

# With the Future Behind Them: Convergent Evidence From Aymara Language and Gesture in the Crosslinguistic Comparison of Spatial Construals of Time

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## Abstract

Cognitive research on metaphoric concepts of time has focused on differences between moving ego and moving time models, but even more basic is the contrast between ego- and temporal-reference-point models. Dynamic models appear to be quasi-universal cross-culturally, as does the generalization that in ego-reference-point models, FUTURE IS IN FRONT OF EGO and PAST IS IN BACK OF EGO. The Aymara language instead has a major static model of time wherein FUTURE IS BEHIND EGO and PAST IS IN FRONT OF EGO; linguistic and gestural data give strong confirmation of this unusual culture-specific cognitive pattern. Gestural data provide crucial information unavailable to purely linguistic analysis, suggesting that when investigating conceptual systems both forms of expression should be analyzed complementarily. Important issues in embodied cognition are raised: how fully shared are bodily grounded motivations for universal cognitive patterns, what makes a rare pattern emerge, and what are the cultural entailments of such patterns.

## 1. Introduction

It is widely recognized that time is conceptualized spatially in a wide range of languages and cultures—indeed, that all languages so far examined take their vocabulary of time primarily from that of space. Specifically, a few basic metaphoric mappings from the spatial domain to the temporal one recur in language after language. Models involving (a) the temporal experiencer as mover in space (*We're coming to the end of the year*) and (b) times as entities moving with respect to a static experiencer (*The end of the year is approaching*) have been noticed as cross-linguistically dominant over and over again.<sup>1</sup> In both these cases, an event in the future is seen as “in front of” the experiencer—assuming that the experiencer is facing the flow of events—whereas a past event is behind the experiencer (*bygone days are behind us*, whereas

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*the week ahead of us is approaching*). Although a language typically has more than one metaphorical model of time, so far all documented languages (with the exception to be discussed later) appear to share a spatial metaphor mapping future events onto spatial locations in front of ego and past events onto locations behind ego, rather than to the left of ego and to the right of ego, for example.

Aymara, an Amerindian language spoken in the Andean highlands of western Bolivia, southeastern Peru, and northern Chile,<sup>2</sup> appears to present a fascinating contrast to these well-known patterns, and a challenge to the cross-cultural universals of metaphoric cognition that have been slowly building up in our databases. In Aymara, the basic word for FRONT (*nayra*, “eye/front/sight”) is also a basic expression meaning PAST, and the basic word for BACK (*qhipa*, “back/behind”) is a basic expression for FUTURE meaning. We therefore need to ask how seriously we should take these simple lexical data as evidence about the cognitive construals of Aymara speakers. Further, is it in fact an instance of the same mappings we have seen in other languages, “reversed” in some way, or are there quite different metaphoric mappings involved? How would we know?

Several questions are at issue. Does Aymara really have a configuration of temporal metaphors unattested in other languages? Does it really lack the canonically expected metaphoric mappings of space onto time? If Aymara indeed has different metaphorical mappings, what are their entailments? Answering these questions will require an in-depth study of both the Aymara metaphors and the “expected” ones. In this article we intend to accomplish four things. First, we shall provide a detailed analysis of the inferential organization of spatial metaphoric construals of time in general. We propose that to answer these questions we must consider a more accurate taxonomy of spatial metaphorical mappings of time than the one commonly found in the literature: one that focuses on reference points rather than on the identity of moving entities.<sup>3</sup> Second, we analyze, from a purely linguistic point of view, a collection of Aymara common linguistic expressions involving temporal uses. We argue that it seems impossible to resolve some of these questions from linguistic data alone. Third, we defend the idea that to resolve such questions, it is possible to take advantage of an added data source in the gestures accompanying Aymara speakers’ descriptions of time. In doing so, we show the crucial importance of working with complementary linguistic and gestural methodologies to access speakers’ conceptual structures. Fourth, we want to analyze some issues regarding the embodied nature of human everyday abstraction (as it is manifested in spatial construals of time), its universal constraints, and the possibilities for cultural variation.

There is strong evidence (Boroditsky, 2000; Boroditsky & Ramscar, 2002; Bowerman, 1996; Bowerman & Choi, 2001, 2003; Slobin, 1996, 2000, 2003) that language-specific patterns of usage prompt corresponding patterns of categorization and conceptualization that shape the habitual cognitive patterns of speakers in the relevant communities; Slobin has called this *thinking for speaking*. However, linguistic output only gives a certain amount of insight into what these cognitive patterns are. When a speaker says *rock-solid evidence*, should we see active metaphoric cognitive construal of the evidence as a physically solid object, or might we rather conclude that this is a historically metaphoric but now purely literal fixed phrase? There are various ways to confirm the liveliness of a thinking for speaking pattern such as a conventional temporal metaphor: Examination of speakers’ patterns of accompanying inferences (Boroditsky, 2000; Gibbs, 1994; Núñez, 2006) and differences in attention and subsequent

memory access (Slobin, 1996, 2000, 2003) are among them. Examination of real-time gestural production is another important one, and is particularly useful in cases where the data are ethnographic rather than experimental; gesture is always there, and visibly present in the videotaped data.

Gestural data thus offer the cognitive scientist crucial complementary information that is unavailable from purely linguistic data. Speech-accompanying gesture is a universal phenomenon, of interest to cognitive science in particular because it is a less conscious and monitored track than language (McNeill, 1992, 2000, 2005). It has been noted (Cienki, 1998a, 1998b; McNeill, 1992; Núñez, 2006; Smith, 2003; Sweetser, 1998a, 1998b) that metaphoric gesture often systematically accompanies metaphoric speech—iconic gestures such as a hand moving upward, for example, may accompany an utterance such as *prices soared*, whereas a downward gesture is highly unlikely in such a context. As with speakers of other languages, we may expect systematic directional gestures accompanying Aymara speakers' temporal reference to past and future: The gestures should show coherent mappings of temporal structure onto space, which should elaborate and clarify the metaphoric structure suggested by the linguistic data. Cienki (1998a) argued further that because the gestural track communicates information that can be complementary to (rather than overlapping with) the linguistic track (Goldin-Meadow, 2003; Goldin-Meadow & Alibali, 1999; Kendon, 2000, 2004; McNeill, 1992), aspects of metaphoric cognitive processing can sometimes be accessible to researchers via the gestural track alone. In Aymara, the gestural track indeed clarifies aspects of the metaphoric model of time that are not clear from linguistic data alone.

Using complementary linguistic and gestural methodologies, we eventually argue that Aymara has basic time metaphors that represent a radically different metaphoric mapping from the ones commonly found in the languages around the world studied so far. Aymara thus appears to be the first well-documented case presenting a genuine fundamental difference in the organization of time construals. Interestingly, it is not difficult to find an embodied experiential motivation for these “different” metaphors; it turns out that Aymara and English could be seen as basing their temporal metaphor systems on somewhat different aspects of humans' basic embodied experience of the environment. However, given how unusual the Aymara metaphors for time are, further questions are raised about the cultural matrix within which particular spatial experiences of time are developed and linguistically coded.

## 2. Metaphors for time: Universals and cultural variability

### 2.1. What counts as a case of “future is behind”?

Lakoff and Johnson have proposed experiential bases for spatial construals of time (M. Johnson, 1987; Lakoff, 1993; Lakoff & Johnson, 1999). These hypothesized bases lie in shared bodily experience of space and its correlation with temporal experience, and thus offer a potentially universal basis for spatiotemporal metaphors. To others it seems equally evident that cultures vary radically in their understandings of time (Dahl, 1995; Grebe, 1990; Klein, 1987; Øyvind, 1995; Thornton, 1987). These two viewpoints are not necessarily incompatible: Humans often have more than one construal of a given complex domain, even in mathematics (for

examples of multiple construals in arithmetic, calculus, and set theory, see Lakoff & Núñez, 1997, 2000; Núñez & Lakoff, 1998, 2005), so it would be perfectly possible for there to be both some very culture-specific and some universal models of time. However, this particular debate seems largely based on inaccurate comparisons, which have led to the postulation of mythical contrasts.

To exemplify the problems underlying claims about exotic languages where “future is behind” and “past is in front,” let us examine an equally exotic language, English. Noting that English speakers readily say things like *Christmas follows Thanksgiving*, or *Christmas comes after Thanksgiving*, meaning that Christmas occurs later than Thanksgiving, we might seize on the “later than” relation and equate it with (relative) futurity. Because *follow* and *come after* are relations of “behindness” (a follower is behind the person followed), we might now claim that in English the future is behind. However, the crucial question is this: Behind what? We could not say, in English, that *Christmas is behind us*, or *Christmas is following us*, to mean that Christmas is future relative to the speaker’s NOW. Indeed, *Christmas is behind us* is perfectly grammatical, but only in the sense that Christmas is in the speaker’s *past*, not his or her future.<sup>4</sup> One could similarly claim that in English the “past is in front” because we find expressions such as *ahead of time*, or *twenty minutes ahead of one o’clock* (National Public Radio time announcement for 12:40), where *ahead of* means “earlier than.” Here, we have a clear answer to the question, “In front of what?”—this is about the relation between two times, neither of which is the speaker’s NOW. One cannot say *ahead of us* meaning “earlier than the present”—instead, it means “later than the present.”<sup>5</sup> As Moore (2000) lucidly explained, many of the claims in the literature about languages where “future is behind” and “past is in front” seem to be based on this kind of confusion of different reference points for the front–back relation.

The problem is that we must not confuse *futurity* (reference to times later than NOW) with *posteriority* (reference to one time as being later in a sequence than another). Not every instance of “later than” relations is an instance of “later than now.” Similarly, we must not confuse past (reference to times earlier than NOW) with *anteriority* (reference to one time as earlier in a sequence than another). The crucial point is that future and past are inherently deictic semantic categories; you have to know the position of ego (i.e., when the relevant speaker’s present is) to be able to calculate the time reference of a future.

The situation in Aymara attracted our attention because it is the only case in the literature of a mapping where indeed future (not general posteriority) seems to be metaphorically IN BACK OF EGO, whereas past appears to be IN FRONT OF EGO. As we shall see, our examination of psycholinguistic and ethnographic data has only confirmed these preliminary impressions. There is some evidence suggesting that the mapping is shared by other neighboring languages—it may be an areal feature.<sup>6</sup> In any case, this exceptional pattern demands our attention. If the universalists are right, why this exception? If the cultural variability advocates are right, why are the other common patterns so pervasively stable across so many unrelated languages around the world?

To explain the Aymara situation, we must first lay out the precise structures of the metaphorical models of time that have been noticed in other languages. Then we must identify the mappings in Aymara, to make sure that we are indeed comparing and contrasting comparable data. We restrict ourselves in this article to a subclass of temporal concepts and metaphors. As Evans (2003) pointed out, humans understand time in a variety of ways; the moment sense, the

duration sense, event-structure senses (related to the aspectual structure of an event), and others. Different metaphoric mappings structure different aspects of this complex experiential and conceptual network. There are good cross-linguistic comparative and experimental data specifically on metaphoric understandings of time as relative motion in linear space, most typically motion along a front-back parameter; this is the primary focus of our comparison to Aymara.

## 2.2. Patterns of mapping space onto time

Research in conceptual metaphor theory since the early 1980s has built up evidence that there is an extensive conventional system of conceptual metaphors in every human conceptual system, mapping inferential structure from a source domain (e.g., space) into a target domain (e.g., time).<sup>7</sup> With respect to time metaphors, Lakoff and Johnson (1980) noticed that in English, people talk both about *going to* do future actions, and about future events as *coming events*. They studied in detail the metaphorical mappings underlying such linguistic usages, and modeled their findings with a general conceptual metaphor that allows the conceptualization of time in terms of motion in space. In its general form, this metaphor was known as TIME PASSING IS MOTION metaphor<sup>8</sup> (Lakoff, 1993; Lakoff & Johnson, 1999). In related work, Fleischman (1982a, 1982b) examined the etymological relation of the Romance tense systems to these metaphorical mappings. From these researchers' work, as well as from that of Clark (1973), came an important division between moving-time and moving-ego metaphors. Lakoff (1993) identified these as two different special cases of TIME PASSING IS MOTION metaphor; namely, TIME PASSING IS MOTION OF AN OBJECT (moving time), and TIME PASSING IS MOTION OVER A LANDSCAPE (moving ego), respectively. The former has a fixed canonical observer where times are seen as entities moving with respect to the observer (Figure 1a), whereas the latter sees times as fixed objects where the observer moves with respect to time (Figure 1b). In these mappings the stationary entity is the deictic center.

Psychologists have since given experimental evidence that real or represented physical motion scenarios can prime parallel construals of time—perhaps simply by activating the relevant source domain (Boroditsky, 2000; Boroditsky & Ramscar, 2002; Gentner, Imai, & Boroditsky, 2002; McGlone & Harding, 1998). Speakers who have just been moving (e.g., traveling on a plane or a train) or imagining self-motion are primed to give moving-ego rather than moving-time interpretations of metaphorical time phrases in English. For example, they are asked to answer questions involving ambiguous forms such as *the meeting was moved forward*. This phrase can be interpreted according to either of Lakoff and Johnson's two mappings, moving-ego or moving-time: If time is seen as moving past ego, earlier events are "ahead of" later ones, and the meeting was rescheduled to an earlier time; whereas if ego is moving through space, then farther future events are farther ahead relative to ego, so moving the meeting ahead is rescheduling it to a later time. With a priming background of self-motion, respondents' interpretation is biased toward understanding *forward* as "to a later time" (i.e., via moving-ego metaphor) if they are primed by a self-motion scenario.<sup>9</sup>

Most of the research cited earlier divides time metaphors into moving-ego and moving-time, and these terms have been used as inverses: Either ego is construed as moving with respect to a temporal landmark, or time is construed as moving with respect to ego. In fact,

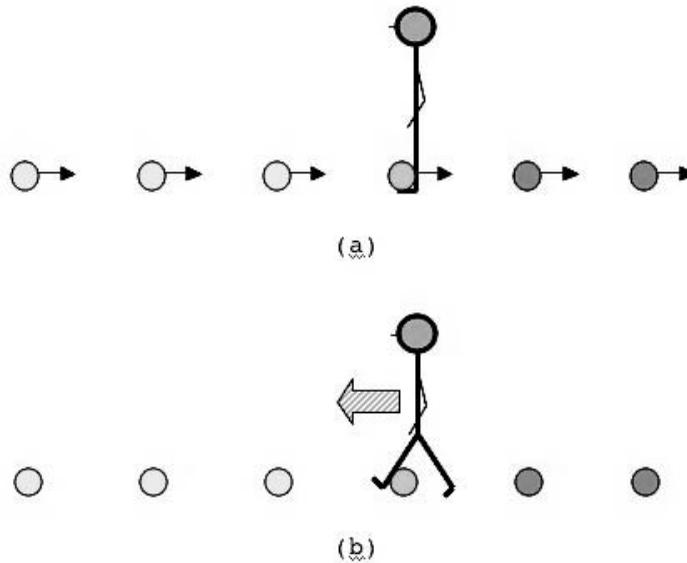


Fig. 1. The TIME PASSING IS MOTION metaphor according to Lakoff (1993). The special case TIME PASSING IS MOTION OF AN OBJECT metaphor is depicted in (a), where times are conceived as spatial objects moving, relative to a static canonical observer, from front (future times) to back (past times). In this case, the observer is the deictic center. The other special case of the metaphor, TIME PASSING IS MOTION OVER A LANDSCAPE, is illustrated in (b), where the observer moves relative to static objects conceived as times. The deictic center in this case is a static object in the landscape.

however, the linguistic data show more complex patterns. Not all spatial language for time is dynamic: *There's no time to do my homework because the class meetings are too close together* simply treats times as locations. Crucially, when time is construed as moving, it is not always with respect to ego as a reference point. In *December follows November*, times are construed as moving, and November is a moving reference point (with directional front–back orientation) for the location of December; there is no ego reference point, although there is some broader temporal “landscape” as a frame of reference. This is quite distinct from *Christmas is coming*, which shows time as moving toward ego as landmark. Moving-ego cases such as *We're racing toward the end of the semester* or *Vacation is just ahead/around the corner*, show ego moving or potentially moving on a path relative to temporal landmarks.<sup>10</sup>

We therefore make the categorical distinction proposed by Moore (2000) and Núñez (1999), between time-based metaphors and ego-based metaphors (of which moving-time and moving-ego metaphors are subcases). Because the word *based* is not specific enough, we now prefer to use the terms ego-reference-point (ego-RP) and time-reference-point (time-RP) to clearly distinguish between the question of what is moving (ego or time) and what is the landmark relative to which motion is construed (ego or time). Front–back orientation can be established for either a moving or a static landmark.<sup>11</sup>

Núñez, Motz, and Teuscher recently gathered experimental evidence from priming that supports the psychological reality of the ego-RP versus time-RP distinction (Núñez, in press;

Núñez, Motz, & Teuscher, in press). After priming with an image of a sequence of cubes moving across a screen horizontally (in either direction), participants responded to the question *Last Wednesday's meeting got moved forward 2 days. On what day did the meeting take place?* They gave a strong predominance of Monday responses over Friday responses, choosing the interpretation of forward as meaning “to an earlier time.” If these participants had been construing spatial relations relative to ego, they would presumably construe all of last week as behind them, not in front of them: *Forward* relative to ego's orientational frame would have meant “to a later time, closer to now.” The clear choice of Monday rather than Friday, after priming with motion scenes with no reference to ego's location, strongly supports the conclusion that there is no ego-RP involved in the construal of such metaphoric phrases as *move a meeting forward* (i.e., when “forward” is taken to mean “earlier” rather than “later”): Event times in such cases are construed as “moving” with respect to a temporal path or landscape.

Let us now analyze in detail the mappings involved in these various conceptual metaphors.

### 2.2.1. Time-RP metaphor

In this conceptual metaphor time is conceptualized in terms of sequentially arrayed objects moving in space. Unlike the ego-RP metaphors, the time-RP metaphors do not require a canonical observer in the source domain of space. The sequence may move horizontally as a whole, and in the direction of one of its extremes. Table 1 shows the mapping of this conceptual metaphor.

Note that in the source domain, “front” is already a metaphorical front recruited from another conceptual mapping, which allows us to ascribe a precise orientation to objects relative to their prototypical direction of motion (as in the *front* of a car). For objects lacking inherent orientation relative to motion (e.g., cubes), people ascribe orientation based on actual motion (Núñez et al., in press). For example, we can immediately and unerringly refer to the “front” side of a cube sliding along a flat surface (Clark, 1973; Fillmore, 1977/1997, 1982; Levinson, 2003). This metaphorical orientation in the source domain of objects forming a moving one-dimensional array is preserved in the target domain of time.

The entailments of this conceptual metaphor are the following:

1. If object B follows object A (in the source domain of space), then, via the mapping, time B occurs later than time A (i.e., it is in the future relative to time A). In other words, earlier times are in front, ahead of, later times.

Table 1  
Time-RP Mapping

Source Domain, One-Dimensional Space	Target Domain, Time
Objects	Times
Sequence of objects	Chronological order of times
Objects in the sequence oriented in terms of front-back relationships (usually given by their direction of motion)	Times oriented in terms of “front-back” relationships (usually given by their direction of “motion”)
An object A located in front/behind an object B	A time A occurs earlier/later than time B
Movement of the entire sequence in one direction (usually horizontally)	Passing of time

2. The mapping preserves transitive relations over relative positions in the sequence (source domain). For instance, if object C follows an object B in the sequence, and object B follows an object A, then object C follows object A. Via the mapping, we therefore know that if time B is later than time A and time C is later than time B, then time C is later than (is in the future relative to) time A.

3. Because the sequence of objects is one-dimensional (linear), time is one-dimensional.

The time-RP metaphor accounts for both the linguistic form and the semantic entailments of expression like these: *Christmas follows Thanksgiving*; *Greenwich Mean Time is lagging behind the scientific standard time*; *Boston time is 3 hours ahead of San Francisco time*; and *It is now 20 minutes ahead of 1 p.m.*

We should observe that English time-RP metaphors are predominantly moving-time, or at least evoke a source domain involving potential motion along a path. Note the preference for *ahead of* and *behind* in the preceding examples; they cannot be replaced by *in back of* and *in front of*. This appears to be because *ahead of* and *behind* refer to spatial relations between entities in motion (or ranged on a path), whereas *in front of* and *in back of* refer to static situations.

The Time-RP metaphor is similar to what Evans (2003) called the complex temporal sequence model in that both invoke a sequence, and neither of them require a specification of present, past, and future. There are, however, some important differences. First, unlike the time-RP metaphor, Evans's model is not characterized by a clear mapping from *space* to *time* (as is required by conceptual metaphor theory). Instead the model only provides a map from temporal entities such as "sequence of temporal events" onto "chronology of events," and "temporal events located before or preceding other events" onto "earlier events" (p. 231). Under the time-RP account, all these elements are entities of the target domain of time, constituting, under the metaphorical mapping, images (in the mapping sense) of purely spatial entities in the source domain. Second, Evans's model is not motivated by the primary role of reference points as time-RP is. This can generate some problems. For instance, Evans, reporting on the work by Hill (1978) on the West African language Hausa, mentioned that in some situations speakers of this language elaborate the earlier event in a temporal sequence in terms of *after/behind* (*baya*), whereas describing the later event in a sequence in terms of *before/in front of* (*gaba*). Evans cited this case as an instance of the complex temporal sequence model, which contrasts with the pattern observed in English. The linguistic examples in Hausa taken from Hill (1978, p. 528) translate into English as "Tuesday is in front of/before Monday" and "Monday is in back of/after Tuesday." However, a close inspection from the perspective of reference points shows that what is giving the front-back orientation to the static array of objects is a well-established pattern in Hausa for characterizing locational relations of objects in space relative to an *observer*. Objects further away from the observer (in front of him or her) are construed as "in front" of objects that are closer to the observer. When mapped onto temporal sequences, Tuesday is indeed "in front" of Monday. The point is that the orientation of objects in the sequence is not intrinsic to it (as required by the time-RP metaphor), but by a background reference point provided by an observer. In this sense, the Hausa data, as analyzed by Evans, are not an instance of a time-RP metaphor, but a form of the ego-RP metaphor where Tuesday is in the future (in front of) relative to Monday.

### 2.2.2. Ego-RP metaphor

As we have seen, the ego-RP metaphor corresponds to the first metaphor of time discussed in the literature (as Time Passing Is Motion in Lakoff, 1993). It has a somewhat more complex structure than the time-RP metaphor discussed in the preceding subsection. Here times are conceptualized as objects located on a one-dimensional space (e.g., path) relative to a canonical observer (ego), whereas time passing is conceived as the relative motion between the observer and the times. The ego-RP mapping has two variants defined by the nature of the moving agent. These two variants share the same inferential structure when no motion is concerned but differ with respect to the identity of the moving and static agents (i.e., moving-time and moving-ego).<sup>12</sup> For the sake of clarity we follow Núñez (1999) and first describe the shared (static) inferential structure present in both variants, and then we analyze the dynamic variants.

### 2.2.3. Ego-RP basic static structure.

The mapping of the basic structure of the ego-RP metaphor can be seen in Table 2.

The entailments of this shared static portion of the ego-RP metaphor are the following:

1. Transitive properties applying to spatial relations between the observer and the objects in the source domain are preserved in the target domain of time. For example, if, relative to the front of the observer, object A is further away than object B, and object B is further away than object C, then object C is closer than object A. Via the mapping, this implies that time C is in a “nearer” future than time A.
2. The same relations hold for objects behind the observer and times in the past.

The inferential structure of this basic static portion of the ego-RP metaphor accounts for a number of linguistic expressions: *The summer is still **far away***; *The end of the world is **near***; *The week **ahead of us** looks promising*; *Election day is **here***; and *I am looking **ahead** to Christmas*.

**2.2.3.1. Ego-RP additional dynamic structure.** When relative motion is added to the basic structure of the ego-RP mapping, new inferential properties emerge. An important dimension of this extension is that motion is relative; that is, the mapping requires that there is a moving agent moving relative to a static passive entity: In the source domain either (a) the objects move relative to a static observer, or (b) the observer moves relative to the objects located along the one-dimensional path. The former is the moving-object variant (also referred to as TIME PASSING IS MOTION OF AN OBJECT metaphor), and the latter, the moving-ego variant (also re-

Table 2  
Ego-RP Mapping (Basic Static Structure)

Source Domain, Horizontal One-Dimensional Space	Target Domain, Time
Objects	Times
Order of objects along a horizontal one-dimensional path	Chronological order of times
Objects in front of the observer	Future times
Objects behind the observer	Past times
Object collocated with the observer	Present time

ferred to as TIME PASSING IS MOTION OVER A LANDSCAPE metaphor). The additional structure of the two dynamic versions of the ego-RP mapping can be seen in Tables 3 and 4, respectively.

The moving-object variant has some important entailments, in addition to those outlined earlier for the general ego-RP mappings:

1. The object passing the observer is, via the mapping, the present time.
2. Because there is only one observer, there is only one present.
3. Because the objects all move in the same direction, time change is unidirectional.
4. Time has a perceived velocity relative to the observer.
5. Distant moving objects (in front of the observer) will arrive later at the observer's location. Via the mapping this entails that a temporal experiencer will experience later times that are farther in the future.
6. Because the moving sequence of objects is one-dimensional, the static observer only experiences colocation with each object along the sequence once. Via the mapping this entails the temporal experiencer will experience a given time only once.

The following are some linguistic expressions with their semantic entailments modeled by this variant of the ego-RP mapping: *The new year is coming upon us*; *Time is flying by*; *The time has long since gone when ...*; *The end of the world is approaching*; and *The time to make a decision has come*.

The inferential structure of the other dynamic variant of the ego-RP metaphor, the moving-ego variant, can be seen in Table 4.

Some important entailments in addition to those of the general ego-RP metaphor are:

1. Time has an extension, and can be measured.
2. An extended time, like a segment of a path, may be conceived as a linear bounded region.

Table 3  
Moving-Object Dynamic Variant of the Ego-RP Metaphor

Source Domain, Horizontal One-Dimensional Space	Target Domain, Time
Dynamic objects	Times
Objects moving horizontally with respect to a static observer (with their fronts in direction of motion)	The passing of time

Table 4  
Moving-Ego Dynamic Variant of the Ego-RP Metaphor

Source Domain, Horizontal One-Dimensional Space	Target Domain, Time
Fixed objects with respect to which the observer moves	Times
Frontal motion of the observer relative to objects	The passing of time
The distance moved by the observer	The amount of time passed

3. A moving observer will arrive later at a destination that is farther forward along her path. Via the mapping, this entails that times that are farther in the future will be experienced later by the temporal observer.
4. Because the space is one-dimensional (one-way passage along a linear path), the moving observer only experiences each location along the path once. Via the mapping this entails that the temporal experiencer experiences a given time only once.

This form of the mapping accounts for linguistic usages such as these: *She **passed** the time happily; We **are approaching** the end of the summer. He **left** his difficult childhood **behind**. We **are racing through** the semester. We **are coming to** the end of the month; and How **long** is she staying?*

As we can see, the two forms of ego-RP mappings have quite different inferential structures, and as Lakoff (1993) pointed out, they are sometimes inconsistent with each other. The same lexical items used in both variants have mutually inconsistent readings. For example, the word *approaching* in *The end of the world is approaching* (moving-time variant), and in *We are approaching the end of the summer* (moving-ego variant) take different arguments. Both refer metaphorically to temporal relations, but the former takes a moving time as a first argument and the latter takes a moving observer as a first argument. The same is valid for *come in the time has come* and in *We are coming to the end of the year*. Despite these differences, however, there is a crucial entailment shared by both variants:

- Whether time A approaches the observer (moving-time variant) or the observer approaches time A (moving-ego variant), it is true, in both cases, that the metaphorical distance between the observer and time A, (a) gets shorter as the action “approaching” takes place, and (b) will be shorter after the action “approaching” is over.

Núñez (1999) argued that given this “general truth,” it is tempting to reduce both variants to a unique abstract mapping characterizing this fundamental entailment. Such a mapping, however, would allow also cases in which both entities, the observer and the objects, move simultaneously, as in “We and Christmas are approaching each other” for which entailments 1 and 2 would also be true. Because such cases have not been empirically observed in natural language, they must be explicitly excluded from the characterization of the ego-RP mapping. This is done by precisely characterizing in the source domains of both variants the impossibility of simultaneous motion of observer and objects. It would be a mistake to consider the two variants of the ego-RP metaphor as cognitively equivalent only because they share inferences about the outcome of relative motion (i.e., the resulting state after the action “approaching” is over). The two variants are construed, cognitively, through different mechanisms.<sup>13</sup> A plausible explanation for why such simultaneous ego-and-time motion metaphors are not found is the importance of landmark–trajector or figure–ground structure in the construal of spatial scenes. If ego and time were both construed as figures in motion, against what ground would the motion be cognitively construed?<sup>14</sup>

Let us sum up the structural mappings involved. In the moving-ego variant of the ego-RP metaphor, self is a moving person, and time is a linear, unidirectional array along which ego moves. In this mapping, we find that necessarily FUTURE IS IN FRONT OF EGO and PAST IS BEHIND EGO. In any moving-time metaphor, it is necessarily the case that LATER

EVENTS ARE BEHIND EARLIER EVENTS and EARLIER EVENTS ARE IN FRONT OF LATER EVENTS. Future events can coherently be understood as “in front” of ego whether ego is moving or standing still, so long as ego is construed as “facing” toward the future.

As Moore (2000) pointed out, the basic distinction between ego-RP and time-RP spatializations of time can be clearly made whether or not change or motion is part of the construal. In saying that *Christmas follows Thanksgiving*, we are talking about the relation of two times in terms of a spatial relation between a landmark and a trajectory object—both moving objects. Ego is not referenced. Although the preferred tense of the statement may change, the verb *follow* will still be appropriate in describing the relationship *2004 follows 2003*, whether the 2 years in question are past or future relative to ego and now. In an ego-RP construal, the relation between an event or a time and the experiencer’s now is highlighted: *Summer vacation is still ahead of me* and *Summer vacation is coming* both specifically reference the futurity of the vacation with respect to now, although only one describes time as “moving.”

It has been pointed out that spatial metaphors for time have a strong experiential basis in everyday human experience of motion along a path, and of moving entities passing us on a path (Emanatian, 1992; Lakoff & Johnson, 1980, 1999; Lakoff & Núñez, 2000; Moore, 2000; Núñez, 1999; Sweetser, 1988). For example, if we walk forward along a path from location  $L_0$  to location  $L_K$ , we experience a correlation between locations along the path and times. The time  $T_K$ , when we reach  $L_K$ , is in the future relative to the moment when the action of moving began (i.e.,  $T_0$ ). The two correlated domains are both linearly structured and preserve a close isomorphism: Just as we cannot get from  $L_0$  to  $L_K$  without going to the intervening points  $L_1$ ,  $L_2$ , and  $L_3$  along the way, so we cannot get from 4:00 p.m. to 4:05 p.m. without living through the intervening times.

This correlation is obviously only partial in our experience: In space, we can step sideways off a path, or turn backward and head the opposite way, while time remains inherently unidirectional and unidimensional. However, there is nonetheless a salient correlation between known past times and known (seen, experienced) locations, and between unknown future times and unknown (still unseen and unexperienced) locations on a partially traversed path. Further, although paths are inherently accessible for traversal in either direction, human bodily interaction with paths is inherently asymmetric at any given time. Due to species-specific morphoanatomy, forward rather than backward (or sideward) motion is effortless, accurate, and generally natural for humans. So human motion experience does in some important respects inherently parallel the intrinsic asymmetry of temporal experience.

One would expect these fundamental correlations between time and self-motion to be experienced by all humans—and most likely by other animals, surely by primates. Similarly, we all experience objects in motion relative to ourselves. Construals of time as relative motion (whether time or ego is moving) thus seem likely candidates for primary metaphors (Grady, 1997a, 1997b; C. Johnson, 1996, 1999a, 1999b), based on the kind of pervasive and salient experiential correlation of two domains that constitutes a primary scene.

Indeed, these mappings seem pervasively salient in the world’s languages, being both the primary sources for lexical expressions of temporal reference and the primary sources of tense markers (where the etymologies of these are known; Bybee & Pagliuca, 1985; Bybee, Perkins, & Pagliuca, 1994; Heine, 1993; Heine, Claudi, & Hünemeyer, 1991; Heine et al., 1993). As one might expect, ego-RP models are the ones involved in deictic temporal reference with re-

spect to now, and thus in tense systems; deictic motion verbs such as *come* and *go* are frequently recruited as tense markers, as in the English *gonna* future (Bybee & Pagliuca 1985; Bybee et al., 1994; Emanatian, 1992; Fleischman, 1982a, 1982b; Sweetser, 1988). Time-RP models are also involved in expression of temporal relations between reference events, independent of relation to now: For example, English *before* and *after*, which etymologically meant “in front of” and “behind” (and once partook of the same time-RP metaphor as *Christmas follows Thanksgiving*) refer to the relation between two times, independent of those times’ relation to the present.

### 2.3. Evaluating cross-cultural variation in mapping patterns

Now that we have laid out the parameters involved in the mapping of time onto space, it is time to directly address the earlier claims in the literature that in certain languages, “the future is in back.” Cultural analysts have long been interested in cultural differences; they have not been slow to notice languages where words meaning *front* and *back*, or *in front of* and *behind*, appear to be used in temporal senses opposite to those expressed by European words with the same spatial meanings. Moore (2000) concluded that in the cases accessible in the literature, analysts have been misled by rather sketchy statements of the English mappings, and are not in fact comparing the right data. In most cases, the confusion is between ego-RP and time-RP metaphors.

We concur with Moore’s (2000) assessment that none of the examples in the literature are adequately supported cases of ego-RP temporal metaphors wherein FUTURE IS IN BACK OF EGO. Thornton (1982, 70ff.) compared Maori uses of FRONT words to mean “earlier” with parallel classical Greek uses; she appeared to be confusing ego-RP and time-RP metaphors, giving no evidence that the long-past Maori events are seen as “in front of” ego rather than “in front of” later events. Dunkel (1983) debunked some of the Greek parallels invoked by Thornton, arguing that there is no evidence that classical Greek has a metaphor PAST IS IN FRONT OF EGO—although indeed it does productively construe earlier (and perhaps past) events as in front of later ones. Klein (1987), claiming to provide evidence of a cyclic time model in Toba, wherein the experiencer faces the past and “future precedes past,” actually provided no concrete evidence for a future-before-past construal. In the process, she gave some quite suggestive evidence for models such as FUTURE EVENTS ARE OBJECTS APPROACHING THE EXPERIENCER—very similar to English *Christmas is coming*. Dahl (1995) argued that for Malagasy, ego faces the past and time is cyclic. However, Dahl’s data most clearly show a moving time metaphor, with time-RP uses of INFRONT OF to mean “earlier than”—no uncommon pattern in Indo-European languages either. The added cyclic structure suggested by Klein and Dahl is another structure, which can be superimposed on linear temporal structure; temporal linearity coexists with and is mapped onto cyclic structure such as the repeating structure of the solar year. In English, as well as in Malagasy, Christmas 2003 precedes Thanksgiving 2004. A circular path preserves linear topology, in the sense that at any given point on the path, the traveler is experiencing a local linear environment and forwards orientation with respect to it.

Perhaps the most intriguing aspect of such reports is that some anthropologists have described speakers’ claims that the future is “behind” ego in the metaphoric sense of being unknown (Hardman, 1988; Hardman, Váásquez, & Yapita, 1988; Miracle & Yapita, 1981; as well as those

cited earlier). One of the top candidates for a universal metaphor is Knowledge Is Vision (C. Johnson 1999a, 1999b; Lakoff, 1993; Lakoff & Johnson, 1980, 1999; Sweetser, 1990). In space, things behind ego are visually inaccessible, hence unknown. In temporal experience, *Realis* (including past) is known, whereas future is unknown. We shall return to this part of the mappings in our discussion of Aymara; here, let us note that the anthropologists' evidence is scanty and ambiguous. Klein (1987), for example, said that Toba speakers are "looking back over their shoulder at the future"—a description that is, to say the least, susceptible to multiple interpretations. Someone looking back over his or her shoulder is in one sense "facing" the direction of gaze; in another sense he or she could be seen as "facing" in the direction of overall bodily orientation. On top of this, it is unclear in Klein, Øyvind, and Thornton exactly how the speakers described the spatial relation of time to ego, and how much of the construal is the analyst's (as they do not give full linguistic analyses of examples, carefully distinguishing ego-RP reference from time-RP reference).<sup>15</sup> This brings us to a final problem with the claims about temporal metaphor in the literature. Most analysts seem eager to present a given culture as having a single unified model of time. They often seem to connect quite scattered data points to form such a unified broader picture. For languages where analysts have examined a fuller range of data, it seems clear that there is not a single entirely coherent metaphoric model of time. English not only varies between the time-RP and ego-RP construals, but between static and moving construals of time as well. So an added concern, in analyzing the Aymara data, is to avoid mentally creating a single synthesis of "the Aymara model of time" without sufficiently rich justification.

Nor are all spatial metaphors for time based in back–front orientation and motion. In Chinese (Yu, 1998), earlier times are also seen as being above later times, and particular set phrases in Chinese vary between this vertical metaphor and the front–back models. Some European languages also have up–down metaphors that relate to temporal structure. Consider the French historical term *basse antiquité* (Late Antiquity, lit. "low antiquity"), or the two contrasting usages High Middle Ages (in English) and *bas moyen âge* in French (lit. "low middle ages"), technical phrases used by historians to refer to the same period, the later medieval period. The French usages seem related to a metaphor such as Earlier Is Higher, Later Is Lower; whereas the English usage seems related to the construal of the later medieval period as culturally and intellectually closer to the following Renaissance, a period of "high" culture (Greater Cultural Achievement Is Greater Height). Aymara also has some more minor vertical temporal metaphors: *alay lunisa* ("high Monday") means "next Monday." In none of these cases are front–back temporal metaphors missing from the relevant languages' linguistic systems—but other metaphors are present as well. Similarly, Emanatian (1992) showed that in temporal deixis, as in spatial deixis, it is possible to displace the deictic center; the result is added complexity in spatial metaphors for temporal structure. Once again, this system is not a replacement for, but an elaboration of, the "standard" options for mapping space onto time.

Therefore we have quite broad (although surely not universal) linguistic evidence supporting the position that spatiotemporal metaphors treating time as relative motion, and focusing on back–front orientation, recur cross-linguistically precisely because certain patterns of universal human experience motivate these metaphoric structures. In these mappings, FUTURE IS IN FRONT OF EGO, not in back.

The next section presents the Aymara linguistic evidence of spatiotemporal metaphoric mappings; the following section sets them in their gestural context.

### 3. What can the Aymara linguistic data tell us about Aymara speakers' construals of time?

The following are common linguistic expressions in Aymara (Albó, 1988; Briggs, 1993; Grebe, 1990; Hardman et al., 1988; Miracle & Yapita, 1981; Tarifa, 1969). In these examples, we can see the use of the nouns *nayra* (“eye, sight, front”) and *qhipa* (“back”) with adjectival and adverbial temporal meanings. Such uses are common in everyday Aymara usage.

#### 3.1. Temporal uses of *nayra*

- (1) *nayra mara* (“last year”)

literal gloss:

<i>nayra</i>	<i>mara</i>
eye/sight/front	year

- (2) *ancha nayra pachana* (“a long time ago”)

literal gloss:

<i>ancha</i>	<i>nayra</i>	<i>pacha</i>	<i>-na</i>
a lot	eye/sight/front	time	in/on/at

- (3) *nayra pacha/timpu* (“past time”)

literal gloss:

<i>nayra</i>	<i>pacha/timpu*</i>
eye/sight/front	time

\**Timpu* is borrowed from the Spanish word for time, *tiempo*.

Before addressing the difference between spatial and temporal senses of *nayra*, we must note that it is not unusual for one word to have the meanings of both “eye” and “face” (cf. classical Greek *ops*), or “face” and “front” (cf. English *face*, or *front*, which etymologically derives from a Latin word for forehead). These appear to be normal polysemy patterns. The eye is part (a salient and important part) of the face, so there is a strong metonymic link between these senses. The face is also perhaps the single strongest defining factor in identifying the front of a human being, another crucial frame–metonymic link. We shall here assume that it is normal for the same word to mean “eye” and “front”—our interest is in the link between the senses of “front” and “past.”

An interpretation offered by previous analysts (Miracle & Yapita, 1981) is that PAST IS IN FRONT in Aymara because the past is known, and the area in front of the speaker is seen. This invokes the Knowledge Is Vision metaphor discussed earlier, mapping a known period of time or sequence of events onto a visually accessible physical area. In somewhat mixed-domain language, Miracle and Yapita (1981) cited a contrast between the “unseen future and the visible present-past”; so more precisely, we should say that in Aymara REALIS IS IN FRONT and IRREALIS IS IN BACK. As we shall later see from gestural data, the present is metaphorically located immediately at the front of the speaker’s body, whereas the past is the space farther in front of the speaker.

*Nayra* is also regularly used in Aymara to mean “first” in a narrative sequence—another case of a use that means “earlier than (some other relevant times or events).” A storyteller might start out by saying *nayra* (lit., “front”, here “first/earliest”), and label subsequent epi-

sodes with *ukat* (“from that”). In enumerating entities in an ordinal list, speakers also label the first entity as *nayra(xa)* and subsequent entities as *ukat qhiparu* (lit., “toward-back from-that”, “backward from that”), where an English speaker might say “first”, “next”, “next.” These uses of *nayra* do not specifically mean “earlier than now”; they appear to refer to the sequential relations between events, without reference to their relation to the present.

However, (1) cannot mean “the year before”; it means specifically “last year” (i.e., the year before now). Similarly, (2) means “a long time ago (before now),” not simply “at a much earlier time.” And (3) refers to the past, not simply to a time earlier than some other time. These uses of *nayra* are deictically framed uses, expressing the relation to the speaker’s present. This relation is implicit—there is no overt reference to “I” or “Now”—but that is equally true of examples such as *the weeks ahead* (meaning future weeks) in English, which carries much the same meaning as *the weeks ahead of us*, despite the lack of an overt noun phrase expressing the landmark of the “ahead” relation.

So we have linguistic evidence for at least two distinct uses of the Aymara word for “in front of,” one meaning “past” (ego-RP) and one meaning “earlier than” (time-RP). Given the fact that there is no overt linguistic expression of the landmarks (like *us*, in the English *ahead of us*) in the deictically interpreted *nayra* examples, it becomes a methodological necessity to add sources of evidence to support our claim that the “past” senses of *nayra* are metaphoric interpretations of deictic spatial senses (ego-RP). Gesture is one such source of evidence.

### 3.2. Temporal uses of *qhipa*

Aymara *qhipa* (“back”) is used in a parallel fashion, to refer to the future or to relatively later times. Examples (4) through (7) show deictically centered uses, which refer to times in the future relative to now, as being “behind (ego).” Again, there is no overt expression of the ego-RP nature of these expressions—no “behind *us*”—so gesture may help to solidify our evidence for the deictic semantics of these expressions.

(4) *qhipüru* (“a future day”)

literal gloss:

<i>qhipa</i>	<i>uru</i>
back/behind	day

(5) *akata qhiparu* (“from now on”)

literal gloss:

<i>aka</i>	<i>-ta</i>	<i>qhipa</i>	<i>uru</i>
this	from	back/behind	day

(6) *qhipa marana* (“in the next [immediately future] year”)

literal gloss:

<i>qhipa</i>	<i>mara</i>	<i>-na</i>
back/behind	year	in/on/at

(7) *qhipa pacha/timpu* (“future time”)

literal gloss:

<i>qhipa</i>	<i>pacha/timpu*</i>
back/behind	time

\**Timpu* is borrowed from the Spanish word for time, *tiempo*.

Example (8), on the other hand, seems ambiguous between a sense of a day that follows some other day, and a future day relative to now. Example (9) refers to a period following some reference year (“that year”) rather than to a period later than now. These seem to be instances of nondeictic, time-RP spatial construals of time.

- (8) *qhipa uruna* (“on the next day/on a future day”)

literal gloss:

<i>qhipa</i>	<i>uru</i>	<i>-na</i>
back/behind	day	in/on/at

- (9) *uka marata qhiparu* (“from that year on”)

literal gloss:

<i>uka</i>	<i>mara</i>	<i>-ta</i>	<i>qhipa</i>	<i>uru</i>
this	year	from	back/behind	day

Example (10) is a conventional phrase of farewell, and appears therefore to mean “until a later day (than today)” —another deictic use.

- (10) *qhipurkama* (“until another day; so long”; Briggs, 1993, p. 412)

literal gloss:

<i>qhipa</i>	<i>uru</i>	<i>kama</i>
back	day	until

### 3.3. Other expressions

As mentioned earlier, the morphemes *nayra* and *qhipa* are also used to refer to positions in a sequence. Here we find this mapping in the terms for various planting or sowing periods in an agricultural cycle (Examples 11–13). Notice that the structure here is richer than that of the narrative and enumerative sequential uses: The annual planting cycle has a “front” (the start) and a “back” (the end), and even a “middle.” There is no deictic structure here, but purely sequential relations unconnected with any specific now: The “front planting” is simply *before* other plantings in the same cycle.

- (11) *nayra sata* (“first planting”)

literal gloss:

<i>nayra</i>	<i>sata</i>
eye/front/sight	planting

- (12) *taypi sata* (“middle planting”)

literal gloss:

<i>taypi</i>	<i>sata</i>
middle/center	planting

- (13) *qhipa sata* (“last planting”)

literal gloss:

<i>qhipa</i>	<i>sata</i>
back/behind	planting

Aymara ego-RP time metaphors appear to be largely static; there are a few uses such as *jutir pacha* “coming time,” attested in Inland Iquique in Northern Chile and in some Bolivian dia-

lects (see also Bertonio, 1612/1984). However, far more dominant are static locational forms such as “back time” for future.

Many Aymara speakers are bilingual between Aymara and a distinct regional Spanish-based linguistic variety called *Castellano Andino* (CA; Andean Spanish). CA shows important influences from its speakers’ Native American language substrates. Aymara-spoken CA, for example, uses Spanish pluperfect tense forms as evidential markers indicating lack of direct personal knowledge about a described past event (Miracle & Yapita, 1981). Pluperfect forms thus contrast evidentially, in CA, with Spanish perfect and imperfect forms, which are used to mark direct experience of past events. Evidentiality is a category not grammatically marked by Spanish tenses.

Among southwestern Aymara speakers, a majority are Aymara–CA bilingual to varying degrees, and some are also familiar with more standard dialects of Chilean Spanish. Older speakers with no formal education are more likely to be monolingual Aymara speakers; speakers who have traveled to work in urban areas are naturally more likely to have had exposure to standard varieties of Spanish as well as CA.

Bilingual speakers may well be familiar with some of the common Spanish motion metaphors for time, as well as Aymara native metaphors. Núñez, Neumann, and Mamani (1997) noted a potential correlation between temporal uses of Aymara motion verbs and the presence of Spanish loan words; this is worth investigating, as it may show that these Aymara motion-verb uses have been reinforced by Spanish bilingualism.

We have noted some linguistic metaphoric uses of spatial terms in CA that are not standard in Spanish. For example, CA speakers use *atrás*, which in standard Spanish means “behind”, to mean “late(r)” (which in standard Spanish would be (*más*) *tarde* or *después*). This use is congruent both with Aymara time-RP use of front–back terms to mean “earlier and later” (*nayra sata*, *qhipa sata*), and with standard Spanish time-RP metaphors in which earlier events are seen as “in front of” later ones (Spanish *ante* means both “before” and “before the eyes of, in the presence of”; the related *delante* means spatially “in front of”). However, these metaphors stand out more clearly in the Aymara data, where exactly the same lexical material means both “front” and “earlier,” or “back/behind” and “later.” In the realm of time-RP metaphors, CA may thus have stronger front–back metaphoric structure for time than standard Spanish, perhaps because of reinforcement from an Aymara substrate.

In sum, Aymara linguistic forms give evidence for both sequential (time-RP) temporal interpretations of *nayra* and *qhipa* (as “earlier” and “later,” respectively) and deictic tense-marking interpretations (as “past” and “future”), which we have tentatively labeled ego-RP. However, ego and now remain implicit, rather than overtly marked, in Aymara deictic linguistic expressions for “next year” or “last year.” Unlike English, where speakers can say *I have a tough semester in front of me* or *That part of my life is behind me*, in Aymara we are never overtly told that it is the year “in front of *me*” or “in back of *us*” (M. Hardman, personal communication, August 26, 1999). Linguistic analysis alone cannot fully answer the crucial question of whether *nayra* and *qhipa* operate with a time-RP model or with an ego-RP one. The semantic interpretations of *nayra* and *qhipa* as past and future are inherently deictic, suggesting intuitively to an English speaker a metaphoric spatial construal with respect to ego’s location; but how do we know for certain that this is how relation to the present is metaphorically construed by Aymara speakers? Perhaps the present is

not metaphorically understood as the speaker's here, but as just another temporal reference point with respect to which to locate times. If *nayra* and *qhipa* are used exclusively with a time-RP model, then Aymara has nothing other than the well-known pattern FRONT IS EARLY and BACK IS LATE, behaving very much like the English term *ahead*, as in *it is 20 minutes ahead of 1 p.m.* (i.e., 12:40 p.m., which is earlier than 1 p.m.). If, on the contrary, *nayra* and *qhipa* are indeed used with an ego-RP model to mean "past" and "future," respectively, then Aymara has a truly rare pattern unlike most languages around the world. The study of gestural data provides the answer to this crucial question.

#### 4. How can Aymara speakers' gestures help us where linguistic data do not?

We have seen that Aymara linguistic forms do constrain our hypotheses about Aymara time metaphors, but not sufficiently for us to answer some important questions. A neglected but powerful source of data is the gestural track that is universally coproduced with spoken languages. As McNeill (1992, 2000, 2005) and others have argued, it offers unique access to some of the less conscious aspects of the cognitive processes underlying language. And, most important for this investigation, gesture like language, represents metaphoric mappings between domains. We can then make use of gestural phenomena to help address the main questions presented at the beginning.

In the last 20 years, the field of gesture studies has moved forward dramatically, thanks to the work of pioneers such as Kendon (1982, 2004), McNeill (1992, 2005), Goldin-Meadow (2003),<sup>16</sup> and many others. Research in a variety of areas, from child development, to neuropsychology, to linguistics, and to anthropology, has shown the intimate link between oral and gestural production. Finding after finding has confirmed that gestures are produced in synchronicity with speech, that they develop in close relation with speech, and that brain injuries affecting speech production also affect gesture production. The following is an abbreviated list of sources of evidence supporting (a) the view that speech and gesture are in reality two facets of the same cognitive linguistic reality; and (b) the embodied approach for understanding language, conceptual systems, and high-level cognition:

1. Universality: Speech-accompanying gesture is a cross-cultural universal (Iverson & Thelen, 1999; Kita & Essegbey, 2001; McNeill, 1992; Núñez & Sweetser, 2001).
2. Largely unconscious production: Gestures are less monitored than speech, and they are to a great extent unconscious. Speakers are often unaware that they are gesturing at all (McNeill, 1992).
3. Speech-gesture synchronicity: Gestures are coproduced with speech, in cotiming patterns that are specific to a given language (McNeill, 1992).
4. Gesture production with no visible interlocutor: Gestures can be produced without the presence of interlocutors; for example, people gesture while talking on the telephone, and in monologues; congenitally blind individuals gesture as well (Iverson & Goldin-Meadow, 1998).

5. Speech–gesture co-processing: Stutterers stutter in gesture, too, and impeding hand gestures interrupts speech production (Mayberry & Jaques, 2000).
6. Speech–gesture development: Gesture and speech development are closely linked (Bates & Dick, 2002; Goldin-Meadow, 2003; Iverson & Thelen, 1999).
7. Speech–gesture complementarity: Gesture can provide complementary (as well as overlapping) content to speech content. Speakers synthesize and subsequently cannot distinguish information taken from the two channels (Kendon, 2000).
8. Gestures and abstract metaphorical thinking: Linguistic metaphorical mappings are paralleled systematically in gesture (Cienki, 1998a; McNeill, 1992; Núñez, 2006; Núñez & Sweetser, 2001; Sweetser, 1998a, 1998b).

The general results of gesture research pose problems for any approach that builds on the assumption that culture and cognitive structure are only to be found in the conscious mind. Linguistic processing is well known to be largely inaccessible to conscious introspection; also, research on metaphor has clearly shown that much metaphoric cognitive structure is both culture-specific and unconscious (Gibbs, 1994; Lakoff & Johnson, 1999). Although instantiated in the body, and making use of shared, mutually observable space, gestures are also culture-specific, as is language. The first notable example of such culture-specificity lies in what Kendon (1990) labeled *quotable gestures* (also called *emblems*), conventional gesture complexes that are meaningful even without accompanying language, and that often have meanings on the same order as those of short colloquial linguistic expressions. Manual “quotables” include more content-oriented usages such as the thumb-and-index circle (“o” hand) used by English speakers to mean “nothing” or “there’s none.” Note that unlike less conventional hand gestures, this can be correctly or incorrectly produced. It is not acceptable to make a thumb + pinky circle instead of a thumb + index circle, in gesturing “none.” Some emblematic gestures seem so tightly tied to speech that they are regularly retained when interlocutors cannot observe them; English speakers nod and Japanese speakers bow during telephone conversations.

However, McNeill (1992) showed that even less conventionalized gesture—so-called free gesture accompanying speech—follows tight language-specific patterns in its cotiming with speech, as well as in which aspects of the described situation are depicted in gesture. These patterns are inaccessible to conscious monitoring.

Spatial structure is in one sense directly represented in gesture; that is, it is represented in the same medium, space. In another sense, however, the speaker’s construal is paramount in this as in other aspects of linguistic and gestural representation. Haviland (1993), for example, described a speaker of Guugu Yimithirr (a native language from Australia), who in retelling a story of a boat capsizing, automatically adjusted his gestural patterns to match the actual “absolute” compass orientation of the boat’s motion in the actual event. Most English speakers would not do this, which may be connected with the fact that English does not normally use absolute spatial coordinates for everyday location of small objects in the immediate environment. In Guugu Yimithirr, unlike English, one would not be able to say that the mug is next to, or in front of, the speaker; one would have to say that it is east, or north, of the speaker, or whatever the appropriate direction might be (Levinson, 2003; Majid et al., 2003).

In short, whenever the speaker is referring to anything besides the actual present physical space, gesture (and sign language, too) necessarily involves some mapping between the real space and represented spatial (or other) structure. The nature of these mappings is culture-specific, and therefore shows more extensive variation cross-culturally than do gestures referring to the actual surrounding space. Our understanding of this is that gestures enact *blends* (in the sense of Fauconnier & Turner, 1996, 1998a, 1998b, 2002) of the real space with other spaces (Liddell, 1998, 2003); mental space blending principles apply similarly in all cases, but the precise mappings vary.

A crucial contrast, for gesture as well as for speech, is between deictically centered and nondeictically-centered gestural structures. Paul Dudis (personal communication, 2002) pointed out to us that in American Sign Language (ASL) spatial arrays, it is possible for the speaker to be located in the array or not (see also Emmorey, 2002, chap. 3). For example, a signer who is asked to identify a student (out of a class not currently in session) might point to a particular locus to his or her left; this might mean, in context, that the student sits in a location in that orientation from the signer's usual location in the classroom. You would have to know the signer's usual classroom location, as well as orientation, to know the relevant student's location. On the other hand, in setting out a map of Berkeley for a signing interlocutor, there might be no place on that map where the signer was located. Although there would inevitably be a perspectival choice of mapping onto the real space (e.g., north = forward away from signer, south = toward signer, east and west = toward the signer's right and left respectively), the signer's own body and bodily location would not be part of that mapping.

It is well known that gesture can be used metaphorically. Both in gesture and in signed languages, a gestural form that is iconic for a source-domain concept can be used to express its counterpart in the target domain of some metaphor. For example, an English speaker may move a hand forward to indicate literal forward motion or location; or a very similar gesture may refer to future time. Taub (2001) presented an extended analysis of the relation between metaphor and iconicity in ASL forms, an analysis that has inspired much of the subsequent work on parallel phenomena in gesture. Cienki (1998a) gave detailed examples of hands moving up and down (on "virtual" vertical scales) to refer to good and bad grades, and to good and bad moral behavior, and Núñez (2006) analyzed cases of mathematicians producing dynamic gestures while explaining series and limits (in ways compatible with the historical origins of these concepts), overruling the fact that the modern formal language used in those domains is fully static. Further examination of metaphoric uses of gesture can be found in Müller (1996), Parrill and Sweetser (2004), Smith (2003), and Sweetser (1998).

Cienki (1998a) and Sweetser (1998a, 1998b) argued that such metaphoric uses of iconic gesture provide interesting evidence of the presence of the source-domain concepts in the mind of the speaker. When such gestures accompany metaphoric language, the gesture offers converging evidence, along with the linguistic forms, of the cognitive processing of two domains. Sweetser (1998a) documented a speaker saying *put you away*, meaning "put you in jail," accompanied by a gesture of moving an object (perhaps a box) from one place to another—literal "putting away." This is additional evidence in support of Gibbs's arguments (based on other data sources) that speakers may be doing metaphoric processing even of very conventional and

idiomatic metaphoric phrases. Cienki also gave examples of cases where speakers use literal language about an abstract domain (*good grade, bad grade*) while gesturing metaphorically about the same domain (e.g., up and down gestures for good grades and bad grades, respectively). In these cases, only the gestures let us know that the speaker is construing the relevant domain metaphorically.

The distinction between deictically centered spaces and spaces without deictic structure is of particular interest in examining metaphoric gestures representing time. As we mentioned earlier, language involves both deictic construals of time (relative to some experiencer's now) and nondeictic representations of temporal sequence. Tense is inherently deictic, as are words like *now, then, and ago*: a message saying *I will arrive 3 days from now* would be completely uninformative without knowing the time of writing. Words like *before* and *after*, on the other hand, are not based on a deictic frame: They are usable, as in examples cited earlier, even to describe generic repetitive relations such as *Christmas comes after Thanksgiving*. Gesture shows the same dichotomy. Cospeech gesture and signed languages both manifest (a) spatialization of time relative to now (ego-RP), represented as spatial relation to the speaker's physical location (here), and (b) representation of temporal sequence without reference to now (time-RP). An English speaker, for example, might gesture forward for the future, and point at the ground in front of his or her feet while saying *right now*; these are part of a general deictic timeline, with future metaphorically located in front and past in back of speaker.<sup>17</sup> This kind of deictic gestural timeline is manifested in other languages as well: Calbris (1990) gave examples of such a timeline in French; it is also regularly manifested in all signed languages for which we have seen data (and well documented in the literature on ASL; see Cogen, 1977, for a seminal early reference; Emmorey, 2001, 2002, for current work). However, the English speaker might also represent a sequence of days or years as a horizontal line from left to right across her gesture space, gesturing to points on that line to refer to particular times or events; in such a left–right time line, there is no inherently built-in now, as the speaker's location is not part of the spatial structure that is mapped onto time (time-RP).

Levinson (1996a, 1996b, 2003) and colleagues have documented languages whose expression of space is absolute rather than relative. Speakers of such languages appear to conceptualize space in more absolute (e.g., north–south or east–west) terms rather than in ego-based terms (or displaced ego-based) such as *front–back* or *left–right*. Because it seems clear that understandings of time are universally based on spatial concepts, we are eager to know more about how absolute spatial conceptualization affects the corresponding conceptualization and expression of time. Levinson (2003, p. 262; 1996a, p. 376) hinted that Tenejapan Tzeltal has an uphill–downhill (locally, also south–north) space–time mapping, where “time is conceived as stretching up to the south” (1996a, p. 376). However, no Tzeltal linguistic or gestural data are provided, making the evaluation of the claim impossible. Moreover, because we have found no full linguistic description of the temporal expressions of any absolute language, we restrict our analysis here to relative spatial languages.

In the next section we show that Aymara speakers' gestures provide further evidence that their construal of time involves a FUTURE IS IN BACK OF EGO (and PAST IS IN FRONT OF EGO) mapping. Moreover, gestural evidence also shows us aspects of this model that are not directly expressed in speech.

## 5. Empirical observation of Aymara gestural data

### 5.1. Method

Speech and gestural data were collected through videotaped ethnographic interviews with Aymara speakers from the Andes highlands of Northern Chile (Núñez et al., 1997). The interviews took place in the two most important Aymara-speaking regions in Northern Chile, namely, inland Arica, and inland Iquique, near the border with Bolivia. From the former region the towns covered were Chapiquiña, Chucuyo, Codpa, Livilcar, Pachama, Pampa Algodonal, Parinacota, Putre, and Socoroma; from the latter, Ancuyo, Cariquima, Chijo, Colchane, Enquelga, Isluga, Mauque, and Villablanca. A few interviews took place in the cities of Arica and Iquique themselves, where there are several communities of Aymara people who have immigrated to these ports. The series of interviews were completed in several trips within 18 months. Approximately 20 hr of raw videotaped interviews were obtained, and later digitized and captured for audio and video analysis.

#### 5.1.1. Participants

As Spanish takes over, the Aymara language is gradually disappearing from the Chilean Andes. This study thus focused on adult senior speakers. In these remote areas, most elderly individuals grew up before the Chilean formal educational system (in Spanish) implemented systematic schooling in the region. Most of them managed to informally learn some form of Spanish (or CA) only in their mid- to late teens. Today the Chilean school system, which is obligatory until eighth grade, is very well established, and functions mostly with Spanish monolingual teachers brought from other regions of the country. Younger generations tend to see Spanish as a language of education, progress, and opportunities, and as a result in many households Aymara is no longer spoken. Nowadays, children who speak Aymara fluently are extremely rare in northern Chile.

Thirty Aymara individuals voluntarily agreed to participate in the study. They were all adults; 20 of them were men (66.6%), and 10 were women (33.3%). Their language proficiency (LP) status varied: Half of the participants had full mastery of Spanish (15 participants, 50%) with various degrees of knowledge of the Aymara language. The other 15 participants (50%) spoke fluid Aymara and had either good but not fluent Spanish, or little or no command of it. A more detailed classification of participants' LP is the following:

LP1 Aymara Monolingual:	1 (3.3%)
LP2 Fluid Aymara, with limited Spanish and very strong CA:	3 (10%)
LP3 Fluid Aymara, with good but not fluent Spanish and frequent use of CA:	9 (30%)
LP4 Bilingual Aymara and Spanish (fully grammatical and good vocabulary in both), and no (or minimal) CA:	9 (30%)
LP5 Spanish monolingual with some Aymara comprehension (no spoken Aymara):	3 (10%)
LP6 Spanish monolingual:	5 (16.7%)

The age (A) of the participants ranged from 38 to 84 years of age, the median age being 64.5 years. The following is the distribution across age groups:

A1 38 to 55 years old:	7 (23.3%)
A2 55 to 64 years old:	8 (26.7%)
A3 65 to 74 years old:	9 (30%)
A4 75 to 84 years old:	6 (20%)

### 5.1.2. Procedure

Interviews were informal, and usually lasted 20 to 50 min. They were conducted by an Aymara-Spanish bilingual informant and two Chilean-Spanish native speakers (one of us—R. Núñez, and a psychologist, V. Neumann). Two local informants, covering each of the two regions described earlier—inland Arica and inland Iquique—collaborated in the study. The interview, which was designed to cover discussions involving reference to time, had two parts. In the first part, participants were asked to talk about, make comments, compare, and explain a series of events that had happened or that were expected to happen in the context of their communities. In the second part participants were asked to talk about traditional “sayings,” anecdotes, and expressions in Aymara involving time, and to give examples of them. In the case of bilingual interviews, participants were asked to translate expressions from Spanish to Aymara and vice versa and to explain them. These expressions were taken from everyday language and from classic texts on Aymara language (Albó, 1988; Bertonio, 1612/1984; Briggs, 1993; Grebe, 1990; Hardman et al., 1988; Miracle & Yapita, 1981; Tarifa, 1969). The course of the interviews was overall rather flexible and open-ended, and the interaction often quite conversational. Depending on the context and the language preference of the participants, interviews took place in Aymara, in Spanish, and sometimes in both, with occasional CA.

## 5.2. Results

### 5.2.1. General statistical analyses

Of the 30 participants, 21 (70%) produced gestures (at least once) cotimed with expressions involving future or past times.<sup>18</sup> Fifteen participants (50%) produced only gestures along the sagittal plane (i.e., frontward, backward), 2 (6.7%) only gestures along the transversal plane (e.g., toward the left or the right), and 4 (13.3%) produced both sagittal and transversal gestures.

*5.2.1.1. Participants producing only past or future gestures.* Out of the 15 participants who produced only frontward–backward gestures cotimed with past and future expressions, two thirds (10 participants) generated either past-front/future-behind patterns or past-behind/future-front ones. Out of these 10 participants, individuals in the younger group (64 years old or younger) were, with one exception, also those who spoke fully grammatical Spanish (5 participants). Similarly, individuals in the older group (65 years old or older) were, with one exception, those who spoke fluent Aymara with limited command of Spanish (3 participants). Figure 2 shows how these 10 participants were distributed with respect to language proficiency.

Out of these 10 participants, all of those who spoke Aymara fluently, CA, or both, but not fluent grammatical Spanish (4 participants, belonging to groups LP1–LP3 mentioned earlier),

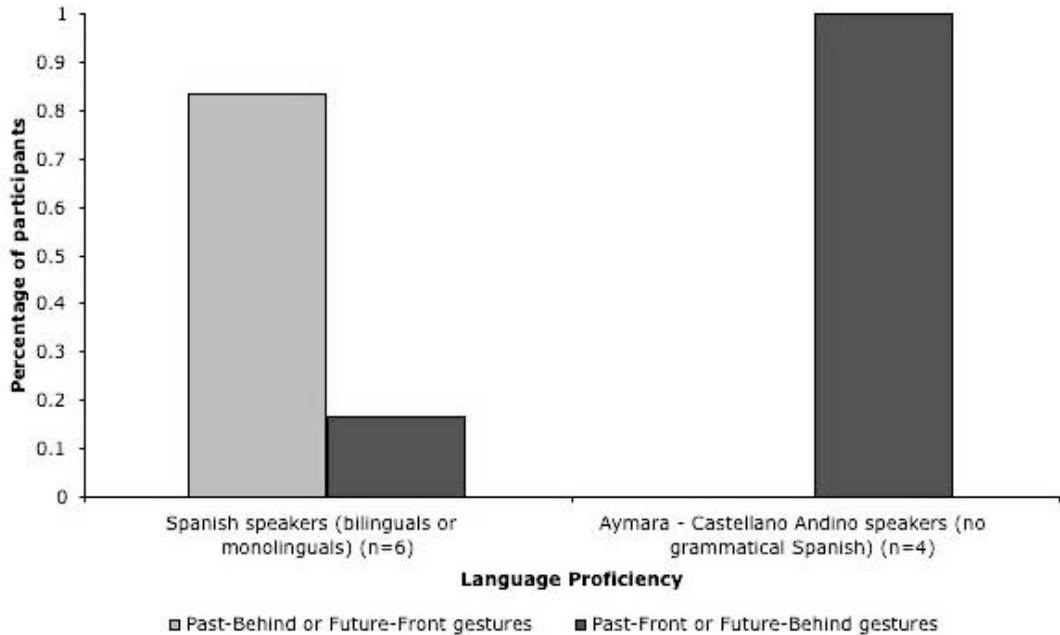


Fig. 2. Percentage of Aymara participants producing only sagittal past-future gestures, split by language proficiency.

gestured with past-front or future-behind patterns. Moreover, all participants gesturing with past-behind or future-front patterns (5 participants) were individuals who spoke Spanish fluently. Only 1 participant who was able to speak Spanish produced gestures in the past-front or future-behind direction. He was a 65-year-old bilingual speaker who also spoke fluent Aymara. These results show that the proportions of participants gesturing with past-front/future-back and past-behind/future-front patterns is not homogeneous with respect to language proficiency (one-tail Fisher's exact probability test,  $p = .024$ ), suggesting that fluency in Aymara relates to past-front/future-behind gestures, whereas fluency in Spanish relates to past-behind/future-front gestures.

Figure 3 shows the distribution of the same sagittal gestural patterns with respect to age.

All participants producing past-behind or future-front gestures (5 participants) were below the overall median age (i.e., 64 years old or younger). All 65-year-old participants or older (4 participants) produced past-front or future-behind gestures. Only 1 participant in the younger group produced gestures in the past-front or future-behind direction. She was a 57-year-old bilingual speaker with almost no formal education who spoke fluent Aymara with good but not fluent Spanish (LP3). The results show that the proportions of participants gesturing with past-front/future-behind patterns and past-behind/future-front ones is not homogeneous with respect to the two age groups (one-tail Fisher's exact probability test,  $p = .024$ ). This suggests that those who produce past-front/future-behind gestures are mostly old individuals (who did not have the opportunity to have formal education in Spanish when they were young), whereas those who produce past-behind/future-front gestures are younger individuals who grew up with (at least a minimum of) formal education in Spanish.

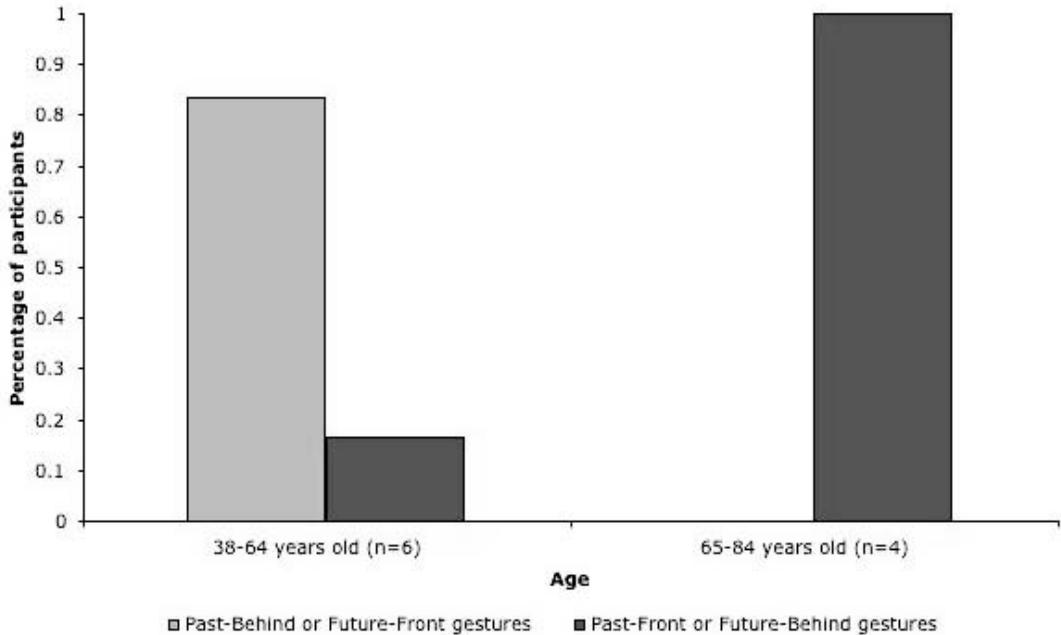


Fig. 3. Percentage of Aymara participants producing only sagittal past-future gestures, split by age.

5.2.1.2. *Participants producing past sagittal gestures.* When speaking about the past, 15 participants out of the total 30 (50%) produced at some point cotimed sagittal gestures in either orientation. For the following analyses we divide this group between those who exclusively gestured toward the front when referring to the past<sup>19</sup> and those who gestured at least once toward the back. This is a strong categorization, as those bilingual speakers who may have gestured several times toward the front but who gestured at least once toward the back fall in the latter category, along with all those participants who may have never gestured frontward when speaking about the past. Figure 4 shows how these participants were distributed with respect to language proficiency.

All but 1 of the participants (88%) who spoke Aymara, CA, or both, but not fluent grammatical Spanish (7 out of 8 participants belonging to groups LP1–LP3) produced only frontward gestures when referring to the past. Five out of 7 participants (71.4%) who were able to speak Spanish gestured, at least once, toward their backs when speaking about the past. These results show that the proportions of participants producing (or not) exclusively frontward gestures when referring to the past is not homogeneous with respect to language proficiency (one-tail Fisher's exact probability test,  $p = .035$ ), suggesting that fluency in Aymara relates to frontward gestures when referring to the past, whereas fluency in Spanish relates to backward gestures.

Figure 5 shows the distribution of the same past sagittal gestural patterns with respect to age.

All but one of the participants aged 65 or older (89%, 8 out of 9 participants belonging to groups A3–A4) produced only frontward gestures when referring to the past. All but 1 of the participants aged 64 or younger (83%, 5 out of 6 participants belonging to groups A1–A2) ges-

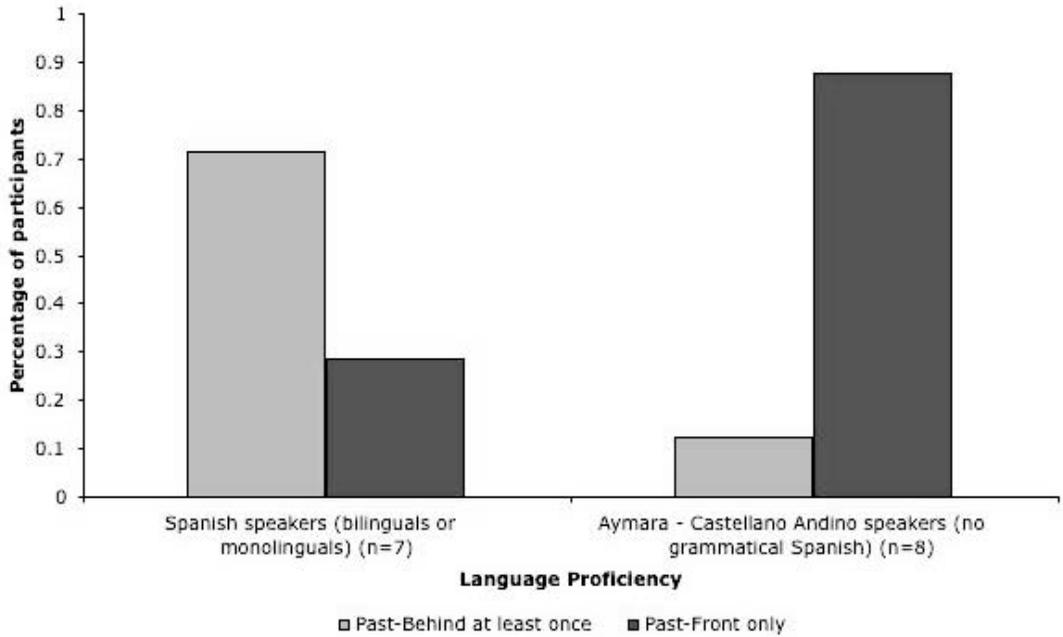


Fig. 4. Percentage of Aymara participants producing sagittal past gestures, split by language proficiency.

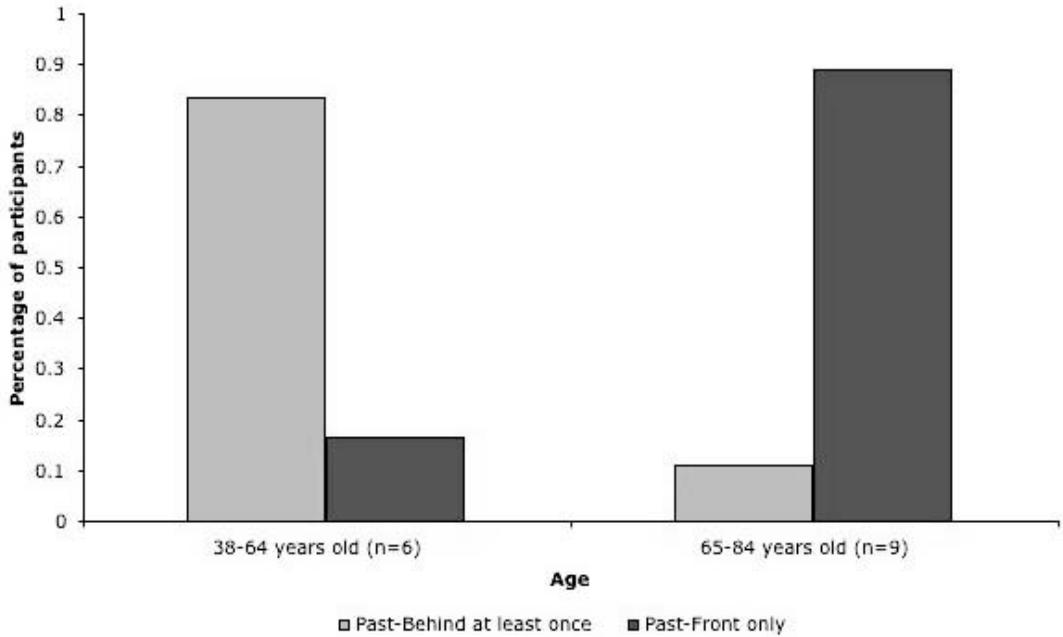


Fig. 5. Percentage of Aymara participants producing sagittal past gestures, split by age.

tured, at least once, toward their backs when speaking about the past. These results show that the proportions of participants producing (or not) exclusively frontward gestures when referring to the past is not homogeneous with respect to the two age groups (one-tail Fisher's exact probability test,  $p = .011$ ). This suggests that older Aymara individuals tend to exclusively produce frontward gestures when referring to the past, whereas younger ones in those cases tend to produce backward gestures.

### 5.2.2. Examples of gestures of Aymara speakers

The following are examples of Aymara speakers' speech-gesture coproduction while using time expressions in conversations in Aymara, Spanish, or both.

### 5.2.3. Ego-RP gestures.

In Example 1 (male speaker, 75, from Socoroma; bilingual interview), an Aymara speaker gestures as he repeats and translates the phrase *nayra mara*, literally "front time." His Spanish translations (actually, expressions in CA) of *nayra mara* are *tiempo antiguo* "old times" and *tiempo antes* "time before." He gestures with his left hand forward from his body as he makes this explanation (Figure 6; person on the right) as he holds a *zampoña*, a musical instrument, in his right hand. The first two forward strokes (Figures 6a and 6c) are cotimed with the two words *tiempo antiguo*, and display an almost full extension of the left arm. The third forward stroke occurs approximately 5 sec later as an emphatic response to the interviewer's question requesting clarification (Figure 7). The speaker shifts the instrument to his left hand, and points forward with his now free right index, higher than the previous left-handed strokes; The gesture is coproduced with the phrase *el tiempo antes*, where the stroke is cotimed with the accented first syllable of *antes* ("before").

In Example 2 (male speaker, 75, from Socoroma; bilingual interview), continuing to explain *nayra mara*, the speaker says it is what is *antiguo* ("old"). As he says *antiguo*, he sweeps his left hand and arm forward (loose five handshape, palm toward body; see Figure 8), starting from a point at the chest (Figure 8a), and finally extending the arm with palm up (Figure 8c). His head is down at the start, and gradually moves up and turns to face the interviewer as the hand gesture moves outward.

Similarly, 20 sec later, in explaining pre-Spanish times (*gentil timpu*), the same speaker says in Spanish, *es la otra generación* ("is the other generation"), meaning distant ancestral



Fig. 6. Example of a two forward stroke gesture cotimed with the two Spanish words *tiempo antiguo*. The timecode shown at the bottom right of each freeze is expressed in *minutes:seconds:frames*. Each *frame* unit corresponds to approximately 1/30 of a second (there are 29.97 frames per second).



Fig. 7. Example of an emphatic right-hand gesture coproduced with the phrase *el tiempo antes*. The stroke is cotimed with the accentuated first syllable of *antes* (“before”).



Fig. 8. Example of a frontward loose left hand cotimed with the word *antiguo* (“old”).

generations. While uttering this phrase, he extends his right arm in two pointing gestures (with index finger) cotimed with the two words *es* (“is”) and *la otra* (“the other”) [generation], respectively. These are directed higher than his earlier points on *antiguo* and *tiempo antiguo*—the first is at his eye level, the second (Figure 9) is above his head, pointing outward and upward.

In Example 3 (male speaker, 73, from Pachama; bilingual interview), the speaker is talking about his “ancestors” (*achachilas*) when the interviewer suggests that this might have been the time of the Incas (*gentil timpu*). The speaker, who is thinking of more immediate ancestors such as great-grandparents, responds in CA (rather ungrammatically in Spanish) *Ese es todavía más allá antes*, “That is even further away before,” meaning that the Incas existed far earlier than what he is talking about. He gestures with both hands, an alternating rotating gesture upward and away from the body (Figure 10). At the peak of the right hand’s rotation cotimed with *más* (“more”) in *más allá antes* (Figure 10c), the right hand forms a point upward and forward (Figures 10d and 10e).

All of these clips show Aymara speakers gesturing forward with reference to past time, whether sweeping forward over temporal extent of past years or pointing forward away from the present toward the past. In the next set of clips, we see specific past and present (realis) periods of time metaphorically represented and pointed to contrastively as different spatial points, pointing downward (colocation or immediate proximity) nearer to the body representing times closer to the present.



Fig. 9. Example of frontward index-finger pointing gesture coproduced with the phrase *es la otra generación* (“is the other generation”), meaning distant ancestral generations.



Fig. 10. Example of a rotating bimanual gesture coproduced, while clarifying a misunderstanding, with the rather ungrammatical Spanish sentence *ese es todavía más allá antes* (“that is even further away before”).

In Example 4 (male speaker, 75, from Socoroma; bilingual interview), speaking in Aymara, the speaker says *aka maran(a)* (“this year”) and gestures with the *zampoña* he is holding in his right hand, rotating and raising his wrist (Figures 11a–11c), and then quickly pointing downward with the instrument’s body right in front of him, between his legs. He holds this position until the word *marana* is finished.

The speaker continues in Spanish, contrasting this year with earlier times. He transfers the *zampoña* to his left hand (Figures 12a and 12b), as he explains to a Spanish-speaking interviewer that the past times (*antes*) were not like these years now (*como estos años de ahora*). As he is about to say *antes* (“before”), his right hand gets ready for a pointing position, extending the index finger (Figure 12c). The stroke that follows immediately after is cotimed with the word *antes*, pointing with the extended index finger forward, slightly outward, at an upward angle (Figure 12d). As he says *como estos años de ahora* (“like these years now”) he iteratively points downward, with the same index finger, toward a location between his legs where he is sitting (Figure 12e). He performs this iterative gesture five times, cotimed with the remaining words of the sentence, and finishing with *ahora* (“now”).

Eighteen seconds later, referring to *gentil timpun*, and to *el tiempo de los gentiles* (“the time of the Incas”) the speaker says *antiguamente* (Spanish for “long ago, in the past”). The *zampoña*, which in the meantime had been moved back to his right hand, is then once again



Fig. 11. Example of a pointing gesture opportunistically using the tip of a tool (a musical instrument). It is coproduced with the Aymara expression *aka maran* (“this year”), pointing straight downward, and marking collocation with ego.



Fig. 12. Example of a right-hand index finger pointing gesture contrasting past times *antes* (“before”) and *ahora* (“now”).

transferred to his left hand while he says *era el tiempo de los gentiles* (“it was the time of the Incas”), such that his right hand is free to prepare for a forward pointing gesture with the index finger (Figures 13a and 13b). The stroke (Figure 13c) is cotimed with the accentuated syllable *-ti-* of the word *antiguamente*, “long ago, in the past” (Figure 13c).

In Example 5 (male speaker, 75, from Socoroma; bilingual interview), the speaker is translating and explaining the Aymara phrase *mimarat aka mararu*, “from last year to this year.” As he gives his Spanish translation, he gestures pointing forward cotimed with the word *del* (“from”) (Figure 14a). He then moves his hand slightly downward pointing to a place in front of him as he says *año pasado* “last year” (Figure 14b). The pointing here is cotimed with the word *pasado*, “last.” Then he proceeds with the gesture, moving his hand toward him and pointing downward again, but this time pointing to a location closer to his body (Figure 14c), as he says *a este año*, “to this year” (final point cotimed with *año*).

The Aymara gestural representation of the future we observed is less elaborated than that of the past. There are obvious “phonetic” reasons why this should be so: Humans cannot gesture



Fig. 13. Example of a forward index finger pointing gesture cotimed with the Spanish word *antiguamente* (“long ago, in the past”).



Fig. 14. Example of a pointing gesture indexing a metaphorical (temporal) range *del año pasado* (“from last year”) *a este año* (“to this year”).

as far behind their bodies as in front, cannot see the gesture space behind them, and cannot control their over-the-shoulder gestures as accurately as forward gestures. In this respect, Aymara speakers are truly a mirror image of English speakers (or ASL signers), whose spatial-gestural representation of the past is less elaborated than that of the future for exactly the same reasons. We have fewer “future” gestures in the Aymara data, and they do not actually involve moving the hand to a point behind the speaker, but using it to point backward toward the area behind the speaker.

In Example 6 (male speaker, 65, from Arica; bilingual interview), the speaker is discussing *tiempo futuro* (“future time”). Cotimed with the word *futuro*, he gestures with his right hand (B handshape) across his body and pointing backward, contralaterally over his left shoulder (Figures 15a and 15b).

In Example 7 (male speaker, 65, from Arica; bilingual interview), the speaker is contrasting past and future. He points backward with his right hand (B shape), contralaterally over his left shoulder, twice, as he says *futuro* (Figure 16).

Three seconds later he performs three forward gestures: one frontal partial rotation (C shape) as he mentions in CA *tiempo antiguo* (Figures 17a–17c), and two sweeping gestures (Figures 17d and 17e) starting from a B shape, palm toward down position, as he says *nayra timpu* (Aymara “past time”). Approximately 5 sec later he points downward twice with his in-

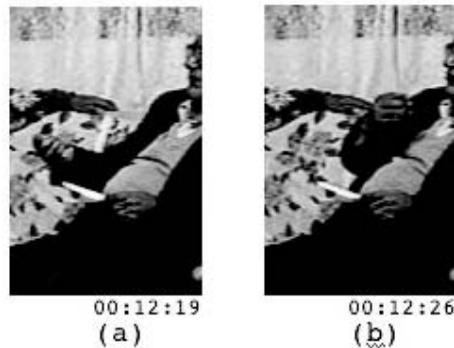


Fig. 15. Example of a contralateral backward gesture coproduced with the Spanish words *tiempo futuro* (“future time”).



Fig. 16. Example of a contralateral backward whole-hand pointing gesture cotimed with the Spanish word *futuro* (“future”).

dex in front of him as he says *jicha* (Aymara “now”), accompanying this with a head nod downward and forward (Figures 17f and 17g). Finally, 3 sec later, he performs an ipsilateral thumb-point, pointing over his right shoulder with his right thumb, as he returns to mention of the future with the word *futuro* (Figure 17h).

In Example 8 (male speaker, 65, from Arica; bilingual interview), at another moment of the conversation, the same speaker refers to the Aymara expression *quipa timpun* (“future time”). Cotimed with the word *quipa* (Aymara for “back”) he performs another backward ipsilateral thumb-point, pointing over his right shoulder with his right thumb (Figures 18a and 18b).

**5.2.3.1. Time-RP gestures.** In Example 9 (male speaker, 80, from Mauque; bilingual interview), the speaker is explaining in Aymara the expression *uru sarjai* (*sarjiwa*) *ukuru ukuru* (“day goes, and day after day”), meaning “time goes on, day by day.” As he says the words of this expression he performs a wavelike gesture zig-zagging up and down and covering, from left to right, all but the right portion of his gestural space. Overall the downward motions have a higher acceleration than the upward ones. He starts by positioning his left hand (B shape) at the lower left side of his gestural space (palm toward right) as he says *uru* (“day”; Figure 19a), then

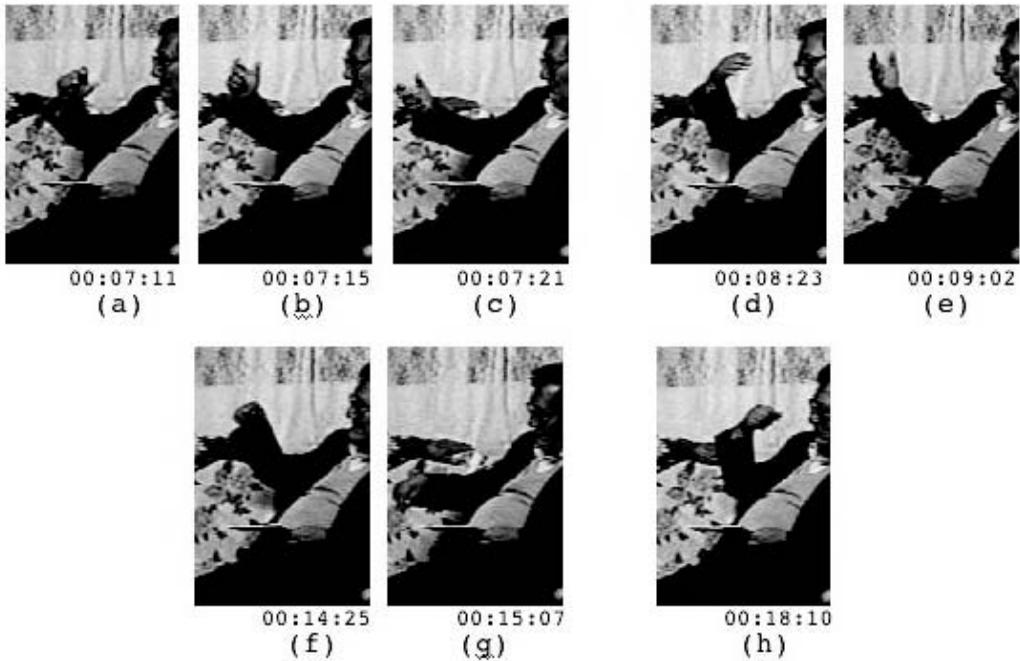


Fig. 17. Example of a sequence of gestures produced within an 11-sec period, contrasting Spanish *tiempo antiguo* (“old times”), Aymara *nayra timpu* (“past time”), Aymara *jicha* (“now”), and Spanish *futuro* (“future”).

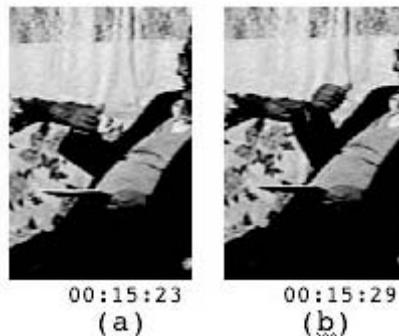


Fig. 18. Example of an ipsilateral backward thumb-pointing gesture coproduced with the Aymara word *qhipa* (“back”).

as he begins to say *sarjai* (local dialectal variation of *sarjiwa*, “go”) his hand moves slightly up and toward the right (Figure 19b) and then down again and further to the right as he finishes with the (accentuated) last syllable of the word, *-jai* (Figure 19c). The gesture proceeds iteratively from left to right, moving up and down, cotiming the downward motion with the words *ukuru* and *ukuru* (“day after day”; Figures 19d–19g).

Left-to-right gestures like this one can be observed in speakers of many languages around the world. They have no origo at speaker’s body, and they accompany language that construes

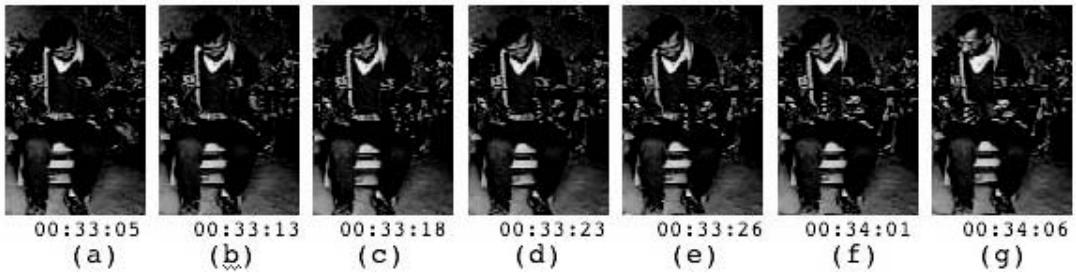


Fig. 19. Example of a time-RP iterative gesture coproduced with the Aymara expression *uru sarjai* (*sarjiwa*) *ukuru ukuru* (“day goes, and day after day”).

time as general motion relative to an unmentioned landscape (time-RP), rather than motion relative to ego. We do not analyze further details of these gestures here, as we are specifically discussing the peculiarity of Aymara’s front–back ego-RP metaphoric construals of time.

#### 5.2.4. Examples of gestures of Aymara participants who only speak Spanish

The gestures from Aymara speakers analyzed in the previous section contrast sharply with the ones produced by Aymara individuals who only speak Spanish. These participants, younger and with several years of formal education in Spanish, gesture in the same way individuals in the Western world would: toward the front when speaking about the future, and toward the back when speaking about the past.

In Example 10 (female speaker, 56, from Putre; Spanish interview), the speaker is comparing how much more sense of community Aymara people had in the past compared to the present. She says *era otra generación* (Spanish “it was another generation”). With her right hand in loose 5 shape, initially with the palm toward left-center (Figure 20a). Then, as she says “ge-ne-ra” she rapidly bends her elbow and moves her hand toward her left (slightly upper) side of the body. Her thumb points toward the upper back (Figures 20b and 20c). As she says the last syllable “ción”, her wrist rotates lightly, orienting her palm and thumb toward the center and down (Figure 20d), and then retracting to resting position (Figure 20e).



Fig. 20. Example of a Spanish-speaking Aymara gesturing with her right hand (in loose 5 shape). She produces a contralateral backward motion cotimed with the Spanish expression *era otra generación* (“it was another generation”).

In Example 11 (male speaker, 38, from Putre; Spanish interview), the speaker is talking about how the Aymara community should fit into the modern world. He says *Lo que nosotros queremos es proyectarnos mejor hacia el futuro, sin olvidar lo que fuimos nosotros en el pasado, en nuestra historia milenaria* (“what we want is to better project ourselves toward the future, without forgetting what we were in the past, in our millennia-old history”). As he says the first syllable “pa” of *pasado* (past) he produces a stroke with a B-shaped hand located at center-center, palm toward body/left and finger pointing toward the upper left (left shoulder; Figures 21a–21c). Milliseconds later, he continues by saying “en nuestra historia milenaria.” He produces a stroke in the syllable “to” of *historia*, similar to the previous one, but this time with the fingers pointing a little bit higher up over the left shoulder (Figures 21d–21f). The retraction is produced cotimed with “milenaria” (Figure 21g).

In Example 12 (male speaker, 53, from Pampa Algodonal; Spanish interview), the speaker is talking about new agricultural technologies they have been adopting in his local community (e.g., drip irrigation systems, etc.). He says *en estos momentos estamos avanzando pól futuro* (“now we are moving ahead toward the future”). As he says “pól futuro” (“toward the future”) he extends his right hand frontward (Figure 22). The stroke (Figure 22d) is cotimed with the syllable “tu” of *futuro*.

In Example 13 (male speaker, 60, from Parinacota; Spanish interview), the speaker is discussing, in a rather pessimistic way, why things are not looking good for the future of his community. He acknowledges that he does not know what will happen exactly, but he says *parece que estamos yendo a lo peor* (“it seems we are going toward the worst”). As he says this, he moves his right hand frontward and slightly downward (Figure 23). He starts the gesture with a loose 5 handshape located at center-center, with the palm toward the body, as he says “que”

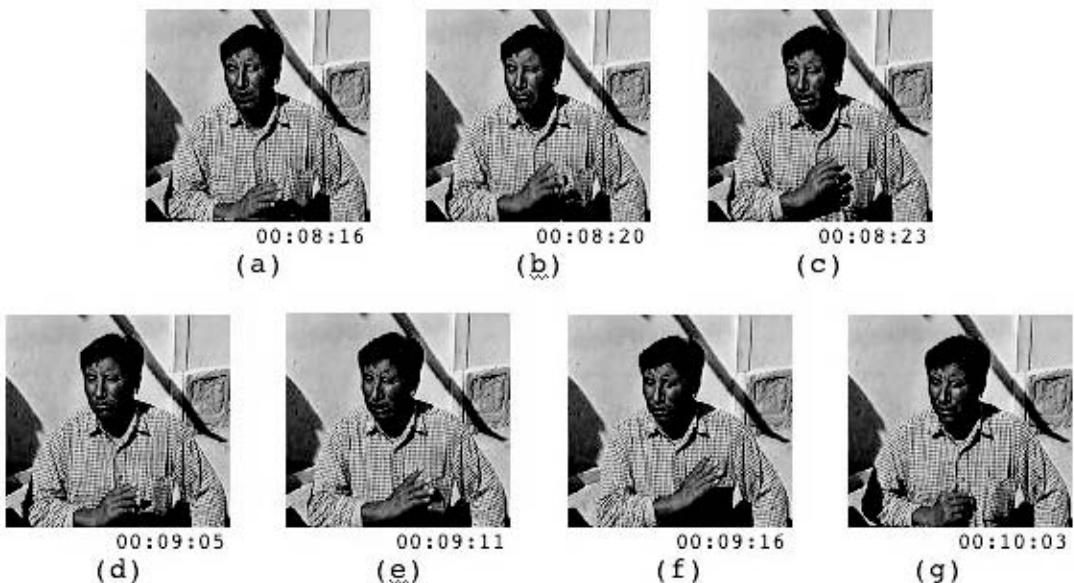


Fig. 21. Example of a Spanish-speaking Aymara gesturing with his right hand pointing backward (contralaterally) as he refers to the the millennia-old history of his culture.

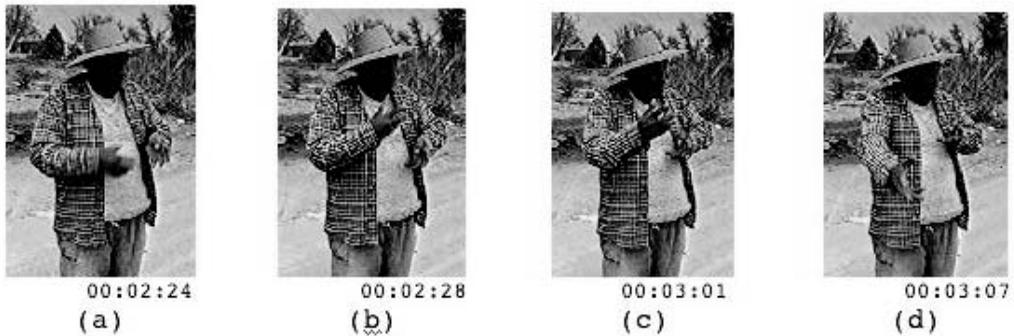


Fig. 22. Example of a Spanish-speaking Aymara gesturing with his right hand pointing forward as he says *en estos momentos estamos avanzando p̄l futuro* (“now we are moving ahead toward the future”).



Fig. 23. Example of a Spanish-speaking Aymara gesturing while discussing the future of his community. He moves his right hand (in loose 5 shape) forward as he says, rather pessimistically, *parece que estamos yendo a lo peor* (“it seems we are going toward the worst”).

(that; Figure 23a). The gesture unfolds frontward cotimed with the first syllable “es” of “estamos” (we are) (Figures 23b and 23c), producing the stroke cotimed with the rest of the word, “tamos” (Figure 23d). The palm gradually points toward up as the wrist rotates slightly, and he accompanies the forward extension of the arm with a slightly downward movement of his head.

### 5.3. Discussion

In our videotaped data, Aymara speakers gesture both in ego-RP and in time-RP patterns. Alongside the ego-RP spatial language used to represent time as in front (*nayra*) and in back (*qhipa*) of ego, they gesturally represent time as deictically centered space: The speaker’s front surface is essentially now, as in English speakers’ gestures. The space behind the speaker is the future, and the space in front of the speaker is the past. Locations in front and closer to the speaker are more recent past times, whereas locations in front and farther from the speaker are less recent times: Speakers contrast “last year” with “this year” by pointing downward first at a

more distant point and then at a nearer one. The farther in the past the reference event is, the farther upward is the angle of forward temporal pointing gestures; this seems to represent added distance in space of the point's goal, as the trajectory of a thrown object has to be higher to throw farther. (Levinson, 2003, pp. 261–262, remarks on the correlation between upward angle and distance in spatial points.)

When talking about wider ranges of time, rather than particular points in time, we have seen speakers sweeping the dominant hand forward to the full extent of the arm as they talk about distant past generations and times, or pulling the hand back toward themselves as they talk about the relation of these past generations to the present. The fact that many of these gestures when displayed by bilingual speakers, were produced when speaking in either Aymara or Spanish, supports the cognitive linguistic claim that conceptual metaphor is not a “mere” linguistic phenomenon but a much deeper one about thought (Fauconnier & Turner, 2002; Johnson, 1987; Lakoff, 1993; Lakoff & Johnson, 1980; Lakoff & Núñez, 2000): It is the peculiar Aymara ego-RP conceptual pattern that underlies the gesture production, and this can be manifested even when bilinguals are speaking in Spanish.

The forward and backward gestures contrast with left-to-right gestures made accompanying linguistic forms such as *uru sarjiwa ukuru ukuru* (literally, “day goes, and day and day”), “time goes on day by day.” Like speakers of a wide range of other languages, we found that Aymara speakers also gesture about temporal sequence in a nondeictic way (with no specified relation to the present) while gesturing along this left-to-right time line laid out in front of the speaker, which does not incorporate a deictic center. The left-to-right gestures have no origo at speaker's body; and they accompany language that construes time as general motion (relative to an unmentioned landscape), rather than motion relative to ego (time-RP). Most of the motion language observed with temporal reference falls into this nondeictic category, and is accompanied by these nondeictic gestures.

One way of understanding the Aymara linguistic and gestural data involving ego-RPs is to see Aymara speakers as using temporal metaphors based on slightly different aspects of our experiential correlations between space and time than the metaphors used by many or most other languages. It has been claimed that Aymara speakers understand the future as behind them because it is unknown. Let us now unpack the mappings inherent in that claim.

First of all, it is important to note that all sighted humans have a basic and central correlation between vision and knowledge. For sighted people, visual input is overwhelmingly our primary means of monitoring our larger surrounding environment, and is also constantly basic in our interaction with our immediate surroundings (in coordination with motor interaction and other senses). Visual intake is a constant source of new information. It is therefore no surprise that it forms the basis for a Knowledge Is Vision metaphor, which is common across the world's languages (for discussion of its ontological basis, see C. Johnson, 1999a, 1999b). Sweetser (1990) documented the pervasiveness of this metaphor in the Indo-European language family, but it is the norm around the world as well. Aymara is one more example.<sup>20</sup>

Now imagine a static viewer with a visual field. He or she can only see what is in the “front” half of the space he or she is in—the direction he or she is facing. One might be able to creep up on this person from behind, unseen; but this would be impossible from the opposite direction. Under such circumstances, what is seen correlates with what is known—and with what is in front of the viewer. Note that we are essentially ignoring the more distant surroundings, be-

yond the visual horizon; these are invisible and unknown, whether they are in front of the viewer or behind her.

However, alter the picture. Imagine a moving person, walking along a path. Of course, like the static viewer, he or she has a visual field and can only see in front of him or her. However, another crucial correlation in his or her experience is that he or she does not know what he or she will find around the next turn in the path. An important division of the world for this person, besides “what I can see in front of me” and “what I can’t see behind me” is the division between “places I haven’t yet been to—and thus haven’t seen and don’t know about” and “places I’ve been to already—and have thus seen and gained some knowledge about.” The correlation here is not KNOWN IS IN FRONT and UNKNOWN IS IN BACK, but rather KNOWN IS BEHIND and UNKNOWN IS AHEAD.

Incidentally, this bodily orientation is consistent with another fundamental bodily experience. If at a moment  $T_0$  a person is situated at a location  $L_0$  and needs to get a known and visible object situated, say, 10 yards away at location  $L_f$ , he or she will most likely walk frontally toward the object to get it. When that person reaches the object at time  $T_f$  he or she will be at location  $L_f$ . At that moment, the initial location  $L_0$  where the person was when he or she had the need is situated behind him or her, and the moment when that occurred ( $T_0$ ) is in the past relative to the moment when the person reaches the object ( $T_f$ ). Similarly, when the person is at the initial location  $L_0$ , the location where he or she can get the object ( $L_f$ ) is in front of him or her, and the time  $T_f$  when the person would actually get the object is in the future relative to the moment when he or she has the need to get the object ( $T_0$ ).

People all share the understanding that the past is known and the future is unknown. However, English speakers, and indeed most of the human world, base their temporal metaphors on the experiential correlations KNOWN IS BEHIND EGO (i.e., behind a moving ego on a path), UNKNOWN IS IN FRONT OF EGO (i.e., in front of a moving ego on a path)—Aymara speakers seem to make use of KNOWN IS IN FRONT OF EGO, UNKNOWN IS IN BACK OF EGO.

We suggest that one reason for the prevalence of the path-based spatiotemporal metaphors over the static visual-field-based ones is precisely that the latter are static. Our experience of time is dynamic, and the path-based metaphors give us a great many inferences that would be hard to get from a static spatial model of time. For example, we cannot infer from the fact that an object happens to be in front of a static viewer that the viewer will be colocated with the object in the future, nor can we infer that an object behind the viewer was colocated with him or her in the past. However, these are appropriate inferences: Future times will become present, and past times once were present. A path-based metaphor yields such inferences readily: A traveler will be at a location ahead of him or her, and has been at locations behind him or her. Further, among locations ahead of the traveler, he or she will be at closer locations sooner than at more distant ones, which maps very nicely onto the linear sequence of future events. And so on. Because of human bodily morphoanatomy, the path-based metaphors, as well as being appropriately dynamic, bring along a FUTURE IS AHEAD/IN FRONT and PAST IS BEHIND/IN BACK set of mappings—hence the prevalence of such mappings.

Obviously such inferential richness does not force speakers to a particular construal, as the attested patterns of Aymara show. Nor are such inferences of change only accessible via a single model; Aymara speakers, for example, have a static ego-RP temporal model, but do seem to have dynamic time-RP models, visibly attested as well in lateral dynamic gesture patterns (see

section 5.2.2.2). A question that remains open, however, is why in Aymara the well-motivated mapping FUTURE IS AHEAD ON A PATH, PAST IS BEHIND is overruled by the static pattern KNOWN IS IN FRONT OF EGO, UNKNOWN IS IN BACK. If this latter pattern also “makes sense” based on aspects of universal human experience, why is it so prominent in Aymara, essentially to the exclusion of the dynamic FUTURE IS AHEAD/IN FRONT and PAST IS BEHIND/IN BACK set of mappings?

We believe that part of the answer comes from the overemphasis Aymara puts on visual perception as a source of knowledge. The Aymara language precisely distinguishes the source of knowledge of any reported information by grammatically imposing a distinction between personal and nonpersonal knowledge and by marking them with verbal inflection or syntactic structures (Miracle & Yapita, 1981); as mentioned earlier, in CA, Spanish pluperfect tense marking has been coopted for a parallel task. Personal knowledge is marked in situations in which the speakers have gained knowledge of what they are talking about largely through the senses (especially visual perception). Nonpersonal knowledge is grammatically marked in all other cases, such as when the reported information has been read or been told, when it concerns guesses and inferences, and so on. So, in Aymara, if a speaker says “Yesterday, my mother cooked potatoes,” he or she will have to indicate whether the source of knowledge is personal or nonpersonal. If the speaker meant “She cooked potatoes, but I did not see her do it” (i.e., nonpersonal knowledge) the speaker would have to use a remote tense marker of nonpersonal knowledge, *-tayna*, as opposed to the remote personal knowledge marker *-Vna* (Miracle & Yapita, 1981). So pervasive is this distinction of sources of personal and nonpersonal knowledge that it is almost impossible to utter a sentence without marking the appropriate source, making this feature one of the most important characteristics of the Jaqi languages to which Aymara belongs (Hardman, 1988). The fact that, phenomenologically speaking, an observer experiences things as being seen or not being seen (i.e., as being in or out of his or her visual field) matches the corresponding binary realis versus irrealis structure of ego-RP temporal organization in Aymara. As Miracle and Yapita (1981) pointed out, in Aymara, time is divided into future and other time, where the division is defined by the unseen future and the visible present and past. The peculiarity of this conception of time would also provide an initial explanation for the general and descriptive observation that Aymara speakers tend to speak more often and in more detail about the past than about the future. Indeed, often elderly Aymara speakers simply refused to talk about the future on the grounds that little or nothing sensible could be said about it.

We conclude here by remarking that although the Aymara evidential system is one added piece of evidence for the pervasive construal of knowledge as visual—a construal also relevant to Aymara time metaphors—this does not allow us to predict that languages will necessarily have formal systems with congruence between these two areas of the grammar. Many languages have visual-data evidentials, but show no evidence of Aymara-style basic temporal metaphor systems. Although the literature on metaphor shows evidence of broad systemic structures (e.g., the moving-object and moving-ego ego-RP metaphors in English), these coexist with very local models. No language reflects only one construal of the world, so there is no reason to expect a rigid constraint that grammars need to be consistent between these two domains.

The precise role of visual perception in shaping the unusual Aymara ego-RP pattern for spatial construals of time, however, remains unclear. Which came first, the obligatory grammati-

cal distinction of personal and nonpersonal knowledge, or the semantic organization of the experience of time? Perhaps they simply coexisted all along in the historical evolution of Aymara without determining any specific causal relation. Further investigation of Aymara, as well as other Jaqi languages, is clearly needed to answer these questions.

Finally, and perhaps most important, the Aymara static ego-RP metaphoric construal of time is manifested not only with a few particular Aymara words, but in general with the concepts of deictic past and future. When speaking CA, with Spanish vocabulary and no metaphoric language (cf. *tiempo antiguo*, “old/past times” in Example 1; or *gentil timpun*, “time of the gentiles/Incas” in Example 2), Aymara speakers still gesture forward when talking about the past and backward when talking about the future. Cognitive and linguistic systems are not globally controlled by a single metaphor—we have seen that Aymara speakers have dynamic time-RP temporal models as well. Neither are temporal gestural forms “lexical” forms tightly linked to linguistic lexical forms. As with many other domains of metaphor, there do seem to be general gestural meaning patterns that can pair up with a variety of linguistic forms in the relevant semantic domains.

## 6. Conclusion

How are our cultural models of time constituted, and how are they related to our models of space? In most cases, recent linguistic evidence suggests strongly that models of time are based on certain aspects of our spatial models, and that those aspects of spatial understanding are at least universally accessible cross-culturally. We argue here that gestural data provide a unique source of convergent empirical support for many of these claims, although also offering challenges to some of them.

Analysts of language cannot help being caught up in the fascinating question of the relation between language and culture, and the equally complex one of the relation between language and cognition. Within the past century, some very strong claims have been made in many different directions. Many cultural anthropologists would follow Whorf and Sapir in claiming that culture-specific factors (including language) necessarily shape our cognition at the most basic level; some would tend to cast doubt on any claims that there is a universal human cognitive base, in any meaningful sense. Current critical theory approaches to culture emphasize the degree to which all of our understanding is constructed—and constantly constructed in interaction—including our understanding of apparently objective entities such as our own bodies, which might be supposed to give us some common hold on a shared reality.

And yet, at least of equal interest are plausible proposals for cross-cultural cognitive universals. Color terms, once the “parade example” of cultural variability (if *blue* and *green* are not universals, what are?) have in the last 30 years come to be seen instead as providing strong evidence of the constraints posed by human perception and cognitive processing on linguistic and cultural categorization (Berlin & Kay, 1969). The picture is complex (see Hardin & Maffi, 1997, for a range of views), but alongside cultural variation there are salient universal human patterns in distinguishing and naming colors. This is scarcely surprising: We apparently share much of our color perception—including the perceptual basis for focal colors—with some other primates, as well as with fellow humans.

A further complication lies in the fact that the same people do not necessarily always enact the same cognitive domains in the same way. Language often seems to offer some particular range of culturally dominant cognitive approaches to a domain, especially when high-level cognition is concerned; as we know, English does not have only one way of conceptualizing time. Further, an investigation that is more distant from linguistic usage may reveal the possibility of the same speakers accessing a different set of categories from those imposed by their language (Kay & Kempton, 1984). Returning to Whorf with the added sophistication of recent cross-linguistic work on language use and acquisition, Slobin (1996, 2003; Özçaliskan & Slobin, 2003) proposed that we recognize that there is a possible contrast between thinking for speaking and other thinking, with potential implications for assessment of cross-cultural differences in cognition.<sup>21</sup> When speaking English, an English speaker has no choice but to attend to the sex of participants who are referred to by third-person singular pronouns; in some languages, this would be unnecessary, and in others there would be far more need to formally mark semantically based gender (e.g., on adjectives or verbs). In the same way, an Aymara speaker has no choice but to attend to the source of knowledge (i.e., personal vs. impersonal) of any reported information, and to give a special status to those events he or she has actually perceived visually.

We have good cross-cultural evidence for a range of experientially based ways of thinking for speaking about time. Often a given language manifests more than one of these patterns. The distinction between time-RP and ego-RP structures that we propose is itself a potential cognitive universal, because both kinds of structures are documented in many languages. One extremely dominant and salient pattern is the ego-RP metaphor *Time Is Ego's Motion Along a Path*; its experiential basis is clearly universal, and the metaphor itself is so nearly universal that we cannot deny its cognitive accessibility to all humans. Instead of *Time Is Ego's Motion Along a Path*, Aymara uses a static mapping of past and future onto the space in front of and behind ego, respectively. This mapping, although its underlying correlations are potentially accessible to any human, has distinctly less elaborate inferential mappings between source and target domains; this may account for its rarity as a primary metaphor of time. Unusual though it may be, gestural as well as linguistic data strongly and systematically attest to its cognitive reality in Aymara speakers. The study of the peculiar Aymara spatial construals of time provides an excellent opportunity to study how fundamental abstract everyday concepts such as time, although ultimately grounded in the same universal human bodily experience of the world, can get shaped in specific ways to generate cultural variability. Sadly, this rare pattern of linguistic and cognitive construal may be vanishing (at least from northern Chile), thus diminishing the rich cultural diversity of our world.

## Notes

1. English: Clark (1973), Lakoff and Johnson (1980, 1999), Lakoff (1993), Gentner, Imai, and Boroditsky (2002). Wolof: Moore (2000; see also added cross-linguistic references). Chagga: Emanatian (1992). Chinese: Yu (1998), Ahrens and Huang (in press). Turkish: Özçaliskan (2002). Japanese: Shinohara (1999). American Sign Language: Cogen (1977), Emmorey (2001, 2002).

2. Aymara is a member of the Jaqi family, a formerly widespread linguistic family in the Andes, which also includes Jaqaru and Kawki (Hardman, 1981, 1988). According to Hardman (1988), Aymara is the mother tongue of a third of the Bolivian population (i.e., more than 2 million people). These numbers, however, vary according to different sources. Based on a 1992 census in Bolivia and Chile, and in 1993 in Peru, the total Aymara-speaking population has been reported to be 1.6 million people (Pedraza, 2005). Today the Aymara area stretches north–south from the Titicaca Lake at the Peruvian–Bolivian border down to Salar de Uyuni in Bolivia. In Chile, the Aymara community has approximately 28,000 people, of which 8,500 speak the language (van Kessel, 1996a). For details about the Aymara language and its social, historical, and cultural context, see Hardman (1981), Albó (1988), van Kessel (1996a, 1996b), and Estermann and Peña, 1997.
3. We note here the special interest of absolute spatial languages, which might well have spatial metaphors different from other documented languages. Unfortunately, detailed data analysis of time construals is not available on any absolute spatial language; see the end of section 4 for discussion.
4. Etymologically, note that the *fore* in *before* meant “in front of” (we still call the front end of a ship the *fore*, and the front upper surface of the head the *forehead*). *Precede* etymologically meant “go in front of.” Similarly, the *aft* in *after* is historically the same “behind” etymon that occurs in the *aft* (rear) end of a ship.
5. Note the contrast between *ahead of* and *in front of* (one cannot say *in front of time*). This is discussed later in the article.
6. M. Hardman (personal communication, August 26, 1999), Peña Cabrera (1997), Calvo Pérez (1993).
7. Lakoff and Johnson (1999) reviewed much of the preceding work; see also Lakoff and Johnson (1980), M. Johnson (1987), Lakoff (1987), Turner (1987), and Lakoff and Turner (1989).
8. Following a convention in cognitive linguistics, the name of a conceptual metaphoric mapping is capitalized.
9. See also Gentner (2001) on the processing effects of consistent versus inconsistent temporal metaphorical models. Shinohara (1999) analyzed moving-time metaphors in Japanese; see Yu (1998) for Chinese.
10. Note that *ahead* requires a construal of at least potential motion along a path; you cannot say that the computer terminal is *ahead of you* on your desk.
11. Note that although *ego* is ambiguous between the physical spatial experiencer and the subjective temporal experiencer, time of course is clearly a target-domain term. Our terminology can therefore be taken as consistent in referring to the metaphors by the structure of the target temporal domain.
12. See Lakoff and Johnson’s (1999, chap. 10) discussion of “orientation” in time metaphors.
13. See also Langacker’s (1987, 1991a, 1991b) discussion of the cognitive differences between compositionally distinct linguistic expressions. Although grandmother and parent’s mother may identify the same referents, it does not follow that they do so via identical cognitive processes.

14. See also Talmy (2000) and Langacker (1987, 1991a, 1991b) for treatments of figure–ground and landmark–trajector expressions in language.
15. Hornung (1989/1992) similarly argued that in ancient Egyptian culture, the future was seen as “behind.” His work is particularly interesting, as it brings pictorial representations into play (e.g., time as an endless rope or as a lengthy serpent); we hope that added analysis of ancient Egyptian temporal models will be undertaken. However, Hornung gave very little concrete support, either linguistic or pictorial, for the claim that the future is specifically behind ego in ancient Egyptian.
16. See also earlier publications, including Goldin-Meadow and Mylander (1984), Goldin-Meadow and Alibali (1999), and Goldin-Meadow, Butcher, Mylander, and Dodge (1994).
17. McNeill (personal communication; 2005) pointed out that gesture researchers generally agree on the presence of the front–back time line pattern in English, although it has not been explicitly analyzed very much on its own. However, Parrill and Sweetser (2004) presented an attested example where a speaker uses such a gestural time line.
18. In this analysis we are not considering gestures cotimed with expressions involving only present times, such as “now,” “today,” or “this week.” All those gestures consisted of some form of downward pointing occurring slightly in front of the person at the center of the gestural space, as if participants were indicating colocation with themselves. As such, when taken separately they are ambiguous with respect to the question of lateral or front–back directionality. The pointed colocation could, in fact, be the center point of a left–right axis or a front–back axis, going, in both cases, in either direction.
19. Overall, Aymara speakers talked (and therefore gestured) less about the future than about the past. The small frequencies involving future gestures determined that meaningful inferential statistical analyses could only be carried out with respect to gestures related to the past.
20. Against the background of this cross-linguistically pervasive mapping, Evans and Wilkins (2000) documented the importance of hearing in the metaphoric treatment of knowledge in Australian native languages. This metaphor should reasonably occur; hearing is also an extremely important sense for knowledge acquisition, although Indo-European sources show hearing to be more of a metaphor specifically for social communication and compliance than for knowledge acquisition about the world at large (Sweetser, 1990). However, such metaphors do not alter the primacy of Knowledge Is Vision in the world’s languages at large, nor do they change the shared basis for that metaphor, one shared by all humans. Moving outside the literature on metaphor, the evidentials literature provides added data supporting the cross-linguistically basic character of the vision–knowledge link. Many languages have a direct visual experience evidential marker; many of those do not allow its use for descriptions of events that the speaker surely witnessed but cannot cognitively vouch for (e.g., events in the speaker’s early childhood, or things that happened while the speaker was very drunk; cf. Chafe & Nichols, 1986).
21. See Whorf’s (1956) original claims about the importance of habitual linguistic usage in relation to thought patterns.

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