# Cross-Linguistic Temporal Reference

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## Abstract

Tense, the grammaticalized marking of location in time, has played a central role in analyses of temporal reference even since before the inception of the formal study of meaning. However, research on a wide range of typologically diverse languages over the past 40 years has revealed that many languages do not have tenses and that there are a variety of other means, both linguistic and contextual, that affect temporal reference besides tense. These empirical findings refute the universality of tense and have significant implications for the role of tense in theoretical analyses of temporal reference. This review catalogues the means that affect temporal reference across tensed and tenseless languages, and offers a theoretical perspective on temporal reference that deemphasizes the centrality of tense.

## 1. INTRODUCTION

Formal research on meaning (formal semantics and pragmatics) takes as a basic working hypothesis the Principle of Compositionality, the principle that states that the meaning of a complex linguistic expression (whether spoken, signed, or written) is derived from the meanings of the morphemes that make up the expression, the way the morphemes are combined (syntax), and the context in which the expression is uttered. Cross-linguistic research on meaning addresses the questions of how meaning is derived in any given language and, subsequently, how languages vary or not in the realization of meaning.

To date, the vast majority of research in formal semantics and pragmatics has been conducted on English and other well-studied languages natively spoken by theoretically trained researchers. As a consequence, theories of meaning are generally assessed on the basis of a typologically limited set of languages. Fortunately, however, the past 40 or so years have witnessed a significant increase in the range of languages in which meaning is explored from a formal perspective. This research has already brought many novel empirical generalizations to bear on the question of how languages differ in the realization of meaning. Languages vary, for instance, in the morphemes used to convey a particular meaning: Whereas reciprocal meaning is realized in many languages by a designated reciprocal expression (e.g., English *each other*, as in *The boys congratulated each other*), it is realized in Cuzco Quechua (Quechuan, Peru) through the combination of a pluractional marker (which indicates the plurality of events) and a reflexive marker (Faller 2007) and in Cheyenne (Algonquian, United States) by a morpheme that realizes both reciprocal and reflexive meanings (Murray 2008). Languages also differ in the interface between syntax and meaning, for instance, in whether quantification is realized by both adverbials and determiners, as in English, or by adverbials alone (e.g., Vieira 1995 on Asurini do Trocará, Tupí-Guaraní, Brazil). Likewise, languages exhibit variation in whether a particular meaning is contributed contextually or by the conventional meanings of linguistic expressions: For an English modal, the conversational base—the information about whether the modal receives, for instance, an epistemic or a deontic interpretation—is contextually provided and its quantificational force (universal or existential) is conventionally specified, whereas the quantificational force of a St'át'imcets (Salish, Canada) modal is contextually provided and the conversational base is conventionally specified (Rullmann et al. 2008).

Empirical generalizations that result from research on meaning across typologically diverse languages provide the basis for cross-linguistically viable theories of meaning. Some researchers assume that languages convey the same meanings because they have the same inventory of morphemes and syntactic structures (e.g., Chomsky 1995, Hornstein 1995). Under an alternative position, adopted in this review, one of the desiderata for a cross-linguistically viable theory is that it captures empirical generalizations and the convergence in meaning without assimilating the morphology and syntax of one language to that of another (e.g., Shaer 1997, Bittner 2014). A theory of quantification is thus cross-linguistically viable if it can capture the finding that a language without determiner quantifiers can convey comparable quantificational meanings to a language with determiner quantifiers without analyzing both languages as having determiners that contribute quantificational meanings.

One of the empirical domains that has been at the center of cross-linguistic research on meaning is temporal reference, which concerns the temporal relation between the time at which an utterance is made and the time that the utterance is about. Tense—the grammaticalized marking of location in time (Comrie 1985, p. 9)—has played a central role in analyses of temporal reference even since before the inception of the formal study of meaning in the early 1970s (Reichenbach 1947, Prior 1967, Montague 1973). The key role assigned to tense in theories of temporal reference

can be attributed to the fact that the well-studied languages that have been the empirical focus of formal research on meaning are tensed languages.

However, cross-linguistic research on temporal reference over the past 40 or so years has revealed languages that do not have tenses (Comrie 1985), including Yucatec (Mayan, Mexico; Bohnemeyer 2002), Mandarin (Chinese, China; Lin 2006) and Kalaallisut (Eskimo, Greenland; Bittner 2005). According to DeCaen (1996, p. 41), about half of the world's languages are tenseless. Despite the widespread evidence for the existence of tenseless languages, some researchers argue that tenseless languages nevertheless have tenses, albeit phonologically empty ones, simply because "temporal interpretation would be impossible" without the presence of tense (Sybesma 2007, p. 581). Due to the theoretical position that holds that tense is indispensable for temporal reference, much of the literature on temporal reference and tenseless languages is dominated by the question of whether tenseless languages can receive truly tenseless analyses.

Other researchers have taken the existence of tenseless languages as an impetus for exploring other means, both linguistic and contextual, that have an influence on temporal reference across languages. This research argues that a cross-linguistically viable theory of temporal reference must acknowledge the range of linguistic and contextual means that affect temporal reference. From this perspective, tense plays a far less central role in temporal reference than previously assumed, in turn allowing for a reassessment of the ways in which tensed and tenseless languages do or do not differ.

This review takes a detailed look at how cross-linguistic research on temporal reference has informed our understanding of variation in this domain of meaning and has shaped theories of temporal reference. To this end, Section 2 introduces the relevant background on temporal reference and tense, and illustrates what a tenseless language looks like. Sections 3 and 4 then explore the linguistic and contextual means that affect temporal reference cross-linguistically: Section 3 focuses on those means that directly affect temporal reference, and Section 4 discusses ways in which temporal reference is indirectly affected. Both of these sections also relate the empirical findings to prominent theories of temporal reference: Section 3 critically reviews tensed analyses of tenseless languages, and Section 4 reviews tenseless analyses of tenseless languages. The review concludes in Section 5 with a brief summary.

## 2. TEMPORAL REFERENCE AND TENSE

Temporal reference is described above as concerning the temporal relation between the time the utterance is about and the time at which the utterance is made. The framework in which temporal reference and tense are made more precise in this review is that of Klein (1994). In this framework, the temporal reference of an uttered matrix clause is characterized as the time the utterance is about, the so-called topic time. This time is the time about which an assertion makes a statement, an interrogative asks a question, and an imperative issues a command (Bohnemeyer 2009, p. 83). To illustrate, consider example 1, adapted from Klein (1994, p. 3f).

(1) Context: A judge (J) is interrogating a witness (W) in court.
J: What did you notice when you looked into the room?
W: The light was on.

The judge's interrogative utterance fixes the topic time as the past time interval when the witness looked into the room. If the witness is a cooperative interlocutor who adheres to general conversational principles (Grice 1975), in particular the principle of making her utterance relevant to the current discourse goal, then her answer can be assumed to elaborate on what the world was

like at this topic time. In example 1, the witness asserts that the state of the light being on held at that topic time; that is, she asserts that the eventuality time of the light being on [where "eventuality" is a cover term for states, processes, and events (Bach 1986)] temporally overlaps with the topic time.

Because the topic time of the witness's utterance in example 1 temporally precedes the utterance time, the witness's utterance has past temporal reference. In the minimal variant of example 1 presented below in example 2, the witness's utterance has present temporal reference because the topic time temporally overlaps with the utterance time.

(2) Context: A judge (J) is interrogating a witness (W) in court.
J: Please tell the court what you are seeing in this picture.
W: The light is on.

In example 2, the eventuality time of the light being on again temporally overlaps with the topic time. The two times do not necessarily overlap: if the witness in example 1 utters the sentence *The computer had been smashed into pieces*, then the eventuality time of the event of smashing the computer temporally precedes the topic time at which the witness looked into the room.[1]

Tenses are paradigmatic expressions that indicate a temporal relation between the topic time and the utterance time (Klein 1994).[2,3] The tenses of a particular language are in complementary distribution and are generally obligatory in finite clauses (but see Section 3.2 on tensed languages with tenseless finite clauses). In a tensed language, like English, the tense marking normally indicates temporal reference: The witness's utterance in example 1 features the past tense copula *was* because the utterance has past temporal reference, whereas the witness's utterance in example 2 features the nonpast tense copula *is* because the utterance has present temporal reference. Tenses are required to be part of a paradigm to distinguish them from temporal adverbials, which may also convey the temporal relation between the topic time and the utterance time but which are not paradigmatic or obligatory.[4] It is important to note that tense does not identify the topic time of the uttered clause, for instance in examples 1 and 2, but only indicates its temporal relation to the utterance time.

A tenseless language is a language that does not have paradigmatic expressions that convey a temporal relation between the topic time and the utterance time.[5] As mentioned above, over the past 40 or so years, a wide range of typologically unrelated languages have been identified as

[1]Reichenbach (1947) introduced three times (the speech time, the event time, and the reference time) to distinguish the interpretations of English simple past and past perfect sentences. Neo-Reichenbachian frameworks, such as that of Klein (1994), but also those of Partee (1984) and Kamp & Reyle (1993), substantiate the notion of the reference time and conceive of two temporal relations between the three times: temporal reference concerns the temporal relation between the utterance and reference/topic times, and aspectual reference concerns the temporal relation between the reference/topic and event(uality) times.

[2]Tenses in subordinate clauses may indicate a temporal relation between the topic time and a time other than the utterance time, such as the eventuality time of the matrix clause (see, e.g., Ogihara 1996 for discussion). This review focuses on the temporal reference of matrix clauses.

[3]This definition of tense differs from Comrie's (1985, p. 9) much-cited definition of tense as "grammaticalized expression of location in time," which does not specify which time is located temporally (e.g., the topic time or the eventuality time). It also differs from the definition of tense as temporally relating the eventuality time (of the eventuality described by the clause) to the utterance time found in, for instance, Chung & Timberlake (1985), Zagona (1990), or Stowell (1996).

[4]Tenses also differ from temporal adverbs in that the former presuppose a particular temporal reference, whereas the latter assert it (e.g., Webber 1988, Kamp & Reyle 1993, Bittner 2008).

[5]This definition of a tenseless language considers only the inventory of (phonologically overt) linguistic forms of the language, not whether the language receives a tensed or a tenseless analysis. Tensed analyses of tenseless languages are discussed in Section 3.4.

tenseless languages. (See the Appendix for a list of languages for which the question of whether they are tenseless has been discussed.) One such tenseless language is Paraguayan Guaraní (Tupí-Guaraní, Paraguay; Tonhauser 2011b). In this language, the predicate stem that heads a clause is obligatorily inflected for person/number information but, crucially, not marked for temporal information. For example, the predicate stem *-ho* 'go' in example 3*a* is inflected only for first-person plural exclusive by the cross-reference marker *ro-* 'A1pl.excl.' The data in examples 3*a–c*, adapted from Tonhauser (2011b, p. 259f), show that predicates that are inflected only for person/number information are compatible with past temporal reference (example 3*a*), present temporal reference (example 3*b*), and future temporal reference (example 3*c*).[6]

(3a) Context: Maria talks about one of her childhood summers.
Peteĩ jey **ro-ho** la campáña-re, che-abuéla
one time **A1pl.excl-go** the country.side-for B1sg-grandmother
o-nase-ha-gué-pe, Kiindý-pe.
A3-be.born-NOM-NOM.TERM-in Kiindy-in
'One day we went to the countryside where my grandmother was born, to Kiindy.'

(3b) Context: A duck offers friendship to a very sad looking frog. The frog exclaims:
**A-guereko** peteĩ angirũ, peteĩ angirũ añete-te!
**A1sg-have** one friend one friend true-very
'I have a friend, a real friend!'

(3c) Context: It's morning, and the speaker is talking about a goose walking past her and the addressee.
Ja'ú-ta-re ko gánso ko'ẽro, **a-juka** ko ka'arú-pe.
A1pl.incl-eat-PROSP-for this goose tomorrow **A1sg-kill** this afternoon-at
'Since we are going to eat this goose tomorrow, I will kill it this afternoon.'

Thus, in contrast to English, Paraguayan Guaraní predicates are not inflected for tense and, hence, do not indicate the temporal relation between the topic time and the utterance time of the clause they head.

It is not trivial to identify whether a language is tensed or tenseless (also see Shaer 1997, 2003; Bittner 2005; Lin 2012). Whether a language is described as tensed or tenseless depends both on the extent to which temporal reference has been described for the language and on the definition of tense that is assumed [for relevant discussions, see, e.g., Ritter & Wiltschko 2004 and Reis Silva & Matthewson 2007 on Blackfoot (Algonquian, United States) and Shaer 1997, 2003 and Bittner 2005 on Kalaallisut]. In Paraguayan Guaraní, for instance, there are examples with predicates marked only for person/number information that have future temporal reference, as illustrated in example 3*c*, but these are not as straightforward to identify as are examples with past and present temporal reference. Utterances that realize future discourse, defined as those in which

[6]The Paraguayan Guaraní examples are given in the standardized orthography of the language used in Paraguay (Minist. Educ. Cult. 2004; Velázquez-Castillo 2004, p. 1421f), except that all postpositions are attached to their hosts. Following this orthography, stressed oral syllables are marked with an acute accent and stressed nasal syllables are marked with a tilde; acute accents are not written for normally accented words (stress is on the final syllable). The following glosses are used in the Paraguayan Guaraní examples: 1/2/3; first/second/third person; 1.2sg, first-person proto-agent/second-person singular proto-patient; A/B = set A/B cross-reference marker; ABL, ablative; excl, exclusive; JE, reflexive/middle marker; NOM, nominalizer; pl, plural; PRON.NON.AG, nonagentive pronoun; PROSP, prospective aspect; SAY, reportative evidential; sg, singular; TERM, terminative aspect.

the eventuality described by the utterance is temporally located in the future of the utterance time, are typically realized using one of several suffixes, such as *-ta* 'PROSP' in example 4*a*; see Tonhauser 2011a for discussion. If one were not aware of the existence of utterances such as example 3*c*, one might hypothesize that *-ta* is a future tense and that Paraguayan Guaraní has a nonfuture/future tense paradigm in which the nonfuture exponent is phonologically covert. Other authors have indeed described Paraguayan Guaraní as a tensed language (e.g., Liuzzi 1987, Liuzzi & Kirtchuk 1989, Dessaint 1996) due to the existence of purported future tenses like *-ta* and purported past tenses like *kuri*, shown in example 4*b*.

(4a) Context: A monkey threatens to defend himself using his teeth.
Roi-su'ú-**ta.**
1.2sg-bite-PROSP
'I am going to bite you.'
(Adapted from Tonhauser 2011a, p. 213)

(4b) The first sentence of a story.

| | | | | | | |
|---|---|---|---|---|---|---|
| O-ĩ-je | **kuri** | upe | kyju | kapi'ipé-pe | peteĩ | ka'ara-gúy-pe. |
| A3-be-SAY | **back.then** | that | cricket | grass-in | one | medicinal.plant-under-at |

'It is said that there once was a cricket in grass under a medicinal plant.'
(Adapted from Tonhauser 2011a, p. 225)

(4c) Context: When I cleaned her wound I tried not to show her how bad it looked.

| | | | | |
|---|---|---|---|---|
| O-ñe-hundí-**ta** | chugui | la | i-po | **kuri**. |
| A3-JE-lose-PROSP | pron.NON.AG.3.ABL | the | B3-hand | **back.then** |

'She was going to lose her hand.'
(Adapted from Tonhauser 2011a, p. 224)

Although *kuri* serves to temporally locate the topic time in the past of the utterance time, it is not a past tense (as argued in detail in Tonhauser 2006, chapter 7.3.1, and Tonhauser 2011a), because it is not part of a tense paradigm. Rather, it is a temporal adverb that establishes past temporal reference when such reference is not established by another temporal adverb or contextually, for instance, at the beginning of a story, as in example 4*b*. That *kuri* 'back then' differs markedly from a past tense is also evidenced by the fact that it occurs only 32 times in the Paraguayan Guaraní translation of *The Little Prince* (de Saint-Exupéry 2005), in contrast to the English past tense in the English version, which occurs in every clause with past temporal reference.

The suffix *-ta* illustrated in example 4*a* is not a future tense (which temporally locates the topic time after the utterance time), but rather a prospective aspect, which conveys that the eventuality time is in the future of the topic time (compare with English *be going to*). One piece of evidence for this analysis, developed by Tonhauser (2011a), is that *-ta* 'PROSP' is acceptable in matrix clauses with past temporal reference, as in example 4*c*. This example conveys that, at the past topic time at which the mother cleaned her daughter's wound, the mother feared that the girl was going to lose her hand at a time in the relative future of this past topic time. Importantly, this relative future time precedes the utterance time.

The distinction between the temporal reference of an uttered clause, the time the utterance is about, and tense, an expression whose meaning conveys the temporal relation between the utterance and topic times, is essential for exploring cross-linguistic variation in temporal reference. Distinguishing temporal reference and tense makes precise the observation that every language realizes clauses with past temporal reference, but not all languages have past tenses that convey that the topic time precedes the utterance time (also see Jespersen 1933, p. 230).

Distinguishing temporal reference and tense also facilitates discussions of variation in the form-to-meaning mapping. Consider the discourses in examples *5a* and *b* (from Cover & Tonhauser 2014): The topic time is established in the context to be the past time interval when the doorbell rang. That the eventuality of the speaker bathing is ongoing at this past topic time is conveyed with a past tense sentence in English but with a nontemporally marked predicate in Paraguayan Guaraní.

Context: I tell my mother that yesterday my doorbell rang at a very inopportune moment. My mother asks me: *What were you doing when the doorbell rang?*

(5a) I was bathing. (English)

(5b) A-jahu. (Paraguayan Guaraní)
A1sg-bathe
'I was bathing.'

Both the English and the Paraguayan Guaraní utterances in examples *5a* and *b* have past temporal reference because their topic times are the past time at which the doorbell rang. Past temporal reference is contributed contextually in both languages, but additionally contributed by past tense marking only in English. If we used the term tense to refer both to the temporal reference of a clause and to expressions that convey information about temporal reference, as some authors do, we would need to say that both utterances in examples *5a* and *b* have past tense, thereby obscuring the differences between the two languages.

## 3. CONSTRAINTS ON TEMPORAL REFERENCE

In this and the following section, I discuss the linguistic and contextual means that directly or indirectly affect temporal reference across languages. This section focuses on those means that directly affect temporal reference, namely context, tenses, and temporal adverbials.

### 3.1. Context

The linguistic and extralinguistic context in which an utterance is made can provide strong clues about the temporal reference of the utterance. [The context is taken here to include information from the utterance situation, the linguistic context in which the utterance is made, and the information structure of the preceding discourse (e.g., Roberts 2004, p. 197f).] In fact, the examples discussed in the previous section already illustrate not only that context may indicate the rough location of the topic time (e.g., within a daylong time interval in one of the summers in the speaker's childhood, in example *3a*), but also that context may even completely determine the topic time, as in examples *5a* and *b*, in which the topic time is the time when the doorbell rang.

How does context restrict temporal reference? One type of analysis, developed by, for example, Partee (1984), Kamp & Reyle (1993), Shaer (2003), Bittner (2008, 2014), Bohnemeyer (2009), and Tonhauser (2011b), models the topic time as an implicit temporal anaphor (e.g., Mitchell 1986, Partee 1989, Condoravdi & Gawron 1996). This implicit temporal anaphor may be taken to be an argument of the (verbal) predicate (e.g., Shaer 2003, Bittner 2014), introduced by tense (Partee 1984) or introduced into the translation syncategorematically (e.g., Tonhauser 2011b). If analyzed as a temporal anaphor, the topic time has to be resolved to an antecedent time interval

in the context in order for the uttered sentence that contributes the topic time to receive an interpretation. Thus, the analysis of the topic time as a temporal anaphor renders temporal reference context dependent.

In principle, a temporal anaphor can be resolved to any contextually available time, including the utterance time (in which case the anaphor receives a deictic interpretation) or a time denoted by a linguistic expression (Partee 1984, 1989; Kamp & Reyle 1993). If constraints on the resolution process are not taken into consideration, the anaphoric topic time may be resolved to any time in the context, rendering the interpretation of the uttered sentence multiply ambiguous. The anaphoric analysis of temporal reference is thus coupled with a resolution process that considers various linguistic and contextual constraints on the resolution of the anaphoric topic time. Context, for instance, can be thought of as constraining the set of times to which the anaphoric topic time may be resolved by requiring that only contextually salient times are possible antecedents. In other words, unless a topic time shift is explicitly indicated by the speaker through, for instance, the use of a temporal adverbial (see Section 3.3), the topic time of an utterance is normally a time that is salient in the context in which the utterance is made. To illustrate the effect of context, consider the dialogues in examples 6*a*/*c* and 6*b*/*c*, in which question 1 inquires about a time this morning when the speaker called the addressee and question 2 inquires about a time last week Thursday when the speaker called the addressee.

(6a) Question 1: What were you doing this morning, when I called you?

(6b) Question 2: What were you doing last week Thursday, when I called you?

(6c) Answer:
A-johéi che-ao.
A1sg-wash B1sg-cloth
'I was doing laundry.'

Analyzing the topic time of the answer utterance in example 6 as a temporal anaphor means that it has to be resolved to the contextually most salient antecedent time interval. Although the utterance time is a contextually salient time in any discourse, and although the tenseless clause in example 6*c* is compatible with present temporal reference, the answer is not understood to be about the utterance time in the discourses in examples 6*a*/*c* and 6*b*/*c*, but rather about past times. Specifically, the time this morning when the speaker called the addressee is contextually most salient in the discourse in example 6*a*/*c*, and the time last week Thursday when the speaker called the addressee is contextually most salient in the discourse in example 6*b*/*c*. As a consequence, the addressee is understood to have been doing laundry this morning in the context of question 1 and last week Thursday in the context of question 2.

Some studies of temporal reference analyze tenses (rather than topic times) as temporal anaphors or assume that tenses are responsible for introducing the temporal anaphor that is interpreted as the topic time (e.g., Partee 1973, 1984; Webber 1988; Kamp & Reyle 1993). Such proposals are linguistically more sophisticated than prior analyses of tense as temporal operators (Prior 1967, Montague 1973) and are empirically adequate for tensed languages like English. Tenseless languages, however, which have been receiving serious attention from formal semanticists only since the 1990s, challenge such analyses because temporal reference is anaphoric in both tensed and tenseless languages. In examples 6*a–c*, for instance, both the Paraguayan Guaraní answer (which is tenseless) and the English variant (which realizes a past tense) receive temporally anaphoric interpretations. Such observations motivate a theoretical analysis that models the anaphoricity of temporal reference independently of the existence of tense (see the above references).

## 3.2. Tense

Given an analysis of the topic time as a temporal anaphor, we can now say that tenses constrain the temporal location of the anaphoric topic time relative to the utterance time; that is, tenses are paradigmatic expressions that constrain the set of possible antecedent times. German (Indo-European, Germany), for instance, is a language with a past/nonpast tense distinction: Past tense constrains the topic time to a time prior to the utterance time, whereas nonpast tense constrains the topic time to a time that temporally overlaps with or follows the utterance time. As a consequence, the past tense sentence in example 7*a* is acceptable if uttered in the past temporal reference context of that sentence, but not in the present and future temporal reference contexts in example 7*b*; vice versa for the nonpast tense sentence in example 7*b*. (Throughout this review, the gloss PAST stands for 'past' and the gloss NPST for 'nonpast.')

(7a) Context: Which type of dance did you dance in the competition?
Ich tanzte Tango.
I dance.PAST tango
'I danced tango.'

(7b) Context: Which type of dance are you currently dancing/will you be dancing in the competition?
Ich tanze Tango.
I dance.NPST tango
'I am dancing/will be dancing tango.'

Given the importance that is traditionally attributed to tense, the observation that tense does not fully determine the temporal reference of an utterance, but only constrains the location of the topic time relative to the utterance time, is worth repeating; as noted by Smith (2008, p. 232), "[t]ense alone locates only relationally." Thus, tense marking in example 7*b* only constrains the temporal reference of the uttered clause to a nonpast time, but it is the context that determines whether it is a time that overlaps with the utterance time or follows it.

Languages are not necessarily either exclusively tensed or tenseless. Navajo (Athabaskan, United States), for example, has been described as a "mixed tense" language, with optional tense marking as well as clauses that are not tense marked (Smith et al. 2003, 2007); also see Baker & Travis (1997) on Mohawk (Northern Iroquoian, Canada and United States). Japanese and Korean are generally considered to be tensed languages, but particular coordination constructions in both languages are either obligatorily tenseless, in the case of Japanese, or optionally tenseless, in the case of Korean (e.g., Yoon 1994, Fukushima 1999, Lee & Tonhauser 2010). Likewise, Ruppe (2013) describes the South Carolina dialect of American English as having tenseless finite (perfect-marked) clauses; also see Deo (2012) on Gujarati (Indo-Aryan, India). For discussions of different tense systems cross-linguistically, and for formal criteria for distinguishing tenses from other expressions that convey temporal meanings, see, for instance, Comrie (1985), Enç (1996), Tonhauser (2007, 2008), Bohnemeyer (2009), and Cover & Tonhauser (2014).

## 3.3. Temporal Adverbials

Temporal adverbials may constrain the temporal reference of the clause in which they occur (temporal adverbials may also constrain the temporal location of the eventuality time; see, e.g., Cover & Tonhauser 2014, section 3, for discussion). Both the deictic temporal adverbial *kuehe* 'yesterday' in Paraguayan Guaraní (example 8*a*) and the German calendric adverb (example 8*b*)

temporally constrain the topic times to the times denoted by the adverbs. An anaphoric temporal adverbial, such as English *the week before* (example 8*c*), temporally constrains the topic time in relation to a contextually salient time. (See Bohnemeyer 1998a for a typology of time relators.)

(8a) Kuehe a-johéi che-ao.
yesterday A1sg-wash B1sg-cloth
'I did laundry yesterday.'

(8b) Said in May 2014.
Am 1. August 2014 ziehe ich nach Frankfurt.
at.the 1. August 2014 move.NPST I to Frankfurt
'I'm going to move to Frankfurt on August 1, 2014.'

(8c) Last week, I ate out twice. The week before, I only ate at home.

Not all languages have tenses, but temporal adverbials seem to constrain temporal reference across all languages that have been described in the temporal reference literature. Languages may, however, lack particular kinds of adverbial constructions: Yucatec, for example, does not lexicalize expressions such as English *before* and *after*; therefore, it lacks adverbial constructions such as *. . .after I ate dinner* (Bohnemeyer 1998a). It is also recognized that tenseless languages do not make up for the lack of tense marking by using temporal adverbials to a higher degree than do tensed languages (e.g., Dahl 2001, Lin 2002, Bohnemeyer 2009).

### 3.4. Tensed Analyses of Tenseless Languages

Cross-linguistically, temporal reference is constrained by context and temporal adverbials (in all languages) and tenses (in some languages). An analysis of the topic time as an anaphoric implicit temporal argument can capture the constraints on temporal reference contributed by context, temporal adverbials and tense. Importantly, because tense is just one type of expression that contributes constraints on temporal reference, the importance of tense to temporal reference is deemphasized.

Many theoretical analyses of tense and temporal reference, however, consider tense indispensable and give tensed analyses to tenseless languages without much discussion, for a variety of reasons (also see Shaer 2003 for a detailed discussion). Some theoretical frameworks assume that the Tense node (T node) is obligatory in the syntactic structure of all languages because the Tense is the head of finite sentences and because the specifier position of the Tense Phrase that Tense projects realizes (nominative) subject noun phrases (e.g., Rouveret & Vergnaud 1980, Chomsky 1995). Others assume that tense is needed for a sentence to denote a proposition (e.g., May 1991, Partee 1992, as discussed in von Fintel & Matthewson 2008, p. 157) or that it is tense or the T node that introduces the topic time (Matthewson 2002, 2003). Yet others seem to assume that because "successful theories of tense assume the presence of a T node. . ., these theories are right and are applicable to all natural languages," including tenseless ones (Sybesma 2007, p. 581). Thus, under such assumptions, tenseless languages receive tensed analyses regardless of the empirical support for such an analysis.

In other research, tenseless languages receive tensed analyses to account for the temporal reference restrictions observed in these languages. To illustrate, consider St'át'imcets, a language in which finite matrix clauses headed by verbs inflected only for person/number information are compatible with past and present temporal reference. The verb *sáy'sez'-lhkan* (play-1SG.SUBJ), inflected for a first-person singular subject (1SG.SUBJ) in example 9*a*, for instance, is compatible

with past and present temporal reference. Verbs inflected only for person/number information are incompatible with future time denoting temporal adverbs, as illustrated in example 9*b*.

(9a) sáy'sez'-lhkan
play-1SG.SUBJ
'I played/I am playing.'
(Matthewson 2006, p. 676)

(9b) * sáy'sez'-lhkan *natcw* / *zánucwem*
play-1SG.SUBJ one.day.away / next.year
'I will play tomorrow/next year.'
(Matthewson 2006, p. 677; asterisk and italics in the original)



To account for these temporal reference restrictions, Matthewson (2006) argues that St'át'imcets is only superficially tenseless and that all finite clauses in the language are marked by a phonologically empty nonfuture tense morpheme that requires the topic time to be at or prior to the utterance time. Example 9*a* is thus correctly predicted to be compatible with past and present temporal reference, and the co-occurrence of the finite verb in example 9*b* with future time denoting temporal adverbials is correctly predicted to be unacceptable. Tensed analyses of tenseless languages have also been developed by Avolonto (1992) for Fɔngbe (Kwa, Benin), Lin (2002, 2003, 2006)[7] for Mandarin, Jóhannsdóttir & Matthewson (2007) for Gitxsan (Tsimshian, Canada), Reis Silva & Matthewson (2007) for Blackfoot, and Morton (2014) for Bassila Anii (Kwa, Togo and Benin).

A tensed analysis of a tenseless language is empirically motivated if the language exhibits temporal reference restrictions comparable to those exhibited by some tensed language, and a tensed analysis is empirically adequate if it captures the empirical generalizations about temporal reference that are currently known about these languages. For some of the aforementioned languages, a tenseless analysis may be possible once the languages are better explored: As discussed above, a tensed analysis of Paraguayan Guaraní may initially seem plausible, given the frequency of sentences like example 4*a*, but is ultimately empirically inadequate given the existence of sentences like example 3*c* (among other reasons; see Tonhauser 2011b for discussion).

For other languages, a tenseless analysis may be possible if the assumption of the centrality of tense in the structure and interpretation of natural languages (see references above) is relaxed or abandoned. Bittner (2014), for instance, develops a tenseless analysis of Mandarin that requires neither the postulation of phonologically null tense morphemes nor the assumption that temporal reference restrictions are contributed by, for instance, aspect markers. By Occam's Razor, an analysis that makes the same empirical predictions with fewer assumptions is to be preferred over one that makes more assumptions (e.g., the postulation of a tense paradigm with only phonologically null members).

It is important to note that the debate about whether tenseless languages receive tensed or tenseless analyses is not merely a matter of terminology or theoretical preference, but has consequences for the long-term goal of identifying universals and variation in cross-linguistic temporal reference. On the one hand, the null hypothesis that tense plays a role in the syntax and interpretation of all languages (e.g., Sybesma 2007) makes clear predictions for language

[7]Lin describes his 2006 analysis as a "tenseless" analysis. However, because in this analysis the perfective aspect requires the topic time to precede the utterance time, this analysis is not, strictly speaking, a tenseless one, given that the perfective aspect encodes a temporal reference restriction.

acquisition, accounts for how languages converge on comparable meanings, and provides a strong position from which to explore variation, for instance, in whether tenses are overtly realized or not (e.g., Matthewson 2006). On the other hand, we already know that tensed analyses are not a viable option for several tenseless languages, including Yucatec (Bohnemeyer 2002, 2009), Kalaallisut (Bittner 2005, 2008, 2014), and Paraguayan Guaraní (Tonhauser 2011b), because such analyses would require the postulation of phonologically null tenses that do not contribute to temporal reference. To abandon the null hypothesis of the universality of tense does not mean that the idea that there are universals in natural language meaning, or in temporal reference, is abandoned. From the now-extensive cross-linguistic literature on temporal reference, it appears evident, for instance, that temporal reference across all languages is context dependent, anaphoric, and constrained by temporal adverbs. Abandoning the null hypothesis of the universality of tense acknowledges the empirical observation that not all languages have tenses and forces us to explore other factors that play a role in temporal reference cross-linguistically.

## 4. RESOLVING TEMPORAL REFERENCE IN DISCOURSE

This section explores ways in which temporal reference is influenced by linguistic expressions whose conventional meanings do not encode a temporal relation between the topic time and the utterance time, but whose meanings nevertheless affect temporal reference. As suggested by the section title, the interpretations of these expressions are conceptualized as affecting the resolution of the anaphoric topic time.

### 4.1. Aspect

The term aspect has been used to refer to properties of eventuality structure (lexical aspect, *Aktionsart*) as well as to the temporal relation between the eventuality time of an utterance and the topic time (grammatical/viewpoint aspect); see, for instance, Comrie (1976), Dahl (1985), Verkuyl (1993), Smith (1997), and Rothstein (2004). Aspect is implicated in temporal reference in two ways. First, aspect mediates the temporal relation of the topic time of one clause to that of another, as discussed in Section 4.1.1. Second, aspect has been claimed to lead to default inferences about the temporal location of the topic time relative to the utterance time, as discussed in Section 4.1.2.

**4.1.1. Temporal relations in discourse.** In narrative discourse, the topic time of an utterance is temporally located not only relative to the utterance time, but also relative to the topic time of a preceding clause. In the English discourse in example 10, for instance, each clause has a past tense finite verb, but the clauses are not merely understood to have past temporal reference. Rather, the second clause is understood to be about the time at which John entered the office, that is, about the topic time of the preceding clause, whereas the third clause is understood to be about a time after that topic time. For discussions and formal analyses of the phenomenon of temporal relations in discourse, see, for instance, Kamp (1979); Hinrichs (1981, 1986); Partee (1984); Dowty (1986); and Kamp & Reyle (1993).

(10) John entered the president's office. The president was writing a letter. The president's advisor signaled to John to take a chair.
(Dowty 1986, p. 53)

In English, the aspectual distinction relevant for establishing temporal relations in discourse is that between imperfective sentences (including progressive sentences such as the second clause in

example 10)[8] and perfective sentences (such as the other two clauses in example 10). On Partee's (1984) analysis, perfective (eventive) sentences update the topic time to a time immediately after the described event, whereas imperfective (stative) sentences do not update the topic time. In example 10, the first (eventive) clause updates the topic time to a time shortly after John entered the president's office; the second (progressive stative) clause does not update the topic time. Because states temporally include their topic times (and possibly also that of other clauses) whereas events are temporally included in their topic times, we understand example 10 to mean that the president was writing a letter at the time that John entered the office but that the advisor signaled to John after John entered the office.

There is extensive cross-linguistic evidence of the effect of aspect on temporal relations in discourse from both tensed and tenseless languages, including Yucatec Maya (Bohnemeyer 2002, 2009), German, Inuktitut (Eskimo, Canada), Ewe (Kwa, Ghana and Togo; Bohnemeyer & Swift 2004), American Sign Language (United States; Rathmann 2005), Paraguayan Guaraní (Tonhauser 2011b), Prakrit and Apabhramsha (Middle Indo-Aryan, India; Deo 2012), Kalaallisut, Polish (Slavic, Poland), and Mandarin (Bittner 2008, 2014). In (tenseless) Yucatec, the temporal reference of the clause marked for perfective (PRV) aspect in example 11*b* in the context of example 11*a* is after the time at which the addressee came to the utterance location. In contrast, the temporal reference of the clause marked for progressive (PROG) aspect in example 11*c* in the context of example 11*a* is the time at which the addressee came to the utterance location.[9]

(11a) Káa=h-tàal-ech way h-ts'o'k ka'-p'éel ha'b=e', . . .
CON=PRV-come-B2sg here PRV-end(B3sg) two-CL.IN year=TOP
'(When) you came here two years ago, . . .'

(11b) . . .káa=**t**-in=mèet-ah le=nah=o'.
CON=**PRV**-A1sg=do:APP-CMP(B3sg) DET=house=D2
'. . .I built the house.'

(11c) . . .**táan** in=mèet-ik le=nah=o'.
**PROG** A1sg=do:APP-INC(B3sg) DET=house=D2
'. . .I was building the house.'
(Bohnemeyer 2009, p. 119; bold added)

There are two points of contention regarding a cross-linguistically viable theory of how aspect comes to affect temporal relations in discourse. First, there is an open question of whether, in languages with perfective and imperfective aspects, temporal relations are entailed (e.g., Bittner 2008, 2014 for Mandarin and Kalaallisut), whether they are merely defaults (e.g., Bohnemeyer 2009 for Yucatec), or whether the role of aspect in temporal relations is subject to cross-linguistic variation. A second point of contention is the aspectual notion that is relevant for temporal relations cross-linguistically. The formal semantic/pragmatic literature (see the references above) generally takes the perfective/imperfective (grammatical) aspect distinction to be relevant.

[8]Progressive aspect is generally taken to be a type of imperfective aspect (Dahl 1985, Bybee et al 1994, Deo 2011).

[9]The following glosses are used in the Yucatec examples in this review: 1/2/3, first/second/third person; A/B, set A/B cross-reference marker; APP, applicative; CL.IN, inanimate classifier; CMP, completive status; CON, connective; DES, desiderative modal; DET, determiner; D2, distal/anaphoric clause-final particle; INC, incompletive status; OBL, obligative modal; PROG, progressive aspect; PRV, perfective aspect; pl, plural; sg, singular; TOP, topic.

Other authors, however (e.g., Smith 2004, Rathmann 2005), take telicity to be the relevant notion, with telic events (events with an inherent logical endpoint, such as those denoted by the verb phrase *run to the park*) updating the topic time, and states and atelic events (eventualities without an inherent logical end point, such as those denoted by *run in the park*) maintaining the topic time. Bohnemeyer & Swift (2004) reconcile the two positions by arguing that grammatical aspect is the cross-linguistically relevant notion and that the seeming relevance of telicity in some languages can be attributed to aspectual reference depending on telicity in such languages. In German, for instance, aspectually unmarked clauses that denote telic events implicate perfective aspectual reference, whereas those that denote atelic events implicate imperfective aspectual reference.

**4.1.2. Default location in time.** The second way in which aspect has been connected to temporal reference is that aspect has been claimed to allow for default inferences regarding the temporal relation between the topic time and the utterance time. To illustrate the general claim, consider the Mandarin sentences in examples 12*a* and *b*. Lin (2003) argues that, uttered out of the blue, the telic sentence in example 12*a* has perfective aspectual reference and, therefore, default past temporal reference (as indicated by the translation), whereas the atelic sentence in example 12*b* has imperfective aspectual reference and, therefore, default present temporal reference (as, again, indicated by the translation).[10]

(12a) Ta dapuo yi-ge hua ping.
he break one-CL flower vase
'He broke a flower vase.'
(Lin 2003, p. 262)

(12b) Ta hen congming.
he very clever
'He is very clever.'
(Lin 2003, p. 263)

Lin (2003, p. 265) captures these observations by arguing that Mandarin has a covert present tense, which must combine with an imperfective aspectual phrase, and a covert past tense, which must combine with a perfective aspectual phrase. Temporal adverbs are said to be able to "override tense selections," although this part of the proposal is not spelled out formally. Thus, Lin takes the default interpretations of sentences uttered out of the blue as evidence for temporal reference restrictions, which in turn motivate the assumption of phonologically empty tenses.

An approach to capturing default temporal reference restrictions without assuming phonologically empty tenses was developed by Carlota Smith and her colleagues (e.g., Smith et al. 2003, 2007; Smith & Erbaugh 2005; Smith 2008). The general idea is that the temporal reference of sentences without tenses or temporal adverbs arises as a default inference from aspectual properties of the sentence in combination with universal pragmatic principles. Temporal information provided by context, temporal adverbials, and tenses (in languages that have them) can override these default interpretations. The relevant principles of the main, default pattern of interpretation, which is deictic, are the following.

[10]The following glosses are used in the Mandarin examples in this review: ASP, aspect; CL, classifier.

- Bounded Event Constraint: Bounded events are not located in the present.
  (Smith et al. 2007, p. 45)
- Simplicity Principle of Interpretation: Choose the interpretation that requires the least information added or inferred.
  (Smith et al. 2007, p. 60)
- Temporal Schema Principle: Interpret zero-marked clauses according to the temporal schema of the situation expressed.
  (Smith et al. 2007, p. 61)

To illustrate how these principles contribute to temporal reference, consider examples 13*a* and *b* from the tenseless language Hausa (Chadic, West Africa), described by Mucha (2012, 2013). Mucha (2013, p. 382) argues that aspect marking induces default temporal reference interpretations for sentences uttered out of the blue: Sentences marked with the so-called continuous aspect, such as example 13*a*, receive unbounded aspectual interpretations and default present temporal reference interpretations, whereas sentences marked with the so-called completive aspect, such as example 13*b*, receive bounded aspectual interpretations and default past temporal reference interpretations.[11]

(13a) Bashir ya-nà̀ wà̀sā.
Bashir 3SG.M-CONT play
'Bashir is playing.'

(13b) Bashir ya yi wà̀sā.
Bashir 3SG.M-COMPL do play
'Bashir played.'
(Mucha 2013, p. 382)

The above three principles allow inferences about temporal reference to be drawn from the boundedness features of these utterances. In the deictic pattern (in which these principles apply), present temporal reference is assumed to be simpler than past or future temporal reference. Thus, by the Simplicity Principle, example 13*a* with unbounded aspectual reference has default present temporal reference. By the Bounded Event Constraint, sentences with a bounded aspectual reference, such as example 13*b*, cannot have present temporal reference. By the Simplicity Principle, and the assumption that past temporal reference is simpler than future temporal reference because the latter is not purely temporal but also modal, example 13*b* has default past temporal reference.

Because boundedness is marked by grammatical aspects in Hausa, the Temporal Schema Principle does not come into play in this language. This principle does, however, apply to the Mandarin sentences given in examples 12*a* and *b* (see Smith & Erbaugh 2005): It results in a default bounded interpretation of the telic sentence in example 12*a*, which thereby has default past temporal reference, and it results in a default unbounded interpretation of the atelic sentence in example 12*b*, which thereby has default present temporal reference.

[11]The following glosses are used in the Hausa examples in this review: 3SG.M = third-person singular masculine; COMPL, completive; CONT, continuous.

This approach to temporal reference has been applied to a wide variety of tensed and tenseless languages in addition to Hausa and Mandarin, including Navajo (Smith et al. 2003, 2007), American Sign Language (Rathmann 2005), South Baffin Inuktitut (Eskimo, Canada; Hayashi 2011), Thai (Tai-Kadai, Thailand), Yucatec, Mandarin, and French (Indo-European, France; Smith 2008). The desideratum that a cross-linguistic theory of temporal reference not assimilate one language to another to account for comparable meanings is fulfilled by this approach: Whereas the pragmatic principles play a role cross-linguistically, their effects differ due to differences in tense morpheme inventories (for discussion, see, e.g., Smith 2008, pp. 228, 231; Smith & Erbaugh 2005, p. 749).

However, the approach raises some serious concerns. First, it is puzzling that the interpretations of decontextualized sentences constitute the central empirical observations even though the approach recognizes that temporal reference is context dependent. A second concern is the assumption that context does not affect the temporal reference of examples produced in out-of-the-blue contexts. As argued by, for instance, Bittner (2007, section 2; 2014, section 3.3) and Lin (2010, p. 309), the topic time is the utterance time in such contexts, and as a consequence, bounded sentences cannot have past temporal reference in such contexts, but rather have present temporal and perfect aspectual reference (as in, e.g., the Kalaallisut sentence in example 15*a*). For proposals along these lines, see Bittner (2008, 2014) on Kalaallisut and Mandarin, and Hayashi (2011) on South Baffin Inuktitut. A final, methodological concern is the extensive reliance on translations of decontextualized sentences because, as discussed by Matthewson (2004) and Deal (2014), translations are at best clues about what a sentence might mean.

## 4.2. Temporal Remoteness Markers

Many languages other than the well-studied European ones have linguistic expressions that seem to convey not only whether an eventuality is temporally located before, at, or after the utterance time, but also how long before or after the utterance time the eventuality is temporally located (e.g., Chung & Timberlake 1985, p. 208; Comrie 1985, chapter 4; Dahl 1985, p. 120ff; Bybee et al. 1994, chapters 3.16, 7.4). In Gĩkũyũ (Bantu, Kenya), for example, the so-called Current Past marker illustrated in example 14*a* "is used to describe events occurring within the 'day' surrounding the moment of speech," whereas the so-called Near Past marker illustrated in example 14*b* "is used to describe events occurring 'recently', but prior to the current 'day"' (Cable 2013, p. 223).[12]

(14a) Mwangi nĩ-a-**kũ**-in-aga.
Mwangi ASRT-3sgS-CUR-dance-PAST.IMP
'Mwangi was dancing (within the day).'

(14b) Mwangi nĩ-a-**ra**-in-aga.
Mwangi ASRT-3sgS-NRP-dance-PAST.IMP
'Mwangi was dancing (before today, but recently).'
(Cable 2013, p. 223)

Cable (2013) empirically shows that the Gĩkũyũ expressions (which he refers to as temporal remoteness markers) do not constrain the temporal relation between the topic time and the

[12]The following glosses are used in the Gĩkũyũ examples in this review: 3sgS, third-person singular subject; ASRT, assertive; CUR, current past; IMP, imperfective; NRP, near past.

utterance time—that is, they are not tenses—but rather constrain the temporal relation between the utterance time and the eventuality time. On Cable's analysis, temporal remoteness markers do not affect temporal reference as part of their conventional meaning, but they can affect temporal reference in utterances with (im)perfective aspectual reference. If, for instance, an utterance has imperfective aspectual reference (i.e., the eventuality time includes the topic time) and the uttered sentence realizes a near past temporal remoteness marker (i.e., the eventuality time precedes the utterance time), it follows that the utterance has past temporal reference (i.e., the topic time precedes the utterance time).

The fact that the meanings of temporal remoteness markers can be captured in neo-Reichenbachian frameworks is indicative of the suitability of these frameworks for the analysis of temporal (and aspectual) reference cross-linguistically. That is, the meanings of such markers can be captured within the framework even though such markers were not envisioned when the framework was developed. At the same time, the finding that there are languages that conventionally specify the temporal relation between the utterance and eventuality times adds a significant theoretical dimension to cross-linguistic descriptions and analyses of temporal (and aspectual) reference, and raises important questions about the interactions between temporal remoteness markers, tenses, and temporal adverbs in the languages that have them.



## 4.3. Mood and Modality

Tenseless languages differ in whether their utterances are compatible with past, present, and future temporal reference [e.g., Yucatec (Bohnemeyer 1998b, 2002, 2009), Paraguayan Guaraní (Tonhauser 2011b), Hausa (Mucha 2012, 2013)], or only with the former two [e.g., St'át'imcets (Matthewson 2006)]. According to Bittner (2007, 2008, 2014), the restriction of particular Kalaallisut clauses to past and present temporal reference arises as a consequence of the meaning of mood. Specifically, the indicative mood "identifies the speech event as a report of a fact" (Bittner 2008, p. 350), which means that an event, such as in example 15*a*, must have already happened, whereas a state, such as in example 15*b* or a process, must (minimally) have begun.[13]

(15a) Ataata ani-pu-q.
Dad go.out-IND.IV-3s
'Dad has gone out.'

(15b) Ataata sinig-pu-q.
Dad be.asleep-IND.IV-3s
'Dad is asleep.'
(Bittner 2008, p. 354)

Kalaallisut receives a tenseless analysis in Bittner's work because temporal reference restrictions are not part of the conventional meaning of any Kalaallisut expression. Rather, such restrictions are (nondefeasibly) entailed by the conventional meaning of indicative mood. As a consequence, stative clauses with indicative mood are straightforwardly predicted to be acceptable in contexts with past temporal reference, without requiring that some default be overridden as in Smith's analysis. (In Bittner 2014, the indicative mood is called and glossed declarative.)

[13]The following glosses are used in the Kalaallisut examples in this review: 3s, third-person singular; DEC, declarative mood; IND.IV, indicative mood intransitive verb.

(16) Ole ippassaq ulapig-pu-q.
Ole yesterday busy-DEC-3sg
'Ole was busy yesterday.'
(Bittner 2014, p. 275)

Unlike Kalaallisut, Yucatec is a tenseless language in which tenseless clauses can in principle have past, present, and future temporal reference (Bohnemeyer 1998b, 2002, 2009).

(17) Túumben le=nah=o'.
new(B3sg) DET=house-D2
'The house is/was/will be new.'
(Bohnemeyer 2009, p. 87)

Perfective-marked clauses, however, which denote events, are compatible with future temporal reference "in conditional antecedents, but not in any clause that asserts, questions, or presupposes propositions" (Bohnemeyer 2009, p. 109). That an event is temporally located in the future of the utterance time may be conveyed through the use of a variety of modal markers in Yucatec, including the obligative marker in example 18*a* and the desiderative marker in example 18*b* (also see Bittner 2005 for Kalaallisut). It is important to note that neither of these examples asserts that the event of the speaker building a house is realized in the future of the actual world; the building of the house may occur in the future in only nonactual possible worlds.

(18a) **Yan** in=mèet-ik le=nah=o'.
OBL A1sg=do:APP-INC(B3sg) DET=house=D2
'I (will) have/had to build the house.'

(18b) **Táak** in=mèet-ik le=nah=o'.
DES A1sg=do:APP-INC(B3sg) DET=house=D2
'I (will) want(ed) to build the house.'
(Bohnemeyer 2009, p. 103; bold added)

Yucatec modals do not restrict temporal reference as part of their conventional meaning. Rather, they characterize the set of worlds in which the described eventuality (in examples 18*a* and *b*, the speaker's building a house) is realized: For instance, in example 18*a* the house is built in all the worlds in which the desires of the speaker are met, and in example 18*b* the house is built in all the worlds consistent with the obligations of the speaker (Bohnemeyer 2009, p. 96f). As a consequence, sentences with modals can convey that an eventuality is temporally located in the future of the utterance time (in a set of possible worlds that may include the actual world) if, for instance, the desire of the speaker to build a house is a current desire. If the aspectual reference of the utterance is (im)perfective, the utterance can have future temporal reference, by virtue of the combined modal and aspectual meanings.

## 4.4. Tenseless Analyses of Tenseless Languages

Tenseless analyses of tenseless languages (languages without tense morphemes) do not assume that tense plays a role in the morphology, syntax, or interpretation of such languages. For instance, such analyses do not assume a T node or a Tense projection in the syntactic structures of such languages. Finite clauses are identified on the basis of agreement, locative, or mood markers

(Ritter & Wiltschko 2005, Tonhauser 2011b, Amritavalli 2014, Bittner 2014). Likewise, such analyses account for temporal reference in tenseless languages without assuming morphemes (e.g., phonologically covert tenses or aspect markers) that conventionally specify temporal reference restrictions. Importantly, temporal reference in tenseless languages under tenseless analyses is just as specific as in tensed analyses of tensed (and tenseless) languages (Bohnemeyer 2002; Shaer 2003; Bittner 2008, 2014) because such analyses allow for a variety of factors (context, adverbials, grammatical aspect, etc.) contributing to temporal reference.

An exciting and quite underexplored area of research on temporal reference concerns variation among tenseless languages. Tenseless languages vary, for instance, with respect to the inventory of mood and aspect markers, and with respect to whether unmarked finite matrix clauses may realize future discourse. Matrix clauses in Mandarin, for example, are freely compatible with past and future temporal reference, when not marked with grammatical aspect markers, as illustrated by examples 19*a* and *b*.

(19a) Zuótiā xiàwǔ wǒ hěn jǐnzhāng.
yesterday afternoon I very nervous
'I was very nervous yesterday afternoon.'
(Lin 2010, p. 315)

(19b) Lǐsī míngtiān líkāi Nánjīng.
Lisi tomorrow leave Nanking
'Lisi leaves Nanking tomorrow.'
(Wu 2003, p. 194a, cited in Bittner 2014, p. 107; glosses simplified)

Bittner (2014) assumes that the topic time plays a role only in the temporal reference of tensed languages; in such languages, the topic time is an implicit argument of the (verbal) predicate. Thus, Bittner's (2014, chapter 10) tenseless analysis of tenseless Mandarin does not rely on the topic time but on a so-called reference eventuality. In analogy to Klein's analysis of grammatical aspect as relating the eventuality time to the topic time, Bittner assumes that the aspectual class of the Mandarin verb temporally relates the described eventuality to the reference eventuality: The reference eventuality temporally includes the eventuality time of an event but is temporally included in the eventuality time of a state. The reference eventuality is, by default, the utterance event, which is temporally located at the utterance time. Prior linguistic context, aspect markers, as in examples 19*a* and *b*, and temporal nouns can override the default and set the reference eventuality to a past or a future eventuality, in which case the described eventuality is temporally located in the past or the future, respectively.

Unlike in Mandarin, (dynamic) matrix clauses in Yucatec are obligatorily marked for grammatical aspectual and modal markers. As discussed above, such clauses are generally compatible with past and future temporal reference, as in Mandarin. Perfective-marked matrix clauses, however, which describe events, are incompatible with future temporal reference, unlike those in Mandarin (see example 19*b*). Bohnemeyer (2002, 2009) captures this empirical finding with a language-particular constraint (the so-called modal commitment constraint) that prevents events from being entailed to be realized in the future of the utterance time.

Finite clauses in Paraguayan Guaraní are obligatorily inflected for person and number information, but not for mood or grammatical aspect. In this language, too, matrix clauses are in principle compatible with past and future temporal reference (see examples 3*a–c*), but matrix clauses with future temporal reference have a very limited distribution. For instance, even though temporally unmarked clauses (such as *a-jahu* 'I bathe') are compatible with imperfective aspectual

reference (i.e., may describe habitual or progressive states), such clauses are not compatible with the temporal adverb *ko'ẽro* 'tomorrow,' unlike their Mandarin or Yucatec counterparts.

(20) # Ko'ẽro a-jahu.
tomorrow A1sg-bathe
(Intended: Tomorrow I am going to bathe.)
(Tonhauser 2011b, p. 260)

Tonhauser (2011b) accounts for the unacceptability of example 20 by empirically showing that *ko'ẽro* 'tomorrow' does not restrict temporal reference but rather temporally locates the eventuality time. Because the clause is compatible only with (im)perfective aspectual reference, which requires the (present) topic time to temporally overlap with the eventuality time, example 20 is correctly predicted to be unacceptable. Tonhauser (2011b) maintains that only those linguistic environments that make available future topic times, such as example 3*c*, can license temporally unmarked verbs with future temporal reference.

In Kalaallisut, too, particular matrix clauses are incompatible with temporal adverbs such as *aqagu* 'tomorrow.'

(21) * Ole aqagu ulapig-pu-q.
Ole tomorrow busy-DEC-3sg
(Intended: Ole is busy tomorrow.)
(Adapted from Bittner 2014, p. 275; asterisk in original)

Unlike Paraguayan Guaraní, Kalaallisut is a tenseless language with obligatory mood inflection. The meaning of the declarative (or indicative) mood marker entails that an eventuality described by a matrix clause is verifiable from the utterance event (which is temporally located at the utterance time; Bittner 2014, chapter 11). Thus, as discussed above, if the described eventuality is temporally located relative to the utterance event, verifiability is satisfied if an event has already happened, and a state or process has (minimally) begun. Under the assumption that *aqagu* 'tomorrow' temporally locates the described eventuality, example 21 is correctly predicted to be unacceptable because, for instance, the state of Ole being busy tomorrow is not verifiable from the utterance event.

In sum, tenseless languages, although unified by the absence of tenses, are a heterogeneous set of languages. The question of how the variation in the morphological inventories observed in these languages affects temporal reference, including the realization of future discourse, is an exciting avenue for future research.

## 5. CONCLUDING REMARKS

Formal research on temporal reference has been informed over the past 40 or so years by data from a wide variety of typologically unrelated languages. The question of tenselessness alone has been discussed for languages in more than 25 language families. Thanks to this wealth of data, it is now established that temporal reference cross-linguistically is influenced by several linguistic and extralinguistic factors. Section 3 reviews factors that directly influence temporal reference, namely context, tense, and temporal adverbials, and Section 4 reviews linguistic expressions that can affect temporal reference indirectly, namely aspect, mood, modality, and temporal remoteness markers.

The vast cross-linguistic literature on temporal reference reveals that the assumption of the universality of tense cannot be maintained, with the consequence that analyses of temporal

reference that de-emphasize the centrality of tense to temporal reference are preferred, by Occam's Razor, over analyses by which all languages have (phonologically covert or overt) tenses. The cross-linguistic literature reveals several universals in temporal reference, including that temporal reference in all languages is context dependent, anaphoric, and influenced by temporal adverbials. Furthermore, this literature shows that languages exhibit variation in whether tense, mood, and grammatical aspect markers or temporal remoteness markers play a role in constraining temporal reference. As discussed in Section 4.4, a question that arises from this recognition that a multitude of expressions affect temporal reference concerns how differences among languages in their morphological inventories affect temporal reference. Additional, detailed, theoretically informed analyses of temporal reference in individual languages can contribute to our understanding of the interplay among the various factors identified as affecting temporal reference. Comparative analyses promise to reveal the taxonomy of temporal reference.

Answers to the aforementioned questions will also influence how temporal reference is formally analyzed. This review has relied on a neo-Reichenbachian analysis in which anaphoric topic times play a role in temporal reference across tensed and tenseless languages (Bittner 2008, Bohnemeyer 2009, Tonhauser 2011b). Alternatively, cross-linguistic differences in morphological inventories may correlate with differences in which types of ontological entities (times, eventualities, worlds) play a central role in the theoretical analysis of temporal reference in a given language, as proposed by Bittner (2014). The investigation of the respective viability of these two positions (and others) lies at the intersection of linguistics, cognitive science, and the philosophy of language.



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## Appendix

The languages summarized in this appendix (each with at least one representative reference) are ones for which the question of whether they are tenseless has been discussed. They are organized by language family; the language families are presented alphabetically.

Algonquian: Blackfoot (Ritter & Wiltschko 2004, Reis Silva & Matthewson 2007)
Arabic: Classical Arabic (Cohen 1989)
Arawakan: Baure (Danielsen 2007, Müller 2013)
Athabaskan: Navajo (Smith et al. 2003, 2007)
Austronesian: Chamorro (Chung & Timberlake 1985, Chamorro 2012), Dyirbal (Comrie 1985, pp. 50–53)
Barbacoan: Tsafiki (Müller 2013)
Chadic: Hausa (Mucha 2012, 2013)

Chinese: Mandarin (Lin 2002, Wu 2003, Bittner 2014)
Dravidian: Jēnu Kurumba (Zvelebil 1982), Kannada and Malayalam (Amritavalli & Jayaseelan 2005)
Eskimo-Aleut: Tarramiut Inuktitut, Hudson Strait (Swift 2004, Bohnemeyer & Swift 2004), South Baffin Inuktitut (Hayashi 2011, Hayashi & Spreng 2005), Mittimatalik (Hayashi & Spreng 2005), Baffin Island (Nowak 1994), Arctic Quebec Inuktitut (Nowak 1994), Kalaallisut (Shaer 2003; Bittner 2005, 2014)
Guaykuruan: Mocovi (Müller 2013), Pilaga (Vidal 2001, Müller 2013)
Indo-Aryan: Pawri (Deo 2006, 2012)
Iroquoian: Mohawk (Baker & Travis 1997)
Kwa: Bassila Anii (Morton 2014), Fɔngbe (Avolonto 1992)
Mayan: Yucatec (Bohnemeyer 1998b, 2009)
Maybrat: Maybrat (Dol 1999, Dahl 2001)
Niger-Congo: Igbo (Comrie 1976, pp. 82–84), Dényá (Abangma 1985), Lokaa (Iwara 1991), Yoruba (Comrie 1976, pp. 82–84)
Oceanic: Mikolese (Chung & Timberlake 1985)
Paezan: Nasa Yuwe (Müller 2013)
Pidgin: Kru Pidgin English (Singler 1990)
Salish: Halkomelem (Wiltschko 2003; Ritter & Wiltschko 2004, 2005), St'át'imcets (Matthewson 2002, 2003, 2006)
Semitic: Classical Hebrew (Cohen 1989)
Sign Languages: American Sign Language (Rathmann 2005), Italian Sign Language (Zucchi 2009), British Sign Language (Brennan 1983, Binnick 1991), Swedish Sign Language (Bergman 1983, Binnick 1991)
Sino-Tibetan: Burmese (Comrie 1985, pp. 50–53)
Tai Kadai: Thai (Iwasaki & Ingkaphirom 2005, Smith 2008)
Tsimshian: Gitxsan (Jóhannsdóttir & Matthewson 2007)
Tupí: Paraguayan Guaraní (Tonhauser 2011b), Mbyá Guaraní (Thomas 2012)
Yanomaman: Yanam (Goodwin Gómez 1990, Müller 2013)
Zamucoan: Ayoreo (Bertinetto 2013)

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