right, especially if one accepts our claims that they are both commonplace and systematic. All this is not to say that non-linguistic representational practices are the only, or even most important, factor in determining temporal gesture patterns across cultures. Rather, the point is that, in addition to what language someone speaks — or in which direction someone writes — explanations must take into account a broader ecology of cultural-conceptual practices.

**Time and metaphorical gesture**

Time, which has long been a paradigm case for researchers interested in human abstraction and conceptual systems, also turns out to constitute an important case study in metaphorical gesture. Gesture studies is experiencing a recent surge of
interest in metaphor, in part due to a concurrent surge of interest in the embodied mind and the embodied nature of human concepts in general (Cienki & Müller, 2008) and abstract concepts in particular (Núñez, 2008). The embodiment approach offers new ways of understanding metaphor, and, accordingly, new ways of categorizing and analyzing metaphoric gesture. The most common classification scheme used in gesture research is McNeill’s four-way distinction between beat, iconic, deictic, and metaphoric (McNeill, 1992, 2005). The scheme is based on bundles of features, some morphodynamic (e.g., beats show a biphasic movement pattern) and some mentalistic (e.g., metaphorics are used during reasoning about abstract ideas). According to the original formulation, a metaphoric gesture “depicts a concrete metaphor for a concept, a visual and kinesic image that we feel is, in some fashion, similar to that concept” (McNeill, 1992, p. 14). McNeill’s key criterion in distinguishing iconic from metaphoric gestures is thus a mentalistic one — namely, the nature of the imagery involved. Iconics spring from actual perceptual experience; metaphorics spring from creative connections between concrete and abstract domains. This designation of “metaphoric” has been valuable for heuristic purposes but bears vestiges of an outmoded conception of metaphor. According to this classic conception, metaphors are creative acts, the one-off brainchildren of the artistic mind.

The usual classification scheme as described above has some trouble accommodating the temporal gestures we observed. A first problem with this scheme is its qualitative split between iconic and metaphoric gestures. Embodied cognitive linguistics and conceptual metaphor theory have moved toward a more mundane view of metaphor, according to which canonically abstract domains like emotion, time, and mathematics are constituted by bodily experience (Lakoff & Johnson, 1999; Lakoff & Núñez, 2000; Taub, 2001). On this view, metaphoric gestures are not virtuosic: they are evidence of the pervasive human ability to reason about abstract concepts using concrete, experiential resources. A further problem with the metaphoric-iconic split is that, increasingly, abstract domains like time and mathematics are, we claim, perceived directly through ubiquitous, culturally constituted ways of representing them. These second-order representations are not simply byproducts of abstract thought, but serve to structure it in deep ways (Hutchins, 1995, 2005). Second-order representations of time include calendars and timelines (such as the ones used as stimuli in this study), but also a number of other representations over which a temporal dimension is covertly layered, such as graphs and even English texts. It is no stretch to say that transversal temporal imagery saturates Western culture. Is a given instance of temporal gesture, then, a case of metaphoric virtuosity, or an iconic gesture that represents commonplace temporal imagery? The same could be asked about gestures in other domains, such as mathematics: is the gestural enactment of a curve iconic for a recently seen graph, or something more creative?
The line between iconics and metaphorics becomes all the more blurry when we consider the extent to which second-order representations shape all kinds of thought. Take space, the most paradigmatically concrete of domains. Contemporary route descriptions in American English are peppered with instructions to go “up” or “down” certain (flat) paths, and are co-produced with seemingly inappropriate gestures like upward points. In San Diego, for example, it is commonplace for a speaker to trace a quick upward arc when saying something like “I’m heading up to Los Angeles.” If such gestures are iconic, they are iconic for maps — that is, second order representations of space — not for direct perceptual experience of lived space. As such they are perhaps no more “concrete” — or more “abstract” — than many of the temporal gestures we describe here. There is no a priori reason to suppose the mental imagery motivating gesture differs according to whether the domain is concrete or abstract. In the case of English speakers, of course, sagittal temporal gestures seem to be motivated, not by second-order representations, but by more primary embodied experiences, such as walking or having objects approach from the front.

The temporal pointing gestures we observed are also hard to fit to the usual classification scheme. In terms of morphodynamics, they are perhaps indistinguishable from garden-variety points to present objects. Yet they indicate entities that are metaphoric, even as they are — or so we have argued — motivated by persistent, culturally shared imagery. One option is to assimilate temporal points into the category of “abstract deixis”, a designation first discussed in detail by McNeill, Cassell, and Levy (1993). The authors describe, for example, cases in which narrators point to different characters in their stories as though they were physically present in interactive space. In the broad sense of points to empty space, so-called “abstract deixis” may be a much larger and more variegated category than has been previously discussed in the literature. Unlike the narrative points described by McNeill et al., which often have the character of creative pronominal reference, temporal points seem to be motivated by a stable set of mental imagery. They are thus only “abstract” in the sense that interlocutor or analyst has no immediate access to that imagery. At least some cases of “abstract deixis” reported in the literature may in fact be cases of transversal temporal pointing gestures. As discussed by Cienki (1998), temporal gestures are sometimes only tacitly temporal — that is, they are not co-produced with temporal language. For instance, in Example 3 above, the speaker points off to her right while saying “satellite”. Given the nature of our observational paradigm, we can infer that she points to her right — not arbitrarily — but because the “satellite” in question is last in a series of events. The transversal temporal pattern may also explain other cases of the reportedly “creative” use of space.
Conclusion

In this paper we have argued that English speakers’ temporal gestures are a patterned enactment of culturally shared temporal conceptualization processes. That is, far from being random and analytically intractable, they are systematically related to the speech they accompany. The types of temporal gestures discussed here were initially identified in the context of observational studies in a controlled, laboratory setting. The true test of their analytic merit, however, is in how useful they prove in understanding talk about time in more naturalistic contexts. Returning briefly to Example (1), discussed in the introduction, it is evident that each of the speaker’s gestures fits into one of the five types outlined above.

Example (1): 10;25
1. Intuitively, when you believe the world is changing quickly then
2. you should discount [the past] quickly, right?
3. You should just forget about [that past] and only look at maybe the [last
4. trial] if you believe change is happening rapidly.
5. If you believe that change is happening slowly, so that [alpha is close to
6. one], so [probably changing is] very small, then you should take in
7. [longer] - take into consideration [longer time-time constants].

In these ten seconds of discourse, the speaker produces two temporal pointing gestures to “the past”, a placing gesture co-timed with a mention of “the last trial”, two animating gestures when discussing the notion of change, and finally two duration-marking (interval) gestures as she says “time scales”. The typology will no doubt benefit from further, more intensive efforts to use it in the analysis of naturally occurring temporal gestures. Further, much more detailed investigation — both ethnographic and controlled-observational — is needed to better understand the presumably systematic partnering of different temporal gestures with different verbal expressions about time. As cognitive science begins to explore in earnest the intersection of temporal reasoning, temporal language, cultural practices, and embodiment, gesture will provide a critical source of evidence.

References


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