Aymara, where the future is behind you:
Convergent evidence from 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. Such dynamic models appear to be quasi-universal crossculturally, 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 appears instead to have a major static model of time wherein FUTURE IS BEHIND EGO and PAST IS IN FRONT OF EGO. We examine both linguistic and gestural data from Aymara, and find strong confirmation of this unusual culture-specific cognitive pattern. Gestural data provides crucial information not available 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 the bodily-grounded motivations for universal cognitive patterns, what makes a rare pattern emerge, and what are the cultural entailments of such patterns.

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 (1) the temporal experiencer as mover in space (*We're coming to the end of the year*) and (2) times as entities moving with respect to a static experiencer (*The end of the year is approaching*) have been noticed as crosslinguistically dominant over and over again.[1] 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 – while a past event is behind the experiencer (*bygone days are behind us*, while *the week ahead of us is approaching*). Languages around the world showing such patterns are as diverse as the Indo-European family (at large), Hebrew, Wolof from Senegal, Japanese, and Chinese. Although a language typically has more than one metaphorical model of

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[1] English: Clark, 1973; Lakoff & Johnson, 1980, 1999; Lakoff, 1993; Gentner, Imai & Boroditsky, 2002. Wolof: Moore, 2000 (and see added crosslinguistic references). Chagga: Emanatian, 1992. Chinese: Yu, 1998; Ahrens & Huang (in press). Turkish: Özcaliskan: 2002. Japanese: Shinohara 1999. American Sign Language: Emmorey, 2001.

time, so far all documented languages (with the exception to be discussed below) appear to share a spatial metaphor mapping future events onto spatial locations in front of Ego and past events onto locations behind Ego.

Aymara, an Amerindian language spoken in the Andean highlands of Bolivia, Peru and northern Chile,[2] appears to present a fascinating contrast to these well-known patterns, and a challenge to the crosscultural universals of metaphoric cognition which 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, while the basic word for BACK (*q''ipa*, "back/behind") is a basic expression for FUTURE meaning. We therefore need to ask how seriously we should take this 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? And 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 will propose that in order to answer the above 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. Second, we will analyze, from a purely linguistic point of view, a collection of Aymara common linguistic expressions involving temporal uses. We will argue that it seems impossible to resolve some of the above questions from linguistic data alone. Third, we will defend the idea that in order 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 will show the crucial importance of working with complementary linguistic and gestural methodologies when conceptual systems are concerned. And 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.

Gestural data offer the cognitive scientist crucial complementary information which 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). It has been noted (McNeill, 1992; Cienki 1998a, b; Sweetser, 1998a, b; Smith 2003; Núñez, 2004) that metaphoric gesture often systematically accompanies metaphoric speech – iconic gestures such as a hand moving upwards, for example, may accompany an utterance such as *prices soared*, while a downwards 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.

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[2] Aymara is a member of the Jaqi family, which also includes Jaqaru and Kawki (Hardman, 1981, 1988). For details about the Aymara language and its social, historical, and cultural context, see Hardman, 1981; Albó, 1988; van Kessel, 1996; and Estermann & Peña, 1997.

Using complementary linguistic and gestural methodologies, we shall eventually argue that Aymara time metaphors do 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. But 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.

1. Metaphors for time: universals and cultural variability.

1.1. What counts as a case of "future is behind"?
George Lakoff and Mark Johnson have proposed experiential bases for spatial construals of time (M. Johnson 1987, Lakoff 1993, Lakoff & Johnson, 1999). These bases lie in shared bodily experience of space and its correlation with temporal experience; they thus provide a potentially universal basis for spatiotemporal metaphors. To others it seems equally evident that cultures vary radically in their understandings of time (Thornton, 1987; Klein, 1987; Grebe, 1990; Dahl, 1995; Øyvind, 1995). These two viewpoints are not necessarily incompatible: humans often have more than one construal of a given complex domain (for examples of multiple construals in Arithmetic and in Set-theoretic reasoning, see Lakoff & Núñez 2000), 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's 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. Since *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. But, the crucial question is, 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 her future.[3] 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* (NPR 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

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[3] 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 which occurs in the *aft* (rear) end of a ship.

than the present."[4] As Moore (2000) lucidly explains, many of the claims in the literature about languages where "future is behind" and "past is behind" seem to be based on this kind of confusion of different reference points for the front-back relationship.

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 where indeed Future (not general posteriority) seems to be metaphorically IN BACK OF EGO, while 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.[5] 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 which 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.

1.2. Patterns of mapping space onto time.
Research in conceptual metaphor theory since the early 80's 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).[6] 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 which 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[7] (Lakoff, 1993; Lakoff & Johnson, 1999). In related work, Fleischman (1982a, b) examined the etymological relationship 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

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[4] Note the contrast between *ahead of* and *in front of* (one cannot say *in front of time*). This will be discussed later in the paper.

[5] M. Hardman (personal communication, August 26, 1999); Peña Cabrera, 1997; Calvo Pérez, 1993.

[6] Lakoff and Johnson (1999) review much of the preceding work; see also Lakoff and Johnson, 1980; Johnson, 1987; Lakoff, 1987; Turner, 1987; Lakoff & Turner, 1989.

[7] Following a convention in Cognitive Linguistics, the name of a conceptual metaphoric mapping is capitalized.

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 (Fig. 1a), while the latter sees times as fixed objects where the observer moves respect to time (Fig 1b). In these mappings the stationary entity is the deictic center.
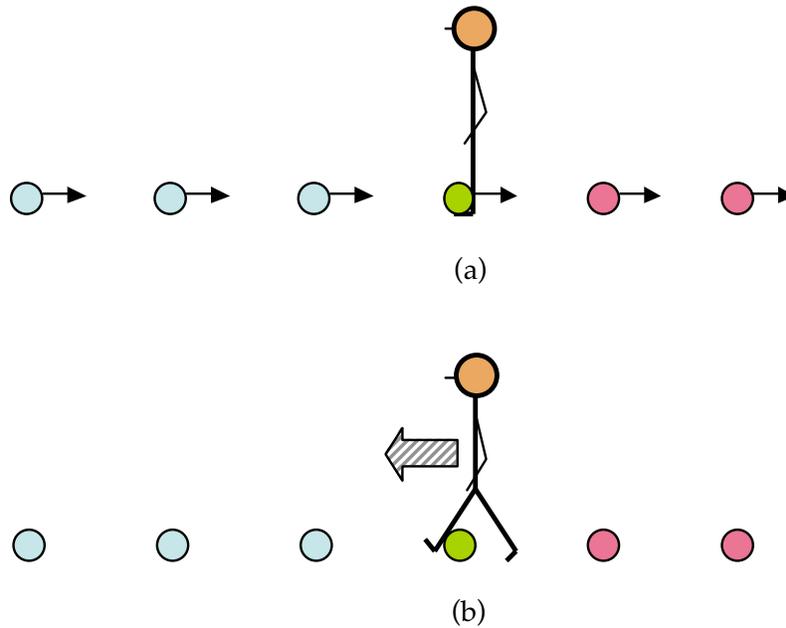

(a)

(b)

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.

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). 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, then earlier events are "ahead of" later ones, and the meeting was rescheduled to an earlier time; while 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

towards understanding *forward* as "to a later time" (i.e., via Moving-Ego metaphor) if they are primed by a self-motion scenario.[8]

Most of the research cited above 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. But in fact 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. And 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 towards Ego as landmark. Moving-Ego cases such as *We're racing towards 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.[9]

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 sub-cases). 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.[10]

Núñez and Motz have recently gathered experimental evidence from priming which supports the psychological reality of the Ego-RP vs. Time-RP distinction (Núñez, in press; Núñez & Motz, 2004). After priming with an image of a sequence of cubes moving across a screen horizontally (in either direction), subjects responded to the question *Last Wednesday's meeting had been moved forward two days. On what day did the meeting take place*? They gave a strong predominance of Monday responses, choosing the interpretation of forward as meaning "to an earlier time." If these English-speaking subjects had been construing spatial relations relative to Ego, they would presumably construe all of last week as behind them, not in front of them: and *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 reference point 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 are rather 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.

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[8] See also Gentner (2001) on the processing effects of consistent vs. inconsistent temporal metaphorical models. And Shinohara (1999) analyzes moving-time metaphors in Japanese; see Yu (1998) for Chinese.
[9] 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.
[10] 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.

1.2.1 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 don't 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. The following is the mapping:

Time-RP mapping

Source Domain *One-dimensional Space*		Target Domain *Time*
Objects		Times
Sequence of objects		Chronological order of times
Horizontal movement of the entire sequence in one direction		Passing of time
Things oriented with their fronts in their direction of motion		Times oriented with their fronts in their direction of motion
An object *A* located in front/behind an object *B*		A time *A* occurs earlier/later than time *B*

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 (such as cubes), we ascribe orientation based on actual motion. For example, we can immediately and unerringly refer to the "front" side of a cube sliding along a flat surface (cf. Clark, 1973; Fillmore, 1997[1977], 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:

a) 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.

b) 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*

c) Since 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:

Christmas *follows* Thanksgiving; Greenwich Mean Time is lagging *behind* the scientific standard time; Boston time is three hours *ahead of* San Francisco time. It is now 20 minutes *ahead* of 1pm.

Finally, we should note 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 examples above; they cannot be replaced by *in back of* and *in front of*. This appears to be because *ahead of* and *behind* refer to spatial relationships between entities in motion (or ranged on a path), while *in front of* and *in back of* refer to static situations.

1.2.2 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), while 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)[11]. 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.

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

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[11] See Lakoff and Johnson's (1999, chap. 10) discussion of "orientation" in time metaphors.

Objects behind the observer		Past times
Object co-located with the observer		Present time

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

a) 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*.

b) The same relationships 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 linguistics 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*; I am looking *ahead* to Christmas.

Ego-RP mapping (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 (1) the observer moves relative to the objects located along the one-dimensional path, or (2) the objects move relative to a static observer. The additional structure of the two dynamic versions of the Ego-RP mapping are the following:

Moving-Object dynamic variant of Ego-RP metaphor

(also referred to as TIME PASSING IS MOTION OF AN OBJECT):

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		The passing of time

motion)		

This variant has some important entailments, in addition to those outlined above for the general Ego-RP mappings:

a) The object passing the observer is, via the mapping, the present time.

b) Since there is only one observer, there is only one Present.

c) Since the objects all move in the same direction, time change is unidirectional.

d) Time has a perceived velocity relative to the observer.

e) 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 which are farther in the future.

f) Since the moving sequence of objects is one-dimensional, the static observer only experiences co-location 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*; The time to make a decision *has come.*

Moving-Ego dynamic variant of the Ego-RP metaphor

(also referred to as TIME PASSING IS MOTION OVER A LANDSCAPE):

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

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

a) Time has an extension, and can be measured.

b) An extended time, like a segment of a path, may be conceived as a linear bounded region.

c) A moving observer will arrive later at a destination which is farther forwards along her path. Via the mapping, this entails that times which are farther in the future will be experienced later by the temporal observer.

d) Since 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:

> 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; 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) has 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*

  1) gets shorter as the action "approaching" takes place, and

  2) will be shorter after the action "approaching" is over.

Núñez (1999) has 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. Since such cases haven't 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.[12] 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?[13]

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" towards the Future.

As Moore (2000) has 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 relationship of two times in terms of a spatial relationship between a landmark and a trajectory object – both moving objects. Ego is not referenced. And 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 two 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 (Lakoff & Johnson, 1980, 1999; Emanatian, 1992; Sweetser, 1988; Núñez 1999; Moore, 2000; Lakoff & Nuñez, 2000). For example, if we walk forwards along a path from point *A* to point *N*, we experience a correlation between locations along the path and times. The moment *N*, when we reach point *N,* is in the future relative to the moment when the action of moving began (i.e., moment *A*). The two correlated domains are both linearly structured and preserve a close isomorphism: just as we cannot get from point *A* to point *E* without going to the intervening points *B, C,* and *D* along the way, so we cannot get from 4:00 PM to 4:05 PM 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 backwards and head the opposite way, while time remains inherently unidirectional and unidimensional. But 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

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[12] See also Langacker's discussion (1987, 1991a, b) 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.

[13] See also Talmy (2000) and Langacker (1987, 1991a, b) for treatments of figure-ground and landmark-trajector expressions in language.

for traversal in either direction, human bodily interaction with paths is inherently asymmetric at any given time. Due to species-specific morphoanatomy, forwards rather than backwards (or sidewards) 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, b; C. Johnson 1996, 1999a, b), based on the kind of pervasive and salient experiential correlation of two domains which constitutes a Primary Scene.

And 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) (Heine et al., 1991; Heine, 1993; Heine et al., 1993; Bybee & Pagliuca, 1985; Bybee et al., 1994). As one might expect, Ego-RP models are the ones involved in deictic temporal reference with respect 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 (Fleischman, 1982a, b; Emanatian, 1992; Bybee & Pagliuca 1985; Sweetser, 1988; Bybee et al., 1994). And Time-RP models are involved in expression of temporal relations between reference events, without 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 Now.

1.3. Evaluating crosscultural 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) concludes 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 assessment that none of the examples in the literature are plausible cases of Ego-RP temporal metaphors wherein FUTURE IS IN BACK OF EGO. Thornton (1982, 70ff.) compares Maori uses of FRONT words to mean "earlier" with parallel Classical Greek uses; she appears 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) debunks 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 – though 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 provides no concrete evidence for a future-before-past construal. In the process, she gives some quite suggestive evidence for models such as FUTURE EVENTS ARE OBJECTS APPROACHING THE

EXPERIENCER – very similar to English *Christmas is coming*. Dahl (1995) argues 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 IN FRONT 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* (Miracle & Yapita, 1981; Hardman 1988; Hardman, Vásquez & Yapita, 1988, as well as those cited above). One of the top candidates for a universal metaphor is KNOWLEDGE IS VISION (Lakoff & Johnson 1980, 1999; Sweetser 1990; Lakoff 1993; C. Johnson 1999a, b). In space, things behind Ego are visually inaccessible, hence unknown. In temporal experience, *Realis* (including Past) is known, while 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, says that Toba speakers are "looking back over their shoulder at the future" – a description which is, to say the least, susceptible to multiple interpretations. Someone looking back over her shoulder is in one sense "facing" the direction of gaze; and in another sense they 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 (since they do not give full linguistic analyses of examples, carefully distinguishing Ego-RP reference from Time-RP reference).

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 which 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 age* 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; while 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) has shown 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.

      So we have quite broad (though surely not "universal") linguistic evidence supporting the position that spatiotemporal metaphors treating time as relative motion, and focusing on back/front orientation, recur crosslinguistically 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.

2. What can the Aymara linguistic data tell us about Aymara construals of time?

The following are common linguistic expressions in Aymara (see Albó, 1988; Briggs, 1993; Grebe, 1990; Hardman, Vásquez, & Yapita, 1988; Miracle and Yapita, 1981; Tarifa, 1969). In these examples, we can see the use of *nayra* ("eye, sight, front") and *q''ipa* ("back") with temporal meanings. Such uses are common in everyday Aymara usage.

2.1. Temporal uses of nayra

(1) *nayra mara* ("last year")

    literal gloss:

        nayra   *mara*

        eye/sight/front   year

(2) *ancha nayra pachana* ("a long time ago")

    literal gloss:

        ancha   *nayra*   *pacha*   *-na*

        a lot   eye/sight/front   time   in/on/at

(3) *nayra pacha/timpu* ("past time")

    literal gloss:

        nayra   *pacha/timpu**

        eye/sight/front   time

        *(*timpu* is borrowed from the Spanish word for time, *tiempo*)

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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. And the face is 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 above, mapping a known period of time or sequence of events onto a visually accessible physical area. In somewhat mixed-domain language, Miracle and Yapita cite 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, while 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 story-teller might start out by saying *nayra* (lit., "front", here "first/earliest"), and label subsequent episodes 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 q''iparu* (lit., towards-back from-that", "backwards 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.

2.2. Temporal uses of q''ipa

Aymara *q''ipa*, "back" is used in a parallel fashion, to refer to the future or to relatively later times. Examples (4)-(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) *q"ipüru* ("a future day")

   literal gloss:

q"ipa	*uru*
back/behind	day

(5) *akata q"iparu* ("from now on")

   literal gloss:

aka	*-ta*	*q"ipa*	*uru*
this	from	back/behind	day

(6) *q"ipa marana* ("in the next [immediately future] year")

   literal gloss:

q"ipa	*mara*	*-na*
back/behind	year	in/on/at

(7) *q"ipa pacha/timpu* ("future time")

   literal gloss:

q"ipa	*pacha/timpu**
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 which 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 non-deictic, Time-RP spatial construals of time.

(8) *q"ipa uruna* ("on the next day / on a future day")

   literal gloss:

q"ipa	*uru*	*-na*
back/behind	day	in/on/at

(9) *uka marata q"iparu* ("from that year on")

    literal gloss:

uka	*mara*	*-ta*	*q"ipa*	*uru*
this	year	from	back/behind	day

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

(10) *q"ipurkama* ("until another day; so long") (Briggs 1993, p.412)

    literal gloss:

q''ipa	*uru*	*kama*
back	day	until

2.3. Other expressions

      As mentioned above, the morphemes *nayra* and *q"ipa* are also used to refer to positions in a sequence. Here we find this mapping in the terms for various harvesting periods in an agricultural cycle (11-13). Notice that the structure here is richer than that of the narrative and enumerative sequential uses: the harvest 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 harvest" is simply before other harvests in the same cycle.

(11) *nayra sata* ("first harvest")

    literal gloss:

nayra	*sata*
eye/front/sight	harvest

(12) *taypi sata* ("middle harvest")

    literal gloss:

taypi	*sata*
middle/center	harvest

(13) *q"ipa sata* ("last harvest")

    literal gloss:

q"ipa	*sata*
back/behind	harvest

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 dialects (see also Bertonio [1612/1984]). But far more dominant are static locational forms such as "back time" for future. Bilingual speakers are of course familiar with some of the common Spanish motion metaphors for time, as well. 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, since it may show that these Aymara uses have been reinforced by Spanish bilingualism.

In sum, Aymara linguistic forms give evidence for both sequential temporal interpretations of *nayra* and *q''ipa* (as "earlier" and "later" respectively) and deictic tense-marking interpretations (as "past" and "future"). Ego and Now remain implicit, rather than overtly marked, in Aymara deictic linguistic expressions for "next year" or "last year" – 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 *q''ipa* operate with a Time-RP model or with an Ego-RP one. If *nayra* and *q''ipa* 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 twenty minutes ahead of 1pm* (i.e., 12:40, which is earlier than 1pm). If, on the contrary, *nayra* and *q''ipa* 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 important question.

3. How can Aymara speakers' gestures help us where linguistic data does 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 which is universally co-produced with spoken languages. As McNeill (1992, 2000) and others have argued, it offers unique access to some of the less conscious aspects of the cognitive processes underlying language. And, most importantly for this investigation, gesture does, like language, represent 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 twenty years, gesture studies has moved forward dramatically, thanks to the work of pioneers such as Kendon (1982), McNeill (1992), Goldin-Meadow & Mylander (1984), 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 (1) the view that speech and gesture are in reality two facets of the same cognitive linguistic reality, and (2) the embodied approach for understanding language, conceptual systems, and high-level cognition:
1) Universality: Speech-accompanying gesture is a crosscultural universal (McNeill, 1992; Núñez & Sweetser, 2001; Iverson & Thelen, 1999).

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 co-produced with speech, in synchronicity patterns which are specific to a given language (McNeill, 1992).

4) Gesture production with no visible interlocutor: Gestures can be produced without the presence of interlocutors, e.g., people gesture while talking on the telephone, and in monologues; congenitally blind subjects gesture as well (Iverson & Goldin-Meadow, 1998).

5) Speech-Gestures co-processing: Stutterers stutter in gesture too, and impeding hand gestures interrupts speech production (Mayberry & Jaques, 2000).

6) Neuropsychology of sign language production: Hand signs are affected by the same neurological damage as speech. Left hemisphere damaged signers manifest similar phonological and morphological errors as those observed in speech aphasia (Hickok, Bellugi, & Klima, 1998).

7) Speech-Gesture development: Gesture and speech develop closely linked (Iverson & Thelen, 1999; Bates & Dick, 2002).

8) Speech-Gesture complementarity: Gesture provides complementary content to speech content. Speakers synthesize and subsequently cannot distinguish information taken from the two channels (Kendon, 2000).

9) Gestures and abstract metaphorical thinking: Linguistic metaphorical mappings are paralleled systematically in gesture (McNeill, 1992, Cienki, 1998a; Sweetser, 1998a,b; Núñez & Sweetser, 2001; Núñez, 2004).

The general results of gesture research pose problems for any approach which assumes that culture and cognitive structure are only to be found in the conscious mind. Although instantiated in the body, and making use of shared, mutually observable space, gestures are culture-specific, as is language. The first notable example of such culture-specificity lies in what Kendon (1990) has labeled *quotable gestures* (also called *emblems*), conventional gesture complexes which are meaningful even without accompanying language, and which 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+little-finger 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.

But McNeill has shown (1992) that even less conventionalized gesture - so-called "free" gesture accompanying speech - follows tight language-specific patterns in its co-timing with speech, as well as in which aspects of the described situation are depicted in gesture.

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, describes a speaker of Nguugu Ymidhirr, who in retelling a story of a boat capsizing, automatically adjusted his gestural patterns so as 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 Ymithirr, 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 her, or whatever the appropriate direction might be (cf. 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 involve 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 crossculturally 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 non-deictically-centered gestural structures. Paul Dudis (personal communication, 2002) has pointed out to us that in ASL spatial arrays, it is possible for the speaker to be located in the array or not. 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 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 = forwards away from signer, south = towards signer, east and west = towards 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 which 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 forwards to indicate literal forwards motion or location; or a very similar gesture may refer to future time. Taub (2001) presents an extended analysis of the relationship between metaphor and iconicity in ASL forms, an analysis which has inspired much of the subsequent work on parallel phenomena in gesture. Cienki (1998a) gives 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 (2004) analyzes 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), Sweetser (1998), Parrill & Sweetser (2002), and Smith (2003).

Cienki (1998a) and Sweetser (1998a,b) have 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 (1998b) documents 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' arguments (based on other data-sources) that speakers may be doing metaphoric processing even of very conventional and idiomatic metaphoric phrases. Cienki also gives 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 non-deictic representations of temporal sequence. Tense is inherently deictic, as are words like *now, then*, and *ago*: a message saying *I will arrive three 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 above, even to describe generic repetitive relationships such as *Christmas comes after Thanksgiving*. Gesture shows the same dichotomy. Co-speech gesture and signed languages both manifest (1) spatialization of time relative to Now (Ego-RP), represented as spatial relationship to the speaker's physical location (Here), and (2) representation of temporal sequence without reference to Now (Time-RP). An English speaker, for example, might gesture forwards for the future, and point at the ground in front of 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. However, she 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 timeline, there is no inherently built-in Now, since the speaker's location is not part of the spatial structure that is mapped onto time (Time-RP).

In the next section we will 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 which are not directly expressed in speech.

4. Empirical observation of Aymara gestural data.

4.1. Method

Speech and gestural data were collected through videotaped ethnographic interviews with Aymara speakers from the Andes' highlands of Northern Chile (Núñez, Neumann, & Mamani, 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 Codpa, Livilcar, Pachama, Chapiquiña, Socoroma, Chucuyo, and Parinacota; from the latter, Cariquima, Villa Blanca, Chijo, Mauque, Ancuyo, Isluga, and Enquelga. 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 hours of raw videotaped interviews were obtained, from which selected passages were taken, and later digitized and captured for audio/video analysis.

4.1.2. Participants

27 persons participated in the study (all of them adults, 65% men, 35% women). Approximately 10% of them were monolinguals (Aymara), 40% had Spanish as a second language (showing significant, but no full mastery of Spanish), 40% were clear bilinguals, and 10% were Spanish monolinguals with very limited knowledge of Aymara. For the analysis of gestures the last category was ignored.

4.1.3. Procedure

Interviews were informal, and usually lasted 20-50 minutes. The interview, which was designed to cover discussions involving reference to time, had two parts. In the first part, subjects 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 subjects 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, subjects 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 (Bertonio, 1612/1984; Albó, 1988; Briggs, 1993; Grebe, 1990; Hardman, Vásquez, & Yapita, 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 subjects, interviews took place in Aymara (with the help of two local informants), in Spanish, and sometimes in both.

4.2. Results

The following are examples of Aymara speakers' speech-gesture co-production while using time expressions in conversations in Aymara and/or Spanish.

4.2.1. Ego-RP gestures

Example 1. (Male speaker from Socoroma; bilingual interview).
In this passage, an Aymara speaker gestures as he repeats and translates the phrase *nayra mara*, literally "front time." His Spanish translations of *nayra mara* are *tiempu antiguo* "old times" and *tiempo antes* "time before." He gestures with his left hand forwards from his body as he makes this explanation (Fig. 2., person on the right) as he holds a *zampoña*, a musical instrument, in his right hand. The first two forward strokes (Fig. 2a and Fig. 2c) are co-timed with the two words *tiempo antiguo*, and display an almost full extension of the left arm. The third forward stroke occurs approximately five seconds later as an emphatic response to the interviewer's question requesting for clarification (Fig. 3). 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 co-produced with the phrase *el tiempo antes*, where the stroke is co-timed with the accentuated first syllable of *antes* ("before").

| (a) | (b) | (c) |

Fig. 2. Example of a two forward stroke gesture co-timed 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).

| (a) | (b) | (c) | (d) |

Fig. 3. Example of an emphatic right hand gesture co-produced with the phrase *el tiempo antes*. The stroke is co-timed with the accentuated first syllable of *antes* ("before").

Example 2. (Male speaker 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 forwards (loose five handshape, palm towards body; Fig. 4), starting from a point at the chest (Fig. 4a), and finally extending the arm with palm up (Fig. 4c). His head is down at the start, and gradually moves up and turns to face the interviewer as the hand gesture moves outwards.

| (a) | (b) | (c) |

Fig. 4. Example of a frontward loose left hand co-timed with the word *antiguo* ("old").

Similarly, 20 seconds later, in explaining pre-Spanish times (*gentil timpu*) the same speaker says *es la otra generación* ("is the other generation"), meaning distant ancestral generations. While uttering this phrase, he extends his right arm in two pointing gestures (with index finger) co-timed 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 (Fig. 5) is above his head, pointing outward and upward.

01:13:11	01:13:14	01:13:17
(a)	(b)	(c)

Fig. 5. Example of frontward index-finger pointing gesture co-produced with the phrase *es la otra generación* ("is the other generation"), meaning distant ancestral generations.

Example 3. (Male speaker from Pachama; bilingual interview).
He 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 (rather ungrammatically in Spanish) *Ese es todavía más allá antes*, "That is even further away before," meaning that the Incas existed way earlier than what he's talking about. He gestures with both hands, an alternating rotating gesture upwards and away from the body (Fig. 6). At the peak of the right hand's rotation co-timed with *más* ("more") in *más allá antes* (Fig. 6c) the right hand forms a point upwards and forwards (Fig. 6d, 6e).

00:08:02	00:08:07	00:08:13	00:08:18	00:08:21
(a)	(b)	(c)	(d)	(e)

Fig. 6. Example of a rotating bi-manual gesture co-produced, while clarifying a misunderstanding, with the rather ungrammatical Spanish sentence *ese es todavía más allá antes* ("that is even further away before").

All of these clips show Aymara speakers gesturing forwards with reference to past time, whether sweeping forwards over temporal extent of past years or pointing forwards away from the present towards 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 downwards (co-location or immediate proximity) nearer to the body representing times closer to the present.

Example 4. (Male speaker 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 (Fig. 7a-7c), and then fastly pointing downwards with the instrument's body right in front of him, between his legs. He holds this position until the word *marana* is finished.

Fig. 7. Example of a pointing gesture opportunistically using the tip of a tool (a musical instrument). It is co-produced with the Aymara expression *aka maran* ("this year"), pointing straight downwards, and marking co-location with Ego.

The speaker continues in Spanish, contrasting this year with earlier times. He transfers the zampoña to his left hand (Fig. 8a-8b), as he explains to a Spanish-speaking inteviewer 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 (Fig. 8c). The stroke that follows immediately after is co-timed with the word *antes*, pointing with the extended index finger forwards, slightly outwards, at an upwards angle (Fig. 8d). As he says *como estos años de ahora* ("like these years now") he iteratively points downwards, with the same index finger, towards a location between his legs where he is sitting (Fig. 8e). He performs this iterative gesture five times, co-timed with the remaining words of sentence, and finishing with *ahora* ("now").

Fig. 8. Example of a right hand index-finger pointing gesture contrasting past times *antes* ("before") and *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* ("long ago, in the past"). The zampoña, which in the meantime had been moved back to his right hand, is then once again 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 (Fig. 9a-9b). The stroke (Fig. 9c) is co-timed with the accentuated syllable *-ti-* of the word *antiguamente*, "long ago, in the past" (Fig. 9c).

00:35:26	00:36:02	00:36:05
(a)	(b)	(c)

Fig. 9. Example of a forward index-finger pointing gesture co-timed with the Spanish word *antiguamente* ("long ago, in the past").

Example 5. (Male speaker from Socoroma, bilingual interview)
Here 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 forwards co-timed with the words *del* ("from") (Fig. 10a). He then moves his hand slightly downwards pointing to a place in front of him as he says *año pasado* "last year" (Fig. 10b). The pointing here is co-timed with the word *pasado*, "last." Then he proceeds with the gesture, moving his hand towards him and pointing downwards again, but this time pointing to a location closer to his body (Fig. 10c), as he says *a este año*, "to this year" (final point co-timed with *año*).

00:19:20	00:20:24	00:21:22
(a)	(b)	(c)

Fig. 10. Example of a pointing gesture indexing a metaphorical (temporal) range *del año pasado* ("from last year") *a este año* ("to this year").

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 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 forwards 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 backwards towards the area behind the speaker.

Example 6. (Male speaker from Arica; bilingual interview)

The speaker is discussing *tiempo futuro* ("future time"). Co-timed with the word *futuro*, he gestures with his right hand (B handshape) across his body and pointing backwards, contralaterally over his left shoulder (Fig. 11a-11b).

00:12:19   00:12:26
(a)   (b)

Fig. 11. Example of a contralateral backwards gesture co-produced with the Spanish words *tiempo futuro* ("future time").

Example 7. (Male speaker from Arica, bilingual interview)
The speaker is contrasting past and future. He points backwards with his right hand (B shape), contralaterally over his left shoulder, twice, as he says *futuro* (Fig. 12).

00:04:16

Fig. 12. Example of a contralateral backward whole-hand pointing gesture co-timed with the Spanish word *futuro* ("future").

Three seconds later he performs three forward gestures: one frontal partial rotation (C shape) as he mentions in Spanish *tiempo antiguo* (Fig. 13a-13c), and two sweeping gestures (Fig. 13d-13e) starting from a B shape, palm towards down position, as he says *nayra timpu* (Aymara "past time"). Approximately five seconds later he points downwards twice with his index in front of him as he says *jicha* (Aymara "now"), accompanying this with a head-nod downwards and forwards (Fig. 13f-13g). Finally, three seconds 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* (Fig. 13h).
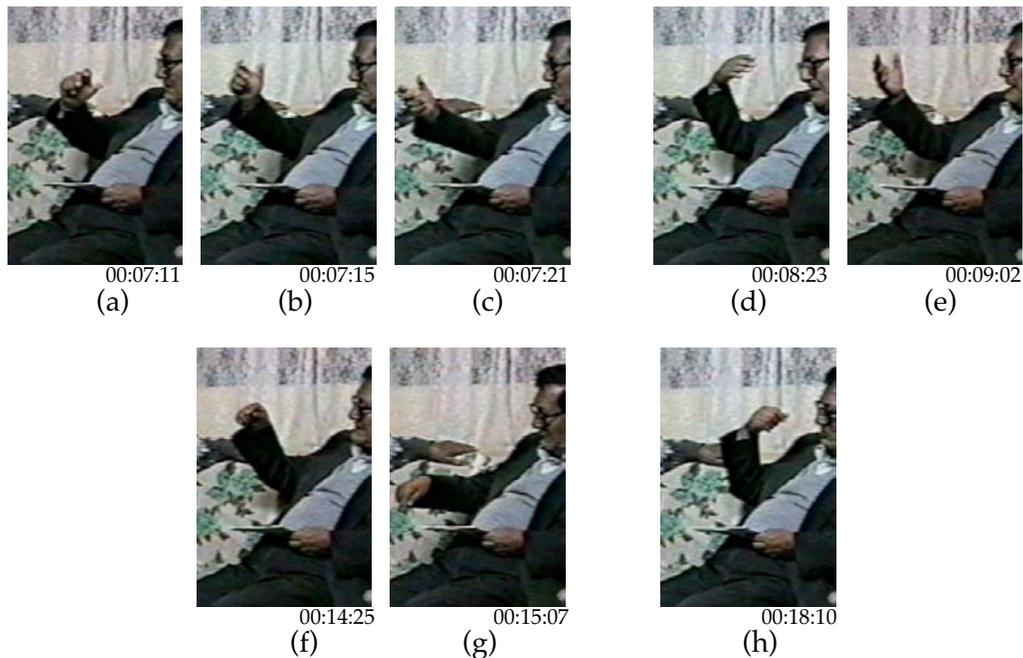
28

00:07:11	00:07:15	00:07:21	00:08:23	00:09:02
(a)	(b)	(c)	(d)	(e)

00:14:25	00:15:07	00:18:10
(f)	(g)	(h)

Fig. 13. Example of a sequence of gestures produced within an eleven-second period, contrasting Spanish *tiempo antiguo* ("old times"), Aymara *nayra timpu* ("past time"), Aymara *jicha* ("now"), and Spanish *futuro* ("future").

Example 8. (Male speaker from Arica, bilingual interview)
At another moment of the conversation, the same speaker refers to the Aymara expression *quipa timpun* ("future time"). Co-timed with the word *quipa* (Aymara for "back") he performs another backwards ipsilateral thumb-point, pointing over his right shoulder with his right thumb (Fig. 14a-14b).
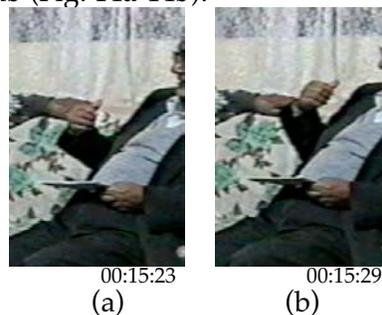

00:15:23	00:15:29
(a)	(b)

Fig. 14. Example of an ipsilateral backward thumb pointing gesture co-produced with the Aymara word *q''ipa* ("back").

4.2.2. Time-RP gestures

Example 9. (Male speaker 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 wave-like gesture zigzagging 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 towards right) as he says *uru* ("day") (Fig. 15a), then as he begins to say *sarjai* (local dialectal variation of *sarjiwa*, "go") his hand moves slightly up and towards the right (Fig. 15b) and then down again and further to right as he finishes with the (accentuated) last syllable of the word *–jai* (Fig. 15c). The gesture proceeds iteratively from left to right, moving up and down, co-timing the downward motion with the words *ukuru* and *ukuru* ("day after day") (Fig. 15d-15g).

| 00:33:05 | 00:33:13 | 00:33:18 | 00:33:23 | 00:33:26 | 00:34:01 | 00:34:06 |
| (a) | (b) | (c) | (d) | (e) | (f) | (g) |

Fig. 15. Example of a Time-Reference-Point iterative gesture co-produced with the Aymara expression *uru sarjai (sarjiwa), ukuru, ukuru* ("day goes, and day after day").

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 which construes time as general motion relative to an unmentioned landscape (Time-RP), rather than motion relative to Ego. We will not analyze further details of these gestures here, since we are specifically discussing the peculiarity of Aymara's front-back Ego-RP metaphoric construals of Time.

4.3. 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 (*q''ipa*) 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, while the space in front of the speaker is the Past. Locations in front and closer to the speaker are more recent past times, while locations in front and farther from the speaker are less recent times: speakers contrast "last year" with "this year" by pointing downwards first at a more distant point and then at a nearer one. The farther in the past the reference event is, the farther upwards is the angle of temporal "points" forwards; 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. When talking about wider ranges of time, rather than particular points in time, we have seen speakers sweeping the dominant hand forwards to the full extent of the arm as they talk about distant past generations and times, or pulling the hand back towards themselves as they talk about the relation of these past generations to the present. The fact that most 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 (Lakoff & Johnson, 1980; Johnson, 1987; Lakoff, 1993; Lakoff & Núñez, 2000; Fauconnier & Turner, 2002): It is the Aymara Ego-RP conceptual

pattern that underlies the gesture production, and this can be manifested even when bilinguals are speaking in Spanish.

The forwards and backwards 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 non-deictic way (with no specified relation to the present) while gesturing along this left-to-right timeline 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 which 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 non-deictic category, and is accompanied by these non-deictic gestures.

One way of understanding the Aymara linguistic and gestural data involving Ego reference points, 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, b). Sweetser (1990) documents 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.[14]

Now imagine a static viewer with a visual field. She can only see what is in the "front" half of the space she is in – the direction she is facing. One might be able to creep up on her 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, beyond the visual horizon; these are invisible and unknown, whether they are in front of the viewer or behind her.

But alter the picture. Imagine a moving person, walking along a path. Of course, like the static viewer, she has a visual field and can only see in front of her. However, another crucial correlation in her experience is that she does not know what she will find around the next turn in the path. An important division of the world for her, 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" as opposed to "places I've been to already – and have thus seen and gained some

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[14] Evans and Wilkins (2000) document 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, although Indo-European sources show hearing to be more of a metaphor for social compliance rather than for knowledge acquisition (Sweetser 1990). But 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.

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.

People all share the understanding that the past is known, the future unknown. But 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 which 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 she will be co-located with the object in the future – nor can we infer that an object behind her was co-located with her in the past. But 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 her, and has been at locations behind her. Further, among locations ahead of her, 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. A question which remains open, however, is why in Aymara this prevalence is overruled by the 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 that it becomes 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). 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, inferences, and so on. So, in Aymara, if a speaker says "Yesterday, my mother cooked potatoes," 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 to (Hardman, 1988). The fact that, phenomenologically speaking, an observer experiences things as being seen or not being seen, that is, as being in or out of her visual field, matches the corresponding binary realis vs. irrealis structure of temporal organization in Aymara. As Miracle &

Yapita (1981) point out, in Aymara time is divided into future and other time, where the division is defined by the unseen future and the visible present-past. The precise role of visual perception in shaping the unusual Aymara Ego-RP pattern for spatial construals of time, however, remains unclear. And, which came first, the obligatory grammatical distinction of personal and nonpersonal knowledge, or the semantic organization of the experience of time? Or perhaps they simply co-existed 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 to these questions.

5. 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 crossculturally. We argue here that gestural data provides 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 relationship between language and culture, and the equally complex one of the relationship 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 crosscultural cognitive universals. Color terms, once the "parade example" of cultural variability (if *blue* and *green* aren't universals, what is?) have in the last thirty 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. 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 don't necessarily always access 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 which 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 (cf. Kay & Kempton, 1984). Returning to Whorf with the added sophistication of recent crosslinguistic work on language use and acquisition, Slobin (1996, 2003; Özçaliskan & Slobin, 2003) has proposed that we recognize that there is a possible contrast between "thinking for speaking" and other thinking, with potential implications for assessment of

crosscultural differences in cognition.[15] 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, while in others there would be far more need to formally mark semantically-based gender (on adjectives or verbs, for example). 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 she has actually perceived visually.

We have good crosscultural 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, since 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, while 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. But 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, while being bodily-grounded in the same universal human body, can get shaped in specific ways to generate cultural variability.

Acknowledgements

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[15] See Whorf's (1956) original claims about the importance of habitual linguistic usage in relation to thought patterns.

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