RESEARCH ARTICLE

Temporal reference in Paraguayan Guaraní, a tenseless language

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Abstract   This paper contributes data from Paraguayan Guaraní (Tupí-Guaraní) to the discussion of how temporal reference is determined in tenseless languages. The empirical focus of this study is on finite clauses headed by verbs inflected only for person/number information, which are compatible only with non-future temporal reference in most matrix clause contexts. The paper first explores the possibility of accounting for the temporal reference of such clauses with a phonologically empty non-future tense morpheme, along the lines of Matthewson's (Linguist Philos 29:673–713, 2006) analysis of a similar phenomenon in St'át'imcets (Salish). This analysis is then contrasted with one according to which temporal reference is not constrained by tense in Paraguayan Guaraní, but only by context and temporal adverbials. A comparison of the two analyses, both of which are couched in a dynamic semantic framework, suggests empirical and theoretical advantages of the tenseless analysis over the tensed one. The paper concludes with a discussion of cross-linguistic variation of temporal reference in tensed and tenseless languages.

Keywords   Temporal reference · Tenseless languages · Paraguayan Guaraní · Future discourse

1 Introduction

The temporal reference of an utterance is the time interval at which the eventuality description denoted by the utterance is temporally interpreted (e.g. Reichenbach 1947; Partee 1984; Dowty 1986; Hinrichs 1986; Kamp and Reyle 1993; Klein

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1994). Cross-linguistically, the temporal reference of an utterance may be restricted contextually,[1] by tenses and by temporal adverbials. In (1), for example, the temporal reference of B's utterance is contextually restricted to the past time interval included within yesterday at which A called B. The progressive eventuality description of B dancing is temporally interpreted at this time; we thus understand B's dancing to have been ongoing when A called B yesterday.

(1)   A: What were you doing when I called you yesterday?
       B: I was dancing.

The temporal reference of an utterance is contextually restricted since it is anaphoric to a contextually given reference time, i.e. the reference time of an utterance is a temporal anaphor that must be resolved to an (accessible) antecedent reference time. In English, tenses additionally impose restrictions on the temporal reference of an utterance. A matrix clause past tense, for example, restricts temporal reference to a past time by requiring that the antecedent reference time temporally precede the utterance time (e.g. Partee 1984; Kamp and Reyle 1993; Kratzer 1998). B's utterance in (1) is acceptable since the contextually salient reference time is a past time. B's utterance in (2), on the other hand, is not acceptable since the constraint introduced by the non-past tense (that the antecedent reference time be a time that is non-past with respect to the utterance time) is not satisfied in the context of A's question.

(2)   A: What were you doing when I called you yesterday?   (= (1A))
       B: #I **am** dancing.

Temporal adverbials may additionally constrain or resolve the temporal reference of an utterance (Hinrichs 1986), as illustrated in A's utterance in (1) and in the examples in (3). The temporal reference of (3a) is resolved to the denotation of the adverb *yesterday*, the day-long interval that precedes the current day. Since this is compatible with the temporal reference restriction introduced by the past tense, (3a) is acceptable. The examples in (3b) and (3c), on the other hand, are not acceptable since the temporal restrictions on the antecedent reference time introduced by the temporal adverbs *right now* and *tomorrow*, respectively, are incompatible with that introduced by the past tense.

(3)   a.   **Yesterday** I **was** dancing.
       b.   #**Right now** I **was** dancing.
       c.   #**Tomorrow** I **was** dancing.

Paraguayan Guaraní, a Tupí-Guaraní language spoken in Paraguay, is a tenseless language (Tonhauser 2006, 2010, to appear), defined here as a language without overt grammaticalized expressions that restrict the temporal location of the ante-

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[1] The context is taken here to be a body of information held in common by the interlocutors in the discourse, including information from the utterance situation, the linguistic context in which the utterance was made, as well as the information structure of the discourse that includes the utterance (see e.g. Roberts 2004, 197f.).

cedent reference time. Verbs in this language are obligatorily inflected only for person/number information[2]: for example, the verb *a-jahu* (A1sg-bathe) 'I bathe', which consists of the verb root *–jahu* 'bathe' and the first person singular set A cross-reference marker *a–*, may constitute a finite clause (as illustrated below). Guaraní verbs can additionally be marked for aspect, modality or mood. When a Guaraní verb is not marked for aspect, modality or mood, it is only compatible with (im)perfective aspectual reference, where the eventuality time temporally overlaps the reference time, to the exclusion of perfect or prospective aspectual reference (as discussed in Sect. 2).

   Given how temporal reference is restricted cross-linguistically, one might expect that in a tenseless language like Paraguayan Guaraní (henceforth Guaraní), the temporal reference of matrix clauses is restricted only contextually and by (optional) temporal adverbials. That is, one might expect that in such a language, finite matrix clauses are in principle compatible with past, present and future temporal reference, since there are no tenses that impose constraints on the temporal relation between the antecedent reference time and the utterance time. This is indeed the case in Guaraní, as illustrated in (4) with matrix clauses containing verbs only marked for person/number information (see Tonhauser 2010, to appear for examples with verbs marked for aspect or modality): (4a) has past time reference, (4b) has present time reference, and (4c) has future time reference (the verbs of the finite matrix clauses appear in bold-face).

(4) a. Context: Maria talks about one of her childhood summers.
         Peteĩ   jey   **ro-ho**   la   campáña-re,   che-abuéla
         one   time A1pl.excl-go the   countryside-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.'
     b. 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!'

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[2] The Paraguayan Guaraní examples are given in the standardized orthography of the language used in Paraguay (Ministerio de Educación y Cultura 2004), except that all postpositions are attached to their host (see Velázquez-Castillo 2004, 1421f.). Following this orthography, accents are not written for normally accented words (stress on the final syllable); stressed nasal syllables are marked with a tilde. The language has two sets of cross-reference markers: The set A prefixes (which mark transitive subjects and some intransitive subjects) are *a(i)*– 'A1sg', *ja(i)*– 'A1pl.incl', *ro(i)*– 'A1pl.excl', *re(i)*– 'A2sg', *pe(i)*– 'A2pl', and *o(i)*– 'A3'; the set B prefixes (which mark some intransitive subjects and possessors) are *che(r)*– 'B1sg', *ñande(r)*– 'B1pl.incl', *ore(r)*– 'B1pl.excl', *nde(r)*– 'B2sg', *pende(r)*– 'B2pl', and *i(ñ)–/h–* 'B3'. The two portmanteaux prefixes *ro(i)*– '12sg' and *po(i)*– '12pl' refer to a first person subject and a second person (singular/plural) object. The following glosses are used: ABL = ablative, CAUS = causative, COMPLETE = completive aspect, CF = counterfactual, DES = desiderative aspect/modal, DIM = diminutive, excl = exclusive, HORT = desiderative/hortative mood, IMP = imperative, incl = inclusive, JE = reflexive/ passive, MIGHT = possibility modal, MUST = necessity modal, NEG = negation, NOM = nominalizer, NOM.TERM = nominal terminative aspect, PERFECT = perfect aspect, pron.O/S = object/subject pronoun, PROSP = prospective aspect/modal, QU = question, RC = relative clause.

    c.   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**
       A1pl.incl-eat-PROSP-for   this goose   tomorrow   A1sg-kill
       ko   ka'arú-pe.
       this   afternoon-at
       'Since we are going to eat this goose tomorrow, I will kill it this
       afternoon.'

There also are, however, matrix clauses that exhibit temporal reference restrictions. In the examples in (5), the verb *a-jahu* (A1sg-bathe) is compatible with the past time adverb *kuehe* 'yesterday' in (5a), the present time adverb *ko'ãga* 'right now' in (5b), but not with the future time adverb *ko'ẽro* 'tomorrow' in (5c).

(5)   a.   Kuehe   **a-jahu**.
           yesterday   A1sg-bathe
           'Yesterday I bathed/was bathing.'
      b.   Ko'ãga   **a-jahu**.
           now   A1sg-bathe
           'I am bathing right now.'
      c.   #Ko'ẽro   **a-jahu**.
           tomorrow   A1sg-bathe
           (Intended: Tomorrow I am going to bathe.)

Similarly, a clause consisting of the verb *a-jahu* (A1sg-bathe) is felicitously uttered as an answer to the question in (6a) about a past activity, or as an answer to the question in (6b) about a present activity, but not as an answer to the question in (6c) about a future activity.

(6)   a.   A: Mba'é-pa   re-japo   kuehe   ro-henoi-vove?
              what-QU   A2sg-do yesterday 12sg-call-when
          A: 'What were you doing yesterday when I called you?'
          B: **A-jahu**.
               A1sg-bathe
          B: 'I was bathing.'
      b.   A: Mba'é-pa   re-japo   ko'ãga?   B: **A-jahu**.
              what-QU   A2sg-do now   A1sg-bathe
          A: 'What are you doing right now?' B: 'I am bathing.'
      c.   A: Mba'é-pa   re-japó-ta   ko'ẽro   dié-pe?
              what-QU   A2sg-do-PROSP tomorrow   ten-at
          A: 'What are you going to be doing tomorrow at 10?'
          B: **A-jahu**#.
               A1sg-bathe
          B: (Intended: I am going to bathe.)

Such utterances thus convey a non-future meaning that is incompatible with the meaning of the temporal adverb *ko'ẽro* 'tomorrow', as in (5c), and unacceptable in future contexts like (6c). The goal of this paper is to explore two hypotheses about temporal reference in Guaraní, including the origin and distribution of this non-future meaning. Both hypotheses derive from the observation, discussed above, that temporal reference is cross-linguistically restricted by context, tenses and temporal adverbials. To capture the effect of context on temporal reference, both hypotheses are formalized in a dynamic semantic framework, introduced in Sect. 2.

The first hypothesis, explored in Sect. 3, is that the non-future meaning is contributed by a phonologically empty non-future tense morpheme, which requires the antecedent reference time to be temporally located at or prior to the evaluation time, which is the utterance time in matrix clauses. This hypothesis is inspired by Matthewson's (2002, 2006) analysis of temporal reference in St'át'imcets (a tenseless Salishan language),[3] which exhibits striking parallels to temporal reference in Guaraní (for similar analyses see Jóhannsdóttir and Matthewson 2007 on Gitxsan (Tsimshian) and Lin 2003, 2005 on Mandarin Chinese (Sino-Tibetan)). Under the analysis developed in this section, the examples in (5c) and (6c) are predicted to be unacceptable, given the phonologically empty non-future tense, if the temporal adverb *ko'ẽro* 'tomorrow' in (5c) is analyzed as requiring the antecedent reference time to temporally follow the utterance time and the context in (6c) is taken to make available only an absolute future antecedent reference time. While this paper ultimately argues that this tensed analysis is not suitable for Guaraní (in part because this analysis falsely predicts examples with future time reference like (4c) to be unacceptable), this analysis of Guaraní engages with Matthewson's (2006) analysis of a different (but similar) tenseless language and thus facilitates a comparison between the two languages.

The second hypothesis, explored in Sect. 4, maintains that no phonologically empty tense morpheme restricts temporal reference in Guaraní. The analysis developed in this section is a tenseless one since only context and temporal adverbials restrict temporal reference (in matrix clauses). This leads to a straightforward account of examples like (4c), where the temporal/causal adverbial can provide the absolute future reference time for the matrix clause. Absolute future reference times are not, however, available in examples like (5c) and (6c), as is empirically motivated in this section. Rather, future discourse (where the eventuality time is temporally located in the absolute future) is realized by verbal prospective markers that temporally locate the eventuality time in the future of a (past or present) reference time. As a consequence, examples like (5c) and (6c) are unacceptable since the contextually available reference times are non-future and verbs marked only for person/number information cannot convey prospective aspectual reference (see Sect. 2).

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[3] Matthewson (2006) does not consider St'át'imcets a tenseless language, but a 'superficially tenseless' one, since temporal reference in this language is constrained by a phonologically empty non-future tense. The definition of tenseless languages assumed here (see above) allows for a distinction between tenseless languages that receive a tensed analysis, such St'át'imcets, and tenseless languages that receive a tenseless analysis, such as Guaraní according to the analysis in Sect. 4.

Section 5 takes stock by comparing the tensed and tenseless analysis of temporal reference in Guaraní on the basis of empirical coverage and theoretical assumptions. While the verdict, for this author at least, comes down in favor of the tenseless analysis over the tensed one, the comparison highlights similarities between the two analyses and theoretical choices available for analyzing the same set of data. Section 6 concludes the paper with a discussion of cross-linguistic variation in temporal reference.

2 Aspectual reference in Paraguayan Guaraní

As mentioned above, Guaraní verbs are obligatorily inflected only for person/ number information (see footnote 2 for details on the two sets of cross-reference markers). Clauses containing verbs marked only for person/number information occur quite frequently in naturally occurring discourse (about 30–60% of clauses in my corpus, depending on the text).[4] Guaraní verbs can additionally be marked for aspect, modality and mood, but since Guaraní does not have tenses (see references above), all Guaraní verbs are temporally unmarked. The main aspect, modal and mood markers of the language[5] are organized into two groups in Table 1 according to the aspectual reference of verbs that are marked with one of these affixes. Verbs marked with a group I affix like -ma 'PERFECT' or -pa 'COMPLETE' are compatible only with perfect aspectual reference (where the eventuality time (ET) temporally precedes the reference time (RT), abbreviated in Table 1 by ET < RT). Affixes in group III include the desiderative/hortative mood marker *t(a)-* 'HORT', the prospective aspect/modal -ta 'PROSP', the desiderative modal -se 'DES', the possibility modal -ne 'MIGHT' and the necessity modal -va'erã 'MUST'. Verbs marked with such an affix can convey prospective aspectual reference (where the eventuality time temporally follows the reference time, RT < ET); the last two are also compatible with imperfective aspectual reference (the aspectual reference of verbs marked with a group III affix is thus abbreviated by RT ≤ ET). Verbs not marked with an aspect, modal or mood affix complete the paradigm: they are compatible with (im)perfective aspectual reference (abbreviated by ET ◯ RT). In the analysis developed in Sect. 2.2, verbs not marked with an aspect, modal or mood affix have (im)perfective aspectual reference, unless the verb combines with such an affix. Alternatively, one could attribute the (im)perfective aspectual meaning to a phonologically empty group II affix.

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[4] The corpus consists of roughly 14,000 Guaraní words, which corresponds to about 30,000 English words since Guaraní is mildly polysynthetic. The texts in the corpus include folktales, fables, personal narratives and a theater play.

[5] The verbal paradigm also includes other suffixes, e.g. -jey 'again', -ve 'more' and the counterfactual suffix -mo'ã discussed in Tonhauser (2009). Co-occurrences of two or more of these markers are not discussed here (see Tonhauser 2006 for discussion).

Table 1 Aspectual reference in Paraguayan Guaraní

Group	Verbal marker	Example (*a-karu* (A1sg-eat))	Aspectual reference
I	*-ma* 'PERFECT'	*a-karú-ma* 'I already ate.'	$ET < RT$
	-pa 'COMPLETE'	*a-karu-pa* 'I finished eating.'	
II	∅	*a-karu* 'I was/am eating/ate/eat.'	$ET \bigcirc RT$
III	*t(a)-* 'HORT'	*t-a-karu* 'Let me eat.'	$RT \leq ET$
	-ta 'PROSP'	*a-karú-ta* 'I am going to eat.'	
	-se 'DES'	*a-karu-se* 'I want to eat.'	
	-ne 'MIGHT'	*a-karú-ne* 'I might eat.'	
	-va'erã 'MUST'	*a-karu-va'erã* 'I must eat.'	

In this paper, temporal reference in Guaraní is discussed on the basis of utterances containing verbs only marked for person/number information. For reasons of space, verbs marked for aspect, modality and mood are mostly excluded (but see Tonhauser 2006, 2009), but since these verbs are also temporally unmarked, the conclusions drawn here for temporal reference in Guaraní carry over to the full paradigm. The next subsection empirically motivates that verbs only marked for person/number information are compatible only with (im)perfective aspectual reference.

2.1 The aspectual reference of verbs marked only for person/number information

Imperfective aspectual reference subsumes progressive, stative and habitual aspectual reference (e.g. Bybee et al. 1994, Deo 2009). That utterances with verbs marked only for person/number information can have progressive aspectual reference was already shown in (6). The examples in (7) and (8) complete the picture: the utterances with the verb *che-kane'õ* (B1sg-tired) in (7) have stative aspectual reference (the eventuality time temporally includes the reference time) and the example in (8) with *a-jahu* (A1sg-bathe) has habitual aspectual reference.

(7) a. A: Mba'é-icha-pa?   B: **Che-kane'õ**.
              what-like-QU   B1sg-tired
         A: 'How are you?'   B: 'I am tired.'
     b. A: Mba'é-icha-pa   re-ĩ   kuehe   ra'e? B: **Che-kane'õ**.
              what-like-QU   A2sg-be   yesterday   B1sg-tired
         A: 'How were you yesterday?'   B: 'I was tired.'

(8) A: Mba'é-pa   re-japo   domingo-kué-pe?   B: **A-jahu**.
          what-QU   A2sg-do   Sunday-NOM.TERM-at   A1sg-bathe
     A: 'What do you do on Sundays?   B: 'I bathe.'

The clauses in the narrative discourse in (9) have perfective aspectual reference, where the reference time temporally subsumes the eventuality time ($ET \subseteq RT$). This discourse is judged by Guaraní speakers to convey a temporal progression, like the

English translation: Juan gets up, then gets dressed and then has breakfast. I assume that eventive utterances advance the reference time to a time shortly after the previous reference time, while stative utterances do not (e.g. Partee 1984; Dowty 1986).

(9)   Context: What did Juan do last Sunday?
       O-pu'a,   **o-jahu**   ha   **o-rambosa**.
       A3-get.up   A3-bathe   and   A3-breakfast
       'He got up, bathed and ate breakfast.'

In sum, utterances containing verbs only marked for person/number information are compatible with both imperfective and perfective aspectual reference.

Such utterances are not, however, compatible with perfect aspectual reference (ET < RT) or prospective aspectual reference (RT < ET). Consider A's question in (10), which inquires about whether B is currently in the (perfect) state of having eaten (ET < RT = UT). The reply in B, which contains a verb only marked for person/number information, is not acceptable, in support of the hypothesis that an utterance with the verb *a-karu* (A1sg-eat) is incompatible with perfect aspectual reference. In the acceptable version in B′, the perfect aspect marker *-ma* 'PERFECT' (from group I in Table 1) is realized on the verb.

(10)   Context: B is visiting A's house around lunch time.
       A: Re-karú-ma?   B: # **A-karu**.   B′: **A-karú-ma**.
             A2sg-eat-PERFECT   A1sg-eat   A1sg-eat-PERFECT
       A: 'Have you eaten?' B: (Intended: I have eaten.) B′: 'I have eaten.'

Another example that shows that such utterances are incompatible with perfect aspectual reference is given in (11): B's response to A's question is unacceptable, but the response by B′, where the first verb is marked with *-ma* 'PERFECT', is acceptable.

(11)   Context: A calls B on the phone, knowing that B had to visit several cities
       today.
       A: Moõ   rei-me?   Caaguasú-pe?
             where   A2sg-be   Caaguasu-in
             'Where are you?   In Caaguasu?'
       B: #Nahániri. **Ai-me**   Caaguasú-pe, ko'ãga ai-me   San Isídro-pe.
             no   A1sg-be   Caaguasu-in   now   A1sg-be   San Isidro-in
             (Intended: No, I've been in Caaguasu, now I'm in San Isidro.)
       B′:   Nahániri. **Ai-mé-ma**   Caaguasú-pe, ko'ãga ai-me
             no   A1sg-be-PERFECT   Caaguasu-in   now   A1sg-be
             San   Isídro-pe.
             San   Isidro-in
             'No. I've already been in Caaguasu, now I'm in San Isidro.'

Utterances with verbs only marked for person/number information are also incompatible with prospective aspectual reference (RT < ET). In Guaraní, verbs

marked with an affix from group III in Table 1 can convey prospective aspectual reference, as illustrated in the examples in (12) and (13b); see Tonhauser (2006, 2010, to appear). These examples form minimal pairs with the (infelicitous) ones in (5c) and (6c), respectively, that realize verbs marked only for person/number information.

(12) Ko'ẽro   a-jahú-**ta**   / a-jahu-**se**   / a-jahú-**ne**
      tomorrow   A1sg-bathe-PROSP   A1sg-bathe-DES   A1sg-bathe-MIGHT
      / a-jahú-**va'erã**.
       A1sg-bathe-MUST
      'Tomorrow I am going to / want to / might / must bathe.'

(13) a. A: Mba'é-pa   re-japó-ta   ko'ẽro   dié-pe?   (= A in (6c))
              what-QU   A2sg-do-PROSP   tomorrow   ten-at
          A: 'What are you going to be doing tomorrow at 10?'
      b. B: A-jahú-**ta**   / a-jahu-**se**   / a-jahú-**ne**
              A1sg-bathe-PROSP   A1sg-bathe-DES   A1sg-bathe-MIGHT
              / a-jahú-**va'erã**.
                A1sg-bathe-MUST
          B: 'I am going to / want to / might / must bathe.'

In sum, Guaraní utterances with verbs marked only with person/number information are only compatible with (im)perfective aspectual reference, where the eventuality time temporally overlaps the reference time.

2.2 Formal framework

The temporal overlap between the eventuality time and the reference times encoded by verbs marked only for person/number information is formally captured in this paper by the *AT* relation (see Condoravdi 2002). In the sample lexical entry for *a-jahu* (A1sg-bathe) in (14), the *AT* relation holds between the (reference) time t' and the (eventuality) time t at which the speaker sp bathes in world w. (The value of the designated variable sp is, for any context, the speaker of the utterance.)

(14) $a\text{-}jahu \Longrightarrow \lambda w \lambda t' \lambda t [AT(t', bathe'(sp, w, t))]$

The definition of the *AT* relation in (15) spells out various ways in which the reference time t' and the eventuality time t can temporally overlap: the two times temporally overlap under a stative or habitual interpretation $(t \bigcirc t')$, t' is a non-final interval of t under a progressive interpretation $(t' \subset_{nf} t)$ and t is temporally subsumed by t' under a perfective interpretation.[6] (The last line of (15) applies when the verb is marked with an aspectual, modal or mood marker.)

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[6] I assume that the aspectual reference of an utterance is jointly determined by the lexical aspect of the verb, context and Aktionsart; see Tonhauser (2006) for discussion. Since this paper is concerned with temporal reference, the analysis of aspectual reference is not further spelled out.

(15)

$$AT(t', P(w,t)) = \begin{cases} t \bigcirc t' \land P(w,t) & \text{if } P \text{ is stative or habitual} \\ t' \subset_{nf} t \land P(w,t) & \text{if } P \text{ is progressive} \\ t \subseteq t' \land P(w,t) & \text{if } P \text{ is perfective} \\ P(w,t) & \text{if } t' = t \end{cases}$$

The analyses developed in Sects. 3 and 4 of this paper are couched in the dynamic semantic framework of Aloni (2000), which is based on Dekker (1993). In this framework, target language utterances are translated into formulas of a higher order predicate logic language $\mathcal{L}$, with first order variables of the types ϵ (for individuals), ι (for intervals) and ω (for worlds), and the addition of Beaver's (2001) presupposition operator ∂. Formulas of $\mathcal{L}$ of type τ are dynamically interpreted as functions from information states to information states. To illustrate, consider the translation of B's utterance in (1), repeated below, into $\mathcal{L}$ given in (16). In this formula, the variable t_{rt} represents the anaphoric temporal reference of the utterance and the designated variable *now* represents the utterance time—the value of this designated variable is, for any context, the time of utterance. The past tense of B's utterance presupposes that t_{rt} temporally precedes *now*, represented by $\partial(t_{rt} < now)$. The existentially bound interval variable t represents the eventuality time at which the speaker dances in the world w_0 (which is analyzed as an anaphor to the world in which the utterance is made). The progressive aspect in B's utterance in (1) constrains the reference time t_{rt} to be a non-final interval of the eventuality time t of the dancing eventuality (see e.g. Dowty 1979, 1986), which is represented by $t_{rt} \subset_{nf} t$ in (16).

(1) A: What were you doing when I called you yesterday?
     B: I was dancing.

(16) $\exists t(dance'(sp, w_0, t) \land t_{rt} \subset_{nf} t \land \partial(t_{rt} < now))$

A model M for $\mathcal{L}$ consists of a pair $\langle D, F \rangle$, where D is a non-empty set of entities and F is a non-empty set of interpretation functions assigning denotations to the non-logical constants of $\mathcal{L}$. An information state is a set of possibilities (Heim 1982), where a possibility $i = \langle f, g \rangle$ consists of an interpretation function f of F and a variable assignment function g. Given a possibility $i = \langle f, g \rangle$, f_i is the interpretation function of i and g_i is the variable assignment function of the possibility. Within an information state, the variable assignment functions of all possibilities have the same domain. For any variable assignment function g, $dom(g)$ is the domain of g. The domain of a possibility i is $dom(g_i)$.

If M is a model for $\mathcal{L}$, and V is the set of variables of $\mathcal{L}$, then the set S^M of information states based on M is defined, as in Definition 1, as the union of all powersets of pairs of interpretation functions and variable assignment functions mapping elements of a set of variables X to elements of the domain of entities D.

Definition 1 Information states

$$S^M = \cup_{X \subseteq V} \mathcal{P}(F \times D^X)$$

Denotations for basic expressions of $\mathcal{L}$ relative to a possibility i with some domain $X \subseteq V$ are defined as in Definition 2:

Definition 2 Denotations of basic expressions

For any non-logical constant α, the denotation of α in i, $i(\alpha) = f_i(\alpha)$.
For any variable x, if $x \in X$, the denotation of x in i, $i(x) = g_i(x)$; $i(x)$ is undefined otherwise.

Utterances are made against a given information state, the input state. Generally, there are two ways in which an utterance might change the information state against which it is uttered. First, new variables can be introduced, resulting in a larger domain. Given two possibilities i and j, $i \leq_x j$ means that $dom(g_j) = dom(g_i) \cup \{x\}$ and i and j agree on all values in $dom(g_i)$. Second, factual information about the values of variables already in the domain of the input state may be changed, so that certain possibilities are lost. The possibilities that are not lost are said to survive. Per Definition 3, a possibility i survives in an (output) information state σ' if and only if there is a possibility in σ' that is the same as i except for, possibly, having a larger domain. An entire input state survives in an output state if and only if all the possibilities in the input state survive in the output state.

Definition 3 Survival

If σ and σ' are information states, and i a possibility in σ, then

(i) i survives in σ', $i \prec \sigma'$, iff $\exists j \in \sigma' : f_i = f_j$ & $g_i \subseteq g_j$.
(ii) σ survives in σ', $\sigma \prec \sigma'$, iff $\forall i \in \sigma : i \prec \sigma'$.

The semantics of $\mathcal{L}$ in Definition 6 defines the context change potential of formulas of $\mathcal{L}$; t is used here as a metavariable for terms, i.e. variables and constants. A formula of the form $\partial\phi$ (read ''it is presupposed that ϕ'') is interpreted as an update that is defined on an information state σ only if ϕ is already supported in σ, with support defined in Definition 4. The clause for existential quantification uses the notation $\sigma[x]$ for the extension of σ with x, defined in Definition 5.

Definition 4 Support

Let $\sigma \in S^M$ and ϕ in $\mathcal{L}$. Then $\sigma \approx \phi$ iff $\exists \sigma' : \sigma[\phi]\sigma'$ & $\sigma \prec \sigma'$

Definition 5 Extension

For any possibility $i \in \sigma$, let $i[x/d] = \langle f_i, g_i \cup \langle x, d \rangle \rangle$. The extension of σ with x, written $\sigma[x]$, is the set of all possibilities $i[x/d]$ such that $i \in \sigma$ and $x \notin dom(g_i)$ and $d \in D$.

$$\sigma[x] = \{i[x/d] : i \in \sigma \ \& \ x \notin dom(g_i) \ \& \ d \in D\}$$

Definition 6 Semantics

$$
\begin{aligned}
\sigma[R(t_1...t_n)] &= \{i \in \sigma \mid \langle i(t_1)...i(t_n)\rangle \in i(R)\} \\
\sigma[\neg\phi] &= \{i \in \sigma \mid \neg\exists\sigma' : \sigma[\phi]\sigma' \ \& \ i \prec \sigma'\} \\
\sigma[\phi \wedge \psi] &= \sigma[\phi][\psi] \\
\sigma[\partial\phi] &= \sigma[\phi] \text{ if } \sigma \approx \phi, \text{ undefined otherwise.}
\end{aligned}
$$

$$\sigma[\exists x \phi] \quad\quad = \sigma[x][\phi]$$
$$\sigma[\forall x(\phi \to \psi)] \quad = \{i \in \sigma : \{j : i \leq_x j \, \& \, j \prec \sigma[x][\phi]\} \subseteq \{j : j \prec \sigma[x][\phi][\psi]\}\}$$

In the remainder of the paper, $\sigma[\phi]$ stands for the result of updating σ with ϕ; the result of this update is a set of possibilities. In this dynamic semantic framework, the interpretation of the formula of $\mathcal{L}$ in (16), repeated in (17a), is as given in (17b).

(17)   a. $\exists t(dance'(sp, w_0, t) \wedge t_{rt} \subset_{nf} t \wedge \partial(t_{rt} < now))$

     b. $\sigma[\exists t(dance'(sp, w_0, t) \wedge t_{rt} \subset_{nf} t \wedge \partial(t_{rt} < now))]$
        $= \sigma[t][dance'(sp, w_0, t) \wedge t_{rt} \subset_{nf} t \wedge \partial(t_{rt} < now)]$
        $= \sigma[t][dance'(sp, w_0, t)][t_{rt} \subset_{nf} t][\partial(t_{rt} < now)]$
        $= \{i \in \sigma[t] : \langle g_i(sp), g_i(w_0), g_i(t)\rangle \in f_i(dance')$
        $\& \, \langle g_i(t_{rt}), g_i(t)\rangle \in f_i(\subset_{nf}) \, \& \, \langle g_i(t_{rt}), g_i(now)\rangle \in f_i(<)\}$

The result of updating a context with the translation of (1) in (17a) is an information state σ' that consists of possibilities i of the input information state σ where the discourse referent t has been introduced, the speaker sp dances in world w_0 at time t and t_{rt} is a non-final subinterval of t. In order for the update to succeed, σ' must also support that t_{rt} precedes the utterance time, i.e. the antecedent of the reference time t_{rt} must precede the utterance time in the possibilities i. The temporal anaphor t_{rt} is associated with a familiarity presupposition (Heim 1982), which is modeled as a condition on successful information updates: the input context must entail the existence of a time that can be the antecedent of this temporal anaphor, i.e. $g_i(t_{rt})$ needs to be in the domain of the possibilities of σ. Since A's question in (1) makes salient a past reference time at which A called B (which therefore is in the domain of the possibilities of σ), resolving t_{rt} to this time satisfies the familiarity presupposition of t_{rt}. B's utterance in (1) is thus correctly interpreted as conveying that B's dancing was ongoing at the past time when A called B.

Having introduced the aspectual reference of utterances with verbs marked only for person/number information and the general theoretical framework, Sects. 3 and 4 develop a tensed and a tenseless analysis, respectively, of temporal reference in Guaraní.

3 Analyzing Guaraní as a tensed language

The temporal interpretation of Guaraní examples like (5) and (6) is highly reminiscent of that of comparable examples in St'át'imcets (Matthewson 2002, 2006), see also e.g. Ritter andWiltschko (2005) on Halkomelem (Salish) and Blackfoot (Algonquian). In St'át'imcets, finite matrix clauses headed by verbs inflected only for person/number information are compatible with past and present time reference, as illustrated for the verb *sáy'sez'-lhkan* (play-1SG.SUBJ) in (18a). Such verbs are incompatible with future time denoting temporal adverbs, as illustrated in (18b). (The gloss 1SG.SUBJ is used for a first person singular subject.)

(18)   a.   sáy'sez'-lhkan
            play-1SG.SUBJ
            'I played / I am playing.'   (Matthewson 2006, p. 676)
       b.   *sáy'sez'-lhkan *natcw*   / *zánucwem*
            play-1SG.SUBJ   one.day.away / next.year
            'I will play tomorrow / next year.'
                                 (Matthewson 2006, p. 677, * and italics in the original)

Matthewson (2006) argues that the non-future temporal reference observed in examples like (18) is contributed by a phonologically empty non-future tense morpheme TENSE. As illustrated in (19), TENSE presupposes that the reference time $g(i)$ in the context c is at or prior to the utterance time t_c; if the presupposition is satisfied, the utterance is temporally interpreted at the reference time $g(i)$ (Matthewson 2006, p. 680).

(19) $[\![\text{TENSE}_i]\!]^{g,c}$ is only defined if no part of g(i) is after t_c. If defined,
       $[\![\text{TENSE}_i]\!]^{g,c} = g(i)$

Under Matthewson's (2006) analysis, the example in (18a) is translated by the formula in (20), according to which (18a) is true in a world w if and only if there is an event e of the speaker playing in w and the situation time of e, represented as $\tau(e)$, is included in the contextually salient non-future reference time $g(i)$.[7,8] This correctly predicts that (18a) is compatible only with past or present time reference.

(20) $\lambda w \exists e[play'(e)(w) \wedge agent(speaker)(c)(w) \wedge \tau(e) \subseteq g(i)]$ (where no part of $g(i)$ follows t_c)

    Whether it is feasible to analyze the temporal reference of languages like St'át'imcets and Guaraní as constrained by a phonologically empty tense morpheme cannot be decided solely on the basis of an analysis of matrix clause assertions; see also Tonhauser (to appear) for this point. I assume, together with Matthewson (2006), that if temporal reference in St'át'imcets or Guaraní indeed involves a non-future tense morpheme, this morpheme is ''present in every finite clause'' (Matthewson 2006, p. 674) and that the temporal reference of all finite clauses can be captured by the analysis. Furthermore, I maintain that the plausibility of a tensed analysis of such languages hinges on the phonologically empty non-future morpheme being similar, not just in its distribution, but also in its interpretation to overt tenses in other languages (see e.g. Chung and Timberlake 1985; Comrie 1985; Dahl 1985; Enç 1996; Ogihara 1996; Sohn 1999; Gennari 2003 for discussions of

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[7] Matthewson (2006) assumes that such utterances have perfective aspectual reference; see also e.g. Bar-el (2005), Bar-el et al. (2005), Matthewson (2004a). In Guaraní, such utterances are also compatible with imperfective aspectual reference (see Sect. 2).

[8] A similar analysis is proposed in Jóhannsdóttir and Matthewson (2007) for Gitxsan (Tsimshian). In Mandarin Chinese, only events but not states seem to exhibit temporal reference restrictions (Lin 2003, 2005). Lin attributes these restrictions to the meaning of a phonologically empty perfective aspect marker of eventive verbs.

meanings of tenses cross-linguistically). If this is not the case, a tensed analysis of temporal reference in Guaraní is potentially stipulatory and referring to the phonologically empty non-future morpheme as a tense is not appropriate (see Tonhauser 2007, 2008 for discussion). The goal of this section is to explore the feasibility of a tensed analysis of temporal reference in Guaraní.

I refer to the phonologically empty non-future morpheme as NONFUT and assume that it occurs in all finite clauses, which in Guaraní includes positive and negative matrix clauses (assertions and questions), complement clauses, relative clauses, temporal adjunct clauses, antecedents of conditionals and clauses subordinate to the modal *i-katu* (B3-possible) 'it's possible (that)'.[9] I assume that NONFUT constrains the location of the antecedent reference time with respect to the utterance time in matrix clauses and with respect to a time that is potentially different from the utterance time in subordinate clauses. As will become clear below, it is not possible for NONFUT to have the meaning of an absolute non-future tense since finite subordinate clauses are compatible with absolute future temporal reference.

In the framework assumed in this paper, the contribution of the phonologically empty non-future tense NONFUT is represented as in (21b): the tense existentially binds the eventuality time t and presupposes a precedence relation between the (reference) time t' and the (evaluation) time t'' (represented by $\partial(t' \leq t'')$). The result of applying NONFUT, after appropriate renaming of the variables, to the translation of *a-jahu* (A1sg-bathe) is given in (21c).

(21)   A-jahu. (A1sg-bathe)
    a.   *a-jahu* $\Longrightarrow \lambda w \lambda t' \lambda t[AT(t', bathe'(sp, w, t))]$
    b.   NONFUT $\Longrightarrow \lambda P_{\langle \omega, \langle \iota, \langle \iota, \tau \rangle \rangle \rangle} \lambda w \lambda t' \lambda t''[\exists t(P(w, t', t) \wedge \partial(t' \leq t''))]$
    c.   NONFUT(*a-jahu*) $\Longrightarrow \lambda w \lambda t' \lambda t''[\exists t(AT(t', bathe'(sp, w, t)) \wedge \partial(t' \leq t''))]$

In matrix clauses, the times t' and t'' are the temporal anaphor t_{rt} and the utterance time *now*, respectively. This is ensured by the matrix clause rule in (22), which introduces the reference time t_{rt} to the translation[10]:

(22)   **Matrix clause rule (tensed analysis)**
    The final translation of a matrix clause translated as ϕ of type $\langle \omega, \langle \iota, \langle \iota, \tau \rangle \rangle \rangle$ is $\phi(w_0, t_{rt}, now)$ of type τ.

The final translation of (21) in (23) is arrived at by applying the matrix clause rule to the translation in (21c). To illustrate the dynamic interpretation of this final

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[9] I assume that a finite clause is one that contains a fully inflected verb. Since Guaraní verb stems are obligatorily inflected only for person/number information, finite clauses in Guaraní are those that can be headed by such verbs. Clauses headed by verbs additionally marked for aspect or modality have the same distribution as clauses headed by verbs marked only for person/number information and are thus also finite, i.e. would also realize the NONFUT tense.

[10] The temporal reference of utterances in tenseless languages is anaphoric, but there is no tense (under a tenseless analysis) that could introduce the anaphoric reference time. While tenses are often taken to be anaphoric (e.g. Partee 1984; Webber 1988), I assume that the anaphoric reference time is not introduced by tense, but by a matrix clause rule to allow for a parallel treatment of tensed and tenseless languages.

translation, I assume in (24) that the *AT* relation is spelled out as requiring the reference time to be a non-final interval of the eventuality time (see (15)).

(23) Final translation of (21): $\exists t(AT(t_{rt}, bathe'(sp, w_0, t)) \land \partial(t_{rt} \leq now))$

(24) $\sigma[\exists t(AT(t_{rt}, bathe'(sp, w_0, t)) \land \partial(t_{rt} \leq now))]$
$= \sigma[\exists t(bathe'(sp, w_0, t) \land t_{rt} \subset_{nf} t \land \partial(t_{rt} \leq now))]$ (AT relation spelled out)
$= \sigma[t][bathe'(sp, w_0, t) \land t_{rt} \subset_{nf} t \land \partial(t_{rt} \leq now)]$
$= \sigma[t][bathe'(sp, w_0, t)][t_{rt} \subset_{nf} t][\partial(t_{rt} \leq now)]$
$= \{i \in \sigma[t] : \langle g_i(sp), g_i(w_0), g_i(t) \rangle \in f_i(bathe')$
$\quad \& \langle g_i(t_{rt}), g_i(t) \rangle \in f_i(\subset_{nf}) \& \langle g_i(t_{rt}), g_i(now) \rangle \in f_i(\leq)\}$

According to the last line of (24), the result of updating a context with (21) is the set of possibilities *i* of the input information state σ where the discourse referent *t* has been introduced, the speaker *sp* bathes in world w_0 at time *t* and t_{rt} is a non-final interval of *t*, and which already support that t_{rt} precedes *now*. Since the discourse referent t_{rt} is associated with a familiarity presupposition, and t_{rt} is presupposed to be non-future with respect to the utterance time, an update of σ with the translation of (21) is defined only if σ already supports that the reference time is a non-future time.

The analysis can be extended to predict that a verb like *a-jahu* (A1sg-bathe) is compatible in matrix clauses with a temporal adverb like *kuehe* 'yesterday', as in (5a), and incompatible with *ko'ẽro* 'tomorrow', as in (5c), repeated below.

(5) a. Kuehe **a-jahu**.
       yesterday A1sg-bathe
       'Yesterday I bathed/was bathing.'
    c. #Ko'ẽro **a-jahu**.
       tomorrow A1sg-bathe
       (Intended: Tomorrow I am going to bathe.)

The two temporal adverbs are analyzed as constraining the temporal location of the time t', which is the temporal anaphor t_{rt} in matrix clauses, as in (25). The constants *yesterday'* and *tomorrow'* denote the day-long time interval preceding and following the day that includes the utterance time, respectively.

(25) a. *kuehe* 'yesterday' $\implies \lambda P_{\langle\omega,\langle\iota,\langle\iota,\tau\rangle\rangle\rangle} \lambda w \lambda t' \lambda t[t' \subseteq yesterday' \land P(w, t', t)]$
     b. *ko'ẽro* 'tomorrow' $\implies \lambda P_{\langle\omega,\langle\iota,\langle\iota,\tau\rangle\rangle\rangle} \lambda w \lambda t' \lambda t[t' \subseteq tomorrow' \land P(w, t', t)]$

The final translations of (5a) and (5c), given the translations in (25) and after application of the matrix clause rule in (22), are given in (26a) and (26b), respectively. For (5a), the constraints on the temporal location of the antecedent times of the anaphor t_{rt} introduced by the temporal adverb and NONFUT are not contradictory. Thus, (5a) is correctly predicted to be acceptable in a context where the reference time is a past time included within or identical to the day prior to the current one. For (5c), on the other hand, the constraints introduced by the temporal adverb and

NONFUT (which are underlined) are contradictory, thus correctly predicting that (5c) is not acceptable, regardless of the context in which the matrix clause is uttered.

(26) a. Final translation of (5a) using NONFUT:
          NONFUT($kuehe(a\text{-}jahu)$)
          $\implies \exists t(\partial(t_{rt} \leq now) \land t_{rt} \subseteq yesterday' \land AT(t_{rt}, bathe'(sp, w_0, t)))$
      b. Final (contradictory) translation of (5c) using NONFUT:
          NONFUT($ko'\tilde{e}ro(a\text{-}jahu)$)
          $\implies \exists t(\underline{\partial(t_{rt} \leq now)} \land \underline{t_{rt} \subseteq tomorrow'} \land AT(t_{rt}, bathe'(sp, w_0, t)))$

3.1 The temporal reference of matrix clauses

Guaraní matrix clauses are compatible only with present or past time reference (with two exceptions, discussed below), regardless of whether the matrix clause is positive, as in the examples above, or negative or a question, as in (27). An utterance of the negated sentence in (27a) is not a felicitous answer to the Guaraní version of the question 'What will you do at the party tomorrow?' and the question in (27b) cannot be used to inquire whether the addressee will sing tomorrow.

(27) a. Context: Are you singing right now? / Were you singing at the party
          yesterday?
          Nd-**a-purahéi**-ri.
          NEG-A1sg-sing-NEG
          'I am/was not singing.'
      b. **Re-purahéi**-pa?
          A2sg-sing-QU
          'Did you sing?' or 'Are you singing?'

According to the semantics in Definition 6 above, an utterance of the negative sentence in (27a), translated as $\neg\exists t(AT(t_{rt}, sing'(sp, w_0, t)) \land \partial(t_{rt} \leq now))$, updates an input information state σ to those possibilities of σ that are not part of an information state σ' that results from updating σ with $\exists t(AT(t_{rt}, sing'(sp, w_0, t))$ $\land \partial(t_{rt} \leq now))$. Since the familiarity requirement of t_{rt} must be satisfied by the possibilities in σ and the presupposition that the reference time is non-future with respect to the utterance time must be supported by σ (after adding the discourse referent t and ensuring that the speaker sings at t in w_0), (27a) is correctly predicted to be compatible only with non-future temporal reference.

Questions are not covered in the fragment developed above. A toy fragment is given here to illustrate the prediction that (27b) is compatible only with non-future temporal reference (see e.g. Groenendijk 2007 for a more sophisticated analysis). In this toy fragment, (27b) is translated as ?($\exists t(AT(t_{rt}, sing'(add, w_0, t)) \land \partial(t_{rt}$ $\leq now))$), with '?' a question operator. The meaning of a question is taken to be the set of possible answers (e.g. Hamblin 1973). Thus, in a dynamic system, a polar question like (27b) partitions the input information state σ into a set of sets of

possibilities i compatible with ϕ and possibilities j compatible with $\neg\phi$, as given in (28). (The elimination of partitions by answers to questions is not modeled here.)

(28) The context change potential of $?\phi$ with respect to an information state σ:
$$\sigma[?\phi] = \{\{i \in \sigma | \exists\sigma' : \sigma' = \sigma[\phi] \,\&\, i \prec \sigma'\}, \{j \in \sigma | \exists\sigma' : \sigma' = \sigma[\neg\phi] \,\&\, j \prec \sigma'\}\}$$

Since updating σ with the question in (27b) requires updating σ with ϕ, i.e. $\exists t(AT(t_{rt}, sing'(add, w_0, t)) \wedge \partial(t_{rt} \leq now))$, and $\neg\phi$, the update with the question is defined only if σ supports the presupposition $\partial(t_{rt} \leq now)$. (27b) is thus correctly predicted to be compatible only with non-future temporal reference.

There are also, however, matrix clauses in Guaraní with absolute future time reference. Two types of constructions have been identified so far. In the first, illustrated in (29), a non-initial conjunct headed by a verb marked only for person/number information has future time reference; the verb of the initial conjunct is marked with the prospective aspect/modal -ta (which locates the eventuality time in the future of the reference time, Tonhauser to appear).[11] In the second, illustrated in (30), the matrix clause that has absolute future time reference is modified by a complex temporal/causal adverbial clause marked with -re 'for' on the verb (example (30a) was already introduced as (4c) in Sect. 1).[12]

(29) a. Context: Friends are waiting for me in the next city over. I'm running late and call them:
          A-jahú-ta   ha (upéi) **a-jupi**   kolektívo-pe.
          A1sg-bathe-PROSP   and then   A1sg-get.on   bus-at
          'I'm going to shower and then I'll get on the bus.'
      b. Context: I am waiting for the baby sitter so that I can go out.
          Che-niñéra   oú-ta   ha (upei) **a-sẽ**   che-róga-gui.
          B1sg-baby.sitter A3.come-PROSP and then   A1sg-leave B1sg-house-ABL
          'My baby sitter is going to come and (then) I'll leave the house.'

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[11] As mentioned in connection with example (9) above, I assume that eventive utterances, but not stative utterances, advance the reference time in narrative discourse. This analysis does not account for the future temporal reference of the non-final conjuncts in (29): since the first conjuncts in these examples are prospective stative utterances with present time reference, they do not advance the reference times to an absolute future time. In Sect. 4, the temporal reference of such coordination constructions is thus treated by a separate rule, given in (58). In this connection, it is interesting to note, however, that one of the three speakers I consulted about such examples accepted temporally unmarked verbs in matrix clauses even when they were not realized in a coordination construction.

[12] The two types of constructions in (29) and (30) were identified through systematic and extensive elicitation of constructions that realize future discourse in other languages. Other constructions explored in these elicitation sessions, like those in (i), did not license absolute future time reference for finite matrix clauses.

(i) a. #A-jahú-ta-rire,   **a-sẽ**   che-róga-gui.
          A1sg-bathe-PROSP-after   A1sg-leave B1sg-house -ABL
          (Intended: After I have/Having bathed, I'll leave my house.)
     b. #Juan o-guahẽ-ta-vove   peteĩ óra-pe,   **a-sẽ**   che-róga-gui.
          Juan A3-arrive-PROSP-when one   hour-in   A1sg-leave B1sg-house-ABL
          (Intended: When Juan comes in an hour, I leave my house.)

    c.   Context: A monkey makes a plan.[13]

        A-há-ta   tataindy reká-vo,   **a-jogua** ha a-rú-ta   ko'ápe.

        A1sg-go-PROSP candle   search-when A1sg-buy and A1sg-bring-PROSP here

        'I am going to search a candle, I'll buy it and I am going to bring it here.'

        (Krivoshein de Canese et al. 2005, p. 64)

(30)   a.   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.'

      b.   Context: Pablo is going to move to Argentina for a job.

          O-hó-ta-re   Páblo   Argentína-pe, **o-jogua**   ao

          A3-go-PROSP-for   Pablo   Argentina-to   A3-buy   cloth

          pyahu   Villaríca-gui   ko'ẽro.

          new   Villarica-ABL   tomorrow

          'Since Pablo is going to Argentina, he will buy new clothes in Villarica
          tomorrow.'

Examples like those in (29) and (30) are problematic for the analysis entertained in this section, since NONFUT constrains the temporal reference of matrix clauses to a time at or prior to the utterance time. To rescue the tensed analysis, one could argue that in the examples in (29) the verb in the second conjunct occurs in the scope of the prospective aspect/modal of the first conjunct. This would allow the eventuality time of the second conjunct to be in the future of the reference/utterance time. This, however, is possible only if the finite clause in the second conjunct does not realize a NONFUT morpheme since this morpheme would also occur in the scope of the prospective aspect/modal of the first conjunct, licensing an (unattested) interpretation where the second conjunct is temporally interpreted in the past of the first conjunct or even in the past of the utterance time. But to stipulate that the second conjunct does not realize a NONFUT morpheme would violate the assumption that NONFUT occurs in every finite clause in the language. Another problem with this alternative analysis is that the verbs in the second conjuncts in the examples in (29) can optionally be marked with the prospective aspect/modal –ta, with no apparent change in meaning. This necessitates the further stipulation that the scope of –ta in the first conjunct depends on the presence of –ta in the second. To rescue the tensed analysis for the examples in (30), one could assume that the evaluation time of the matrix clauses is not the utterance time but some absolute future time: NONFUT would then allow the matrix clause to have absolute future time reference. This, however, violates the cross-linguistic finding, captured in the

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[13] The analysis of these constructions developed in Sect. 4, in particular the rule in (58), correctly predicts that the third conjunct in this example can also occur without –ta without change in meaning.

matrix clause rule in (22), that the evaluation time of matrix clause tenses is the utterance time.

Alternatively, we can take examples like (29) and (30) to show that Guaraní matrix clauses do not categorically have non-future temporal reference. A tensed analysis of Guaraní temporal reference cannot, however, easily capture this non-categoricity. This is referred to below as problem P1 of the tensed analysis.

3.2 The temporal reference of subordinate clauses

Unlike finite matrix clauses, finite subordinate clauses in Guaraní are readily compatible with absolute future time reference. The examples in (31) illustrate this for the antecedent of a conditional in (31a), a temporal adjunct clause in (31b), the complement of the possibility modal *i-katu* 'it's possible (that)' in (31c), a complement clause in (31d), and a relative clause in (31e). The contexts of the examples and the temporal adverbials in (31c) and (31d) show that the eventuality/reference times of the relevant clauses (with verbs bold-faced) are temporally located in the future of the utterance time.

(31)　a.　Context: Paloma has a terrible voice but still wants to sing at tonight's event. Maria says:
　　　　　Re-purahéi-ramo,　　a-sẽ-ta.
　　　　　A2sg-sing-if　　　　A1sg-leave-PROSP
　　　　　'If you sing, I am going to leave.'
　　　b.　Context: I'm getting ready to leave the house. Maria tells me:
　　　　　Re-ho-mboyve,　　　re-karú-ta.
　　　　　A2sg-go-before　　　　A2sg-eat-PROSP
　　　　　'Before you leave, you are going to eat.'
　　　c.　Context: Malena's wedding is tomorrow. She invited Paloma to sing at the wedding but doesn't know whether she'll come. Juan says:
　　　　　I-katu　　　　**o-purahei**　　ko'ẽro.
　　　　　B3-possible　　A3-sing　　　　tomorrow
　　　　　'It's possible that she will sing tomorrow.'
　　　d.　Context: To play a trick on Mario, we plan to call him to ask directions to his house.
　　　　　Mario　　　oi-mo'ã-ta　　　**ja-ju**-ha.
　　　　　Mario　　　A3-think-PROSP　A1pl.incl-come-NOM
　　　　　'Mario is going to think that we are coming.'
　　　e.　Context: A child was born blind but has just undergone an operation to restore her eyesight. This morning is the first time she's allowed to take off her bandages. She says:
　　　　　Ko　　　pyharé-pe　a-mombe'ú-ta　　che-sý-pe　　　o-pa
　　　　　this　　night-at　　A1sg-tell-PROSP　B1sg-mother-to　A3-complete
　　　　　mba'e　**a-hechá**-va　ko　ára-pe.
　　　　　thing　A1sg-see-RC　this　day-at
　　　　　'Tonight I am going to tell my mother about all the things I see today.'

The examples in (31) show that NONFUT cannot be an absolute tense, which would require the evaluation time to be the utterance time in both matrix and subordinate clauses, falsely predicting that the subordinate finite clauses in (31) are incompatible with absolute future time reference. Since, however, NONFUT is assumed to be a relative tense, the evaluation time of a NONFUT morpheme that occurs in a subordinate clause may be an interval distinct from the utterance time, such as the matrix clause eventuality time. As a consequence, the temporal reference of finite subordinate clauses can differ from that of finite matrix clauses. In particular, the analysis predicts that finite subordinate clauses are compatible with absolute future time reference if the evaluation time is an absolute future time. For example, the complement clause *ja-ju* 'we come' in (31d) may have absolute future time reference if the evaluation time of the embedded NONFUT morpheme is the matrix eventuality time: the content of Mario's thinking is the proposition that the group that includes the speaker comes to his house at the future thinking time.

The availability of this reading of (31d) is correctly predicted by the formal analysis, as illustrated in (32) and (33) below. The translation of the subordinate clause is given in (32a): the embedded NONFUT morpheme requires that the (reference) time t', which is at the time t at which the group ξ comes to Mario's house (by the AT relation), is at or prior to the (evaluation) time $t''(\partial(t' \leq t''))$. Since the matrix clause rule in (22) does not apply to complement clauses, the times t' and t'' of the complement clause are not identified with t_{rt} and *now*, respectively, but can be temporally located by the matrix clause. According to the translation of the verb *oi-mo'ã* (A3-think) in (32b), the (reference) time t' of the (underlined) clausal argument R is existentially bound (as the time t^5) and the (evaluation) time t'' of the clausal argument R is identified with the matrix eventuality time t^3. The combination of the translation of the matrix clause verb *oi-mo'ã* (A3-think) with its clausal complement is given in (32c): the embedded NONFUT tense now requires the time t^5 at which the group comes to be at or prior to the matrix eventuality time $t^3(\partial(t^5 \leq t^3))$.

(32)   a.   NONFUT($ja\text{-}ju$)$\Longrightarrow \lambda w \lambda t \lambda t' \lambda t''[\exists t(AT(t', come'(\xi, w, t)) \wedge \partial(t' \leq t''))]$

       b.   *oi-mo'ã* (A3-think) $\Longrightarrow \lambda R_{\langle \omega, \langle \iota, \langle \iota, \tau \rangle \rangle \rangle} \lambda w \lambda t^4 \lambda t^3[AT(t^4, think'(m,$
                        $\lambda w'' \exists t^5 (\underline{R(w'', t^5, t^3)}), w, t^3))]$

       c.   *oi-mo'ã*(NONFUT($ja\text{-}ju$))
              $\Longrightarrow \lambda w \lambda t^4 \lambda t^3[AT(t^4, think'(m, \lambda w'' \exists t^5 \exists t(AT(t^5,$
              $come'(\xi, w'', t)) \wedge \partial(t^5 \leq t^3)), w, t^3))]$

The matrix clause verb *oi-mo'ã* (A3-think) is modified by the prospective aspect/modal marker *–ta*. According to its translation in (33a), it is a verbal modifier[14] that

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[14] The formal analysis of the prospective aspect/modal *-ta* borrows 'best' from Portner (1998) in a slightly adapted fashion; 'best' applies to a modal base, an ordering source and a world/time pair and returns those worlds in the modal base that are best with respect to the ordering source at the world and time of evaluation. As discussed in detail in Tonhauser (2009, 2010, to appear), this analysis correctly predicts that utterances with the prospective aspect/modal marker *-ta* in a matrix or a subordinate clause are compatible with past reference times, as illustrated also with (57) in Sect. 4. See Matthewson (2006) for a similar observation about the St'át'imcets future marker *kelh*.

introduces a temporal precedence relation between the (reference) time t' and the (eventuality) time t'' of its argument $P\,(t' < t'')$. Since both of P's temporal arguments are t'', the AT relation of the argument P is spelled out according to the last line of (15). The derivation of the translation of (31d) is given in (33b).

(33) a. –*ta* presupposes an epistemic modal base with stereotypical ordering source or a circumstantial modal base with an ordering source that specifies the relevant agent's intentions. If defined,

$$-ta \Longrightarrow \lambda P_{\langle \omega,\langle t,\langle t,\tau\rangle\rangle\rangle}\lambda w\lambda t'\lambda t''[\forall w'(w' \in best(MB, OS, \langle w, t'\rangle)$$
$$\rightarrow t' < t'' \wedge P(w', t'', t''))]$$

(adapted from Tonhauser, to appear)

  b. (31d) $\Longrightarrow$ NONFUT(-*ta*(*oi-mo'ã*(NONFUT(*ja-ju*))))
  $\Longrightarrow$ NONFUT(-*ta*($\lambda w\lambda t^4\lambda t^3[AT(t^4, think'(m,$
  $\lambda w''\exists t^5\exists t(AT(t^5, come'(\xi, w'', t)) \wedge \partial(t^5 \leq t^3)), w, t^3))]$))
  $\Longrightarrow$ NONFUT($\lambda w\lambda t'\lambda t''[\forall w'(w' \in best(MB, OS, \langle w, t'\rangle)$
  $\rightarrow t' < t'' \wedge AT(t'', think'(m, \lambda w''\exists t^5\exists t(AT(t^5, come'(\xi, w'', t))$
  $\wedge \partial(t^5 \leq t''))$, $w', t''))))$
  $\Longrightarrow$ (translation of NONFUT spelled out)
  $\lambda P\lambda w\lambda t'\lambda t''[\partial(t' \leq t'') \wedge \exists t^6(P(w, t', t^6))](\lambda w\lambda t'\lambda t''[\forall w'(w' \in$
  $best(MB, OS, \langle w, t'\rangle)$
  $\rightarrow t' < t'' \wedge AT(t'', think'(m, \lambda w''\exists t^5\exists t(AT(t^5, come'(\xi, w'', t))$
  $\wedge \partial(t^5 \leq t''))$, $w', t''))))])$
  $\Longrightarrow$ (application of NONFUT to its argument)
  $\lambda w\lambda t'\lambda t''[\partial(t' \leq t'') \wedge \exists t^6(\forall w'(w' \in best(MB, OS, \langle w, t'\rangle)$
  $\rightarrow t' < t^6 \wedge AT(t^6, think'(m, \lambda w''\exists t^5\exists t(AT(t^5, come'(\xi, w'', t))$
  $\wedge \partial(t^5 \leq t^6)), w', t^6))))]$
  $\Longrightarrow$ (after application of the matrix clause rule (22))
  $\partial(t_{rt} \leq now) \wedge \exists t^6(\forall w'(w' \in best(MB, OS, \langle w_0, t_{rt}\rangle)$
  $\rightarrow t_{rt} < t^6 \wedge AT(t^6, think'(m, \lambda w''\exists t^5\exists t(AT(t^5, come'(\xi, w'', t))$
  $\wedge \partial(t^5 \leq t^6)), w', t^6))))$
  $\Longrightarrow$ (after spelling out the AT relations per (15))
  $\partial(t_{rt} \leq now) \wedge \exists t^6(\forall w'(w' \in best(MB, OS, \langle w_0, t_{rt}\rangle)$
  $\rightarrow t_{rt} < t^6 \wedge think'(m, \lambda w''\exists t^5\exists t(t \subseteq t^5 \wedge come'(\xi, w'', t)$
  $\wedge \partial(t^5 \leq t^6)), w', t^6)))$

According to the last line of (33b), updating an information state σ with the translation of (31d) is defined only if the reference time t_{rt} is non-future with respect to the utterance time *now*. If defined, the translation of (31d) updates the input information state to those possibilities where in all best worlds w' there is a time t^6 in the future of the reference time at which Mario thinks that the group ξ's coming is at a time t that temporally subsumes the time t^5, which is presupposed to be at or prior to t^6. Thus, crucially, if t^5 is located at t^6, and t^6 is an absolute future time, the analysis correctly predicts that (31d) has an interpretation according to which the time t^5 (and thus also the time t) is an absolute future time, i.e. the friends' coming to Mario's house is at Mario's thinking time in the future of the utterance time.

However, the analysis also licenses an (unattested) interpretation of (31d) according to which the time t^5 is prior to the matrix eventuality time t^6.[15] That is, the analysis falsely predicts the availability of an interpretation of (31d) according to which the group ξ comes prior to Mario's thinking time or even prior to the utterance time (cf. the English utterance *Mario is going to think that we came*). An additional constraint is needed to exclude this reading. I refer to this below as problem P2 of the tensed analysis.

The remainder of this section examines how the absolute future reference of the other subordinate finite clauses in (31) can be accounted for. In the above analysis of complement clauses, the absolute future temporal interpretation is licensed because the evaluation time of the embedded NONFUT morpheme is an absolute future time, namely the matrix eventuality time. Formally, this is possible since the prospective aspect/modal marker -*ta* of the matrix verb temporally locates the matrix eventuality at an absolute future time and this time can serve as the evaluation time of the NONFUT morpheme of the complement clause. The same analysis can account for the future time reference of the relative clause in (31e), if the matrix clause marker -*ta* is assumed to scope over the relative clause NONFUT morpheme.[16]

The following discussion shows, however, that it is not possible to assume that the matrix eventuality time is the evaluation time of NONFUT in antecedents of conditionals, temporal adjunct clauses or clauses embedded under *i-katu* 'it's possible'. This means that NONFUT differs from relative tenses of other languages in that there are constructions where neither the utterance time nor the matrix eventuality time are suitable evaluation times for an embedded NONFUT tense.

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[15] The backshifted interpretation is generally conveyed in Guaraní by marking the complement clause with the nominal terminative aspect marker -*kue*; in (i), this marker is realized as -*gue*. See Tonhauser (2006, 2007) for discussion and analysis.

(i)   Context: Mario wants us to visit him but we're too lazy to make the long trip. The speaker suggests that we ask Mario's neighbor to drop off a basket with fruit in front of his house.
Mario   oi-mo'ã-ta   ja-ju-ha-gue.
Mario   A3-think-PROSP   A1pl.incl-come-NOM-NOM.TERM
'Mario is going to think that we came.'

[16] It is thus correctly predicted that when the matrix eventuality time is not in the future of the utterance time, as in the examples in (i), the complement and relative clauses do not have future time reference.

(i)   a.   Context: Yesterday we were playing a trick on Mario. We called him and asked for directions to his house.
Mario oi-mo'ã   ja-ju-ha.
Mario A3-think A1pl.incl-come-NOM
'Mario thought that we were coming.'
     b.   Context: A child was born blind but underwent an operation to restore her eyesight. She has just spent her first day seeing. She says:
Ko pyharé-pe a-mombe'u che-sý-pe   o-pa   mba'e a-hechá-va ko ára-pe.
this night-at A1sg-tell   B1sg-mother-to A3-complete thing A1sg-see-RC this day-at
'This evening, I told my mother about all the things I saw today.'

Consider first the conditional in (31a), repeated below for convenience: in order for the future eventuality time introduced by the prospective aspect/modal marker *–ta* of the matrix clause to serve as the evaluation time of the NONFUT morpheme of the antecedent of the conditional, *–ta* as well as the NONFUT morpheme of the matrix clause would need to scope over the entire conditional, as illustrated in the logical form in (34a). This correctly predicts that the antecedent of the conditional is compatible with absolute future time reference when the matrix eventuality time is an absolute future time. It also predicts, however, that the eventuality time of the antecedent clause can only be temporally located at or prior to the matrix clause event time, given the contribution of the NONFUT morpheme in the antecedent. The example in (34b) shows that this is an incorrect prediction: here, the eventuality time of the antecedent temporally follows the eventuality time of the matrix clause consequent.

(31a)   Context: Paloma has a terrible voice but still wants to sing at tonight's
        event. Maria says:
        Re-purahéi-ramo,   a-sẽ-ta.
        A2sg-sing-if   A1sg-leave-PROSP
        'If you sing, I am going to leave.'

(34)   a.   Logical form of (31a) under the assumed analysis:
            NONFUT(-*ta*(-*ramo*(NONFUT(*re-purahei*), *a-sẽ*)))
       b.   Context: Juan and Malena have been fighting a lot lately since Juan
            wants to move to Buenos Aires to earn better money. We have plans
            to visit them tomorrow to counsel them. I say:
            Juan   **o-hó**-ramo   Búenos   Áires-pe   ambue   arý-pe,   Maléna
            Juan   A3-go-if   Buenos   Aires-to   other   year-at   Malena
            i-pochý-ta   ko'ẽro.
            B3-angry-PROSP   tomorrow
            'If Juan goes to Buenos Aires next year, Malena is going to be angry
             tomorrow.'

The temporal reference of the temporal adjunct clause in (31b), repeated below, is non-future neither with respect to the utterance time nor with respect to the matrix eventuality time. Rather, the temporal connective *–mboyve* 'before' requires the temporal adjunct clause to temporally follow the matrix eventuality time. Thus, interpreting NONFUT as a relative tense with the matrix eventuality time as the evaluation time would falsely predict examples like (31b) to be unacceptable.

(31b)   Context: I'm getting ready to leave the house. Maria tells me:
        Re-ho-mboyve,   re-karú-ta.
        A2sg-go-before   A2sg-eat-PROSP
        'Before you go, you are going to eat.'

Finally, the analysis does not extend to clauses embedded under the modal *i-katu* (B3-possible), as in (31c), since the matrix eventuality time here is located at the

utterance time, not in the absolute future. Consequently, the matrix eventuality time cannot be the absolute future evaluation time needed to license the absolute future temporal reference of the subordinate finite clause.

(31c)   Context: Malena's wedding is tomorrow. She invited Paloma to sing at
         the wedding but doesn't know whether Paloma will come. Juan says:
         I-katu   **o-purahei**   ko'ẽro.
         B3-possible A3-sing   tomorrow
         'It's possible that she will sing tomorrow.'

In sum, the fact that antecedents of conditionals, temporal adjunct clauses and the complements of *i-katu* 'it's possible (that)' are not generally temporally interpreted in the non-future of the respective matrix clauses shows that the hypothesized NONFUT tense in such subordinate clauses is neither an absolute tense (expressing a non-future temporal relation between the reference and the utterance time) nor a relative one (expressing a non-future temporal relation between the reference time and the matrix eventuality time).

   In order to maintain the assumption that a NONFUT tense plays a role in constraining temporal reference in Guaraní, it is necessary to stipulate an absolute future evaluation time distinct from both the utterance time and the matrix eventuality time in these three constructions. The proposal entertained in the following is that this absolute future evaluation time is introduced by the three constructions regardless of the temporal reference of the matrix clause. This correctly predicts that the finite subordinate clauses in (31a–c) are compatible with absolute future time reference, since their temporal reference can be at the absolute future evaluation time introduced by the construction. Since the temporal reference of the subordinate clauses can also be a time prior to this absolute future evaluation time, the analysis also correctly predicts that such clauses can have present or past time reference, in addition to future time reference. Examples that illustrate such interpretations are given in (35) for clauses subordinate to the modal *i-katu* (B3-possible), in (36) for antecedents of conditionals and in (37) for temporal adjunct clauses.[17]

(35)   a.   Context: Malena wonders where Maria is. Pablo says:
              I-katu   **o-ke**.
              B3-possible A3-sleep
              'It's possible that she's sleeping.'
        b.   Context: Richard wonders whether his brother sang at the party last night.
              Mario, who didn't attend the party either, says:
              I-katu   **o-purahei** (kuehe).
              B3-possible A3-sing   yesterday
              'It's possible that he sang (yesterday).'

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[17] As in English and other languages, the temporal reference of a temporal adjunct clause in Guaraní has past time reference when the matrix clause eventuality is temporally located in the past, as in (37), and future time reference when the matrix clause eventuality is temporally located in the future, as in (31b). This cross-linguistic observation is not captured by the analysis developed here, but might best be captured by a general constraint on interpretation.

(36)   a.   Context: Marcel has been waiting for Maria to return.
           Marcel **o-vy'a**-ramo (ko'ãga), Maria o-guahẽ   kuehe.
           Marcel A3-happy-if now   Maria A3-arrive yesterday
           'If Marcel is happy (now), Maria arrived yesterday.'

      b.   Context: Juan and Malena have been fighting about whether Juan should move to Buenos Aires for work: Juan wants to go, Malena wants him to stay. We're on our way to visit them since we haven't seen them in a couple of days. On our way, we ponder about Malena's mood:
           Juan **o-ho**-ramo Búenos Áires-pe ko'ẽro,   upevare Maléna i-pochy
           Juan A3-go-if   Buenos Aires-to tomorrow for.that Malena B3-angry
           ko'ãga.
           now
           'If Juan goes to Buenos Aires tomorrow, Malena is angry now.'

(37)   Context: Mario was over for dinner last night.
      O-karu-mboyve,   o-je-po-hei.
      A3-eat-before   A3-ᴊᴇ-hand-wash
      'Before he ate, he washed his hands.'

In sum, the absolute future time reference of finite subordinate clauses cannot be captured by analyzing ɴᴏɴꜰᴜᴛ as a relative tense that constrains the temporal reference of a subordinate clause to a time at or prior to the matrix evaluation time. Rather, to derive appropriate interpretations for clauses subordinate to *i-katu* (B3-possible), antecedents of conditionals and temporal adjunct clauses, these constructions must introduce an absolute future evaluation time for the embedded ɴᴏɴꜰᴜᴛ tense. The fact that the interpretation of embedded ɴᴏɴꜰᴜᴛ tenses in these constructions requires an idiosyncratic analysis is referred to below as problem P3.

3.3 A Sequence-of-Tense rule?

Problems P2 and P3 can be avoided by assuming a Sequence-of-Tense rule like (38) for Guaraní, similar to rules found in temporal analyses of English and Japanese (see e.g. Ogihara 1994, 1996).

(38)   Sequence-of-Tense-like rule for Guaraní:
      The ɴᴏɴꜰᴜᴛ morpheme of a finite subordinate clause is not interpreted under identity with a ɴᴏɴꜰᴜᴛ morpheme in the matrix clause.

A consequence of this rule is that the ɴᴏɴꜰᴜᴛ morpheme realized in relative and complement clauses is not interpreted and, hence, the back-shifted interpretation is not licensed, thus addressing problem P2. If ɴᴏɴꜰᴜᴛ is not interpreted in clauses subordinate to the modal *i-katu* (B3-possible), antecedents of conditionals and temporal adjunct clauses, an absolute future evaluation time need not be

stipulated, addressing problem P3. Thus, adopting the rule significantly improves the tensed analysis of temporal reference in Guaraní.

But the improvement comes at a cost. One consequence of applying the Sequence-of-Tense rule in the five constructions in (31) to avoid problems P2 and P3 is that NONFUT is only interpreted in matrix clauses in Guaraní. Thus, NONFUT would be similar to overt tenses in other languages in its distribution, since it is realized in all finite clauses, but potentially different from overt tenses in any other language since it is not interpreted in any subordinate clause.[18] Another conceptual problem with the rule in (38) is that the data that motivate the rule are very different in Guaraní than in other languages. In English, for example, the Sequence-of-Tense rule is motivated by the finding that a past tense (stative) complement clause like that of (39) can temporally precede the matrix eventuality time, as in (39a), or temporally overlap with the matrix eventuality time, as in (39b). The Sequence-of-Tense rule ensures the availability of this second reading by removing the embedded past tense from interpretation; this is indicated in (39b) with ~~PAST~~.

(39)   Mary believed that John was happy.
    a.   Backshifted interpretation: PAST($believe(mary,$ PAST$(happy(john))))$
        ''Mary believed that John was happy at a time prior to her believing time.''
    b.   Overlapping interpretation: PAST($believe(mary,$ ~~PAST~~ $(happy(john))))$
        ''Mary believed that John was happy at the time of her belief.''

In Guaraní, however, the NONFUT morpheme of a complement clause does not need to be deleted to derive the temporal overlap, as illustrated above for (31d). Rather, in Guaraní, the Sequence-of-Tense rule is assumed only to avoid problems P2 and P3 of the tensed analysis, i.e. to remove the negative effects of assuming a NONFUT tense in the first place—at least in part, since problem P1 remains.

3.4 Interim conclusions

This section has entertained the hypothesis that temporal reference in Guaraní is constrained by a phonologically empty non-future tense morpheme (NONFUT). The development of the formal analysis, according to which all finite clauses realize NONFUT, was informed by observations about the temporal reference of finite clauses in a variety of matrix and subordinate constructions. Three problems with the analysis are that not all matrix clauses have absolute non-future temporal reference (problem P1), that NONFUT in complement and relative clauses licenses unattested back-shifted interpretations (problem P2) and that neither the utterance time nor the matrix eventuality time can serve as the evaluation time for NONFUT in other subordinate clauses (problem P3). Assuming a Sequence-of-Tense rule that ensures that NONFUT is not interpreted in subordinate clauses avoids problems P2 and P3, but comes at a conceptual cost. And problem P1 remains: it is not clear how a tensed analysis of temporal reference in Guaraní can account for the non-categoricity of

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[18] It is an open, empirical question whether there are languages with overt tenses that are realized in all finite clauses, but only make a meaning contribution in matrix clauses, and not in subordinate clauses.

absolute non-future temporal reference of matrix clauses. While further exploration of the tensed analysis might lead to improvements, this raises the question whether a tenseless analysis, one that doesn't assume NONFUT, might not be better suited to account for the data. Such an analysis is explored in the next section.

4 A tenseless analysis of temporal reference in Guaraní

The hypothesis explored in this section is that temporal reference in Guaraní is not constrained by tense. Rather, the proposal is that the temporal reference of matrix clauses is constrained by context and temporal adverbials alone. This has the desirable consequence that a matrix clause in Guaraní is principally compatible with past, present and future time reference, as is indeed the case (see Sect. 1, examples (4)). Thus, problem P1 of the tensed analysis does not arise since matrix clauses are not categorically required to have absolute non-future temporal reference. For subordinate finite clauses, the proposal is that the subordinating construction constrains the temporal reference of the subordinate clause, along the lines of the analysis developed in Sect. 3. Crucially, since the temporal reference of subordinate clauses under the tenseless analysis is not constrained by NONFUT, the temporal reference of such clauses can instead depend entirely on the temporal constraints introduced by the various subordinating constructions, in addition to context and temporal adverbials. As a consequence, problems P2 and P3 do not arise under the tenseless analysis, as shown below.

The challenge for the tenseless analysis of temporal reference developed in this section is to show that context and temporal adverbials can restrict temporal reference so as to account for the unacceptability of examples like (5c) and (6c). To this end, Sect. 4.1 empirically motivates that absolute future reference times, in contrast to past and present ones, are not contextually available in Guaraní. This unavailability predicts that matrix clauses are compatible only with past and present temporal reference, as shown in detail in Sect. 4.2, except in those constructions (see (29) and (30)) that introduce future reference times for the temporal interpretation of a matrix clause. The temporal reference of finite subordinate clauses is analyzed in Sect. 4.3. Section 4.4 summarizes the tenseless analysis.

4.1 Future discourse in Guaraní

Reichenbach (1947) already recognized that, in principle, an eventuality can be temporally located in the past or future of the utterance time in two ways; this observation was part of the motivation for recognizing a reference time in addition to the eventuality time and the utterance time. First, an eventuality time can be temporally located at a contextually salient past or future antecedent reference time. Second, the eventuality time can be temporally located in the past or the future of a present antecedent reference time. The English examples in (40) illustrate these two options for past discourse, i.e. utterances where the eventuality time is located in the past of the utterance time ($ET < UT$).

(40) a. Jared danced. $[ET \subseteq RT < UT]$
       b. Jared has danced. $[ET < RT = UT]$

Both (40a) and (40b) convey that Jared's dancing is temporally located prior to the utterance time ($ET < UT$). In (40a), the past tense on *danced* constrains the temporal location of the antecedent reference time to a time prior to the utterance time ($RT < UT$) and the perfective aspect temporally locates the eventuality time within the past reference time ($ET \subseteq RT$). In (40b), on the other hand, the eventuality time is located in the past of the reference time by the perfect aspect *HAVE danced* ($ET < RT$), while the reference time is the utterance time ($RT = UT$), as per the contribution of the present tense. The former option of realizing past discourse, which I refer to as the 'reference time' option, relies on the availability of a past antecedent reference time, while the latter option, referred to as the 'eventuality time' option, does not: here, the antecedent reference time is the utterance time.

In principle, both the reference time option and the eventuality time option are also available for future discourse, i.e. utterances where the eventuality time is located in the future of the utterance time ($UT < ET$). If the English auxiliary *will* in (41a) is analyzed as a future tense (e.g. Kissine 2008), it presupposes an antecedent reference time in the absolute future ($UT < RT$) at which the eventuality of Jared dancing is temporally located ($ET \subseteq RT$). In this case, the temporal adverb *tomorrow* constrains the temporal location of the absolute future reference time. Future discourse is realized in (41b) without an absolute future reference time: the prospective aspect/modal construction *be going to* locates the eventuality time in the future of the reference time ($RT < ET$), which is the utterance time per the meaning contributed by the present tense ($UT = RT$). Here, the temporal adverb *tomorrow* temporally constrains the location of the eventuality time.

(41) a. Jared will dance tomorrow. $[UT < RT \supseteq ET]$
       b. Jared is going to dance tomorrow. $[UT = RT < ET]$

Both the reference time and the eventuality time option are readily attested cross-linguistically for past discourse, in tensed and tenseless languages alike. With future discourse, on the other hand, the situation is different: future discourse is widely realized by prospective aspects, modals and mood markers (e.g. Bybee and Pagliuca 1987; Bybee et al. 1994) and it is unclear whether any language has grammaticalized expressions that constrain the location of the antecedent reference time to an absolute future time (see e.g. Comrie 1985, p. 44, 1989). In English, there is evidence that the auxiliary *will* in examples like (41a) is not a future tense, but rather realizes future discourse by locating the eventuality time in the future of a (present) reference time (for discussion see e.g. Enç 1996; Abusch 1998; Sarkar 1998; Copley 2002; Kaufmann 2005; Werner 2006). The English non-past tense can realize future discourse, but only with scheduled eventualities, as shown in the examples in (42) from Lakoff (1971), cited in Kaufmann (2005).

(42) a.   The Yankees play the Red Sox tomorrow.
       b. #The Yankees play well tomorrow.

And there are languages like Kalaallisut, a tenseless Eskimo-Aleut language spoken on Greenland (Bittner 2005), where future discourse seems to be realized

exclusively by the eventuality time option. In this language, declarative mood matrix clauses are compatible only with present and past time reference, as illustrated in the examples in (43) from Bittner (to appear).[19]

(43) a. (*Aqagu)   ulapig-pu-nga.
          (*tomorrow) busy-DEC.IV-1s
          'I am busy (*tomorrow).'   (Bittner to appear: 15, glosses adapted)
      b. Ole ullumi aallar-pu-q.
          Ole today leave-DEC.IV-3s$_\top$
          'Ole left today'   (Bittner to appear: 15, glosses adapted)

As discussed in detail in Bittner (2005), future discourse is realized in Kalaallisut exclusively by (what I refer to as) the eventuality time option, using prospective statives, as in (44a), prospective inchoatives (which evoke realized starts of expected processes), as in (44b), or prospective matrix moods (which mark the speech act as a request or wish), as in (44c).

(44) a. Sapaati-t   akunnir-i   marlussuit qaangui-pp-ata
          Sunday-pl.ERG space-3p$_\perp$.pl a.few   pass-HYP$_\perp$-3p$_\perp$
          puigur-**unar**-pa-at.
          forget-be.likely-IND.TV-3p.3s
          'They're likely to forget this in a few days.'   (Bittner 2005, p. 352)
      b. Aap, akkaa. Aggiuti-**lir**-pa-ra!
          yes uncle bring-begin-IND.TV-1s3s
          'Yes, Uncle. I'm coming with him!'   (Bittner 2005, p. 353)
      c. Qimmi-t nirukkar-**niar-tigik**.
          dog-pl   feed-please-IMP.1p.3p
          'Let us feed the dogs, ok?'   (Bittner 2005, p. 353)

There are thus languages, like Kalaallisut, where future discourse is realized by temporally locating the eventuality time in the future of a present reference time. Such languages do not have grammaticalized expressions that constrain the temporal location of the antecedent reference time to a future time. Crucially, then, future discourse in such languages makes no reference to absolute future reference times, which means that in such languages the reference time remains at a past or present time throughout discourse. This has consequences for temporal reference: if only past and present antecedent reference times are contextually available, temporal reference is contextually restricted to be non-future.[20]

I propose that Guaraní, too, is a language where temporal reference is contextually restricted to non-future times. Evidence for this proposal is that Guaraní does not have a

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[19] Glosses in (43) and (44): $\top$ = topic, $\perp$ = background, 1 = first person, 3 = third person, DEC = declarative mood, ERG = ergative, HYP = hypothetical mood, IMP = imperative mood, IND = indicative mood, IV = intransitive verb, p/pl = plural, s = singular, TV = transitive verb.

[20] Bittner (to appear) does not assume this analysis but instead proposes that the declarative/indicative mood requires that the eventuality denoted by the clause be currently verifiable, thus precluding future temporal reference of the clause. Such an analysis is not possible for Guaraní since, as noted above, matrix clauses do not categorically have absolute non-future temporal reference.

future tense and that future discourse in Guaraní is realized almost exclusively (apart from the constructions in (29) and (30)) by the eventuality time option, i.e. by reference to past and present antecedent reference times in whose future the eventuality time is located. This latter piece of evidence was established on the basis of a corpus study of future discourse, following the strategy employed in Bittner (2005): two bilingual texts (English/Guaraní and Spanish/Guaraní) were used to identify how future discourse that is realized with *will, shall* and *be going to* in English and with *IR a* and the synthetic future in Spanish is realized in the Guaraní versions. The two texts used are *The Little Prince* (Saint-Exupéry 1946, Guaraní translation: Saint-Exupéry 2005) and a book of Guaraní short stories with their Spanish translation (Krivoshein de Canese et al. 2005). The results are very similar to that of Bittner's (2005) comparable study of future discourse in Kalaallisut: future discourse in Guaraní is realized almost exclusively by prospective aspect/modal markers, possibility and necessity modals, and prospective moods. The results of this corpus study, which are presented in the following, thus motivate that absolute future antecedent reference times are not contextually available in Guaraní.

Of the 153 examples of future discourse in the two texts, 93 were realized with the prospective aspect/modal marker *-ta* or its counterpart *-mo'ã* 'CF' in negative clauses (Tonhauser 2009, to appear). Two examples from this set are given in (45).

(45) a. Context: The pilot says to the little prince:
          Nde-ovecha ra'ý-pe a-japó-**ta**   peteĩ juru   joko-ha   ra'anga.
          B2sg-sheep child-at A1sg-make-PROSP one   mouth hold-NOM figure
          'I am going to make you a picture of a muzzle for your sheep.' [GLP, 30][21]
          'I **will** draw you a muzzle for your sheep.'   [ELP, 26]
      b. Context: The pilot tells the little prince:
          N-a-kañy-**mo'ã**-i   ndéhe-gui.
          NEG-A1sg-hide/flee-CF-NEG pron.O.2sg-ABL
          'I am not going to go away from you.'   [GLP, 87]
          'I **shall** not leave you.'   [ELP, 83]

Future discourse is realized with possibility or necessity modals in 49 of the 153 examples. Examples with the possibility modal *-ne* 'MIGHT' and the necessity modal *-va'erã* 'MUST' are given in (46). The examples (47) show that the modals used to realize future discourse in (46) are also compatible with present discourse, i.e. they are not future tenses (see also Tonhauser 2006, 2010).[22]

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[21] Abbreviations for the example sources are [K. et al.] (the Guaraní/Spanish bilingual book, Krivoshein de Canese et al. 2005), [ELP] (the English translation of *The Little Prince*, Saint Exupéry 1946) and [GLP] (the Guaraní translation, Saint-Exupéry 2005).

[22] With negated eventualities, the marker *chéne* may also be used, as illustrated in (i). This marker occurs in three of the 49 examples. Whether *chéne* is related to the possibility modal *–ne* 'MIGHT' is a question for future research.

(i)   Context: The fox tries to console the little prince.
      O-joguá-**ne**   a-mano-ha   ha nda-ha'é-i   **chéne** añetegua.
      A3-play-MIGHT A1sg-die-NOM and NEG-pron.S.3-NEG chéne true
      'It might appear that I have died and that is not going to be true.'   [GLP, 88]
      'I **shall** look as if I were dead; and that **will** not be true.'   [ELP, 84]

(46) a.   Context: The fox wants to convince the little prince to tame him.
            Ai-kuaá-**ne**   peteĩ pypore ryapu nda-ha'é-i-ha   ambué-icha.
            A1sg-know-MIGHT one   track   sound NEG-pron.S.3-NEG-NOM other-like
            'I might know one sound of steps that is not like the others.'   [GLP, 68]
            'I **shall** know the sound of a step that will be different from
            all the others.'   [ELP, 64f.]

     b.   Context: The pilot is puzzled that the little prince doesn't want to tie
            up his sheep.
            I-katu   ne-re-mosã-i-rõ   o-ho ndéhe-gui   ha
            B3-possible NEG-A2sg-tie.up-NEG-if A3-go pron.O.2sg-ABL and
            o-kaný-**ne**.
            A3-hide/get.lost-MIGHT
            'It's possible, if you don't tie him, he will get away from you and might
            get lost.'   [GLP, 16]
            'But if you don't tie him, he **will** wander off somewhere and get lost.'
                                                          [ELP, 12]

     c.   Context: The little prince is about to leave the pilot.
            Nde   ha'é-**va'erã**   akói   che-angirũ.
            pron.S.2sg pron.S.3-MUST   always B1sg-friend
            'You must always be my friend.'   [GLP, 87]
            'You **will** always be my friend.'   [ELP, 83]

(47) a.   Context: A family is discussing who might disrespect them.
            The father says to the daughter:
            Nde   rei-kuáa-**ne**,   che-memby!
            pron.S.2sg A2sg-know-MIGHT B1sg-child
            'You might know, my child!'
                                 (theater play, presented in Tonhauser, to appear)

     b.   Context: A woman has just heard that a man's daughter has
            gotten married.
            O-vy'a-íterei-**va'erã**.
            A3-happy-very-MUST
            'He must be very happy.'
                                  (theater play, presented in Tonhauser, to appear)

In 10 of the 153 examples, future discourse is realized with prospective moods, such as the imperative in (48a) or the desiderative mood marker *t(a)*– (Gregores and Suárez 1967, 103) in (48b), which also marks permission and hortative mood (Velázquez-Castillo 2004, 1423f).

(48) a.   Context: The king tells the little prince what to do as a minister.
            E-mo-angaipa-kuaa   ñe-manó-me   ára   ha   ára.
            A2sg.IMP-CAUS-sin-know   JE-die-at   day   and   day
            'From time to time you make him know sin at death.'   [GLP, 41]
            'From time to time you **will** condemn him to death.'   [ELP, 37]

   b.   Context: A man sits down to eat after having been kept from dinner
        all evening long.
        T-a-sena-mi   hasýpeve.
        HORT-A1sg-eat.dinner-DIM   finally
        'I'm finally going to eat dinner.'
        '**Voy a** cenar a pesar de todo.'   [K. et al., pp. 26, 27]

Finally, the corpus study revealed one example, given in (29c) above, where a finite
clause, the second conjunct of a coordination construction, is compatible with
absolute future time reference.

In sum, future discourse in Guaraní is realized almost exclusively by the even-
tuality time option, i.e. with expressions that temporally locate the eventuality time
in the future of the present reference time. The proposal formalized in the next
section is that absolute future reference times are not contextually available in
Guaraní, thus resulting in past or present temporal reference for matrix clauses.
Exceptions are the constructions in (29) and (30) that license absolute future time
reference for matrix clauses by introducing absolute future reference times for the
respective matrix clauses.

4.2 The temporal reference of Guaraní matrix clauses

To capture formally that Guaraní matrix clauses are compatible with past, present
and future temporal reference, the matrix clause rule in (50) applies directly to the
translation of verbs like verb *a-jahu* (A1sg-bathe) in (49), familiar from Sect. 3. The
rule identifies the two times in the translation of the verb as the temporal anchor t_{rt}
and the (existentially bound) eventuality time t, respectively.

(49)   *a-jahu* $\Longrightarrow \lambda w \lambda t' \lambda t [AT(t', bathe'(sp, w, t))]$

(50)   **Matrix clause rule (tenseless analysis):**
        The final translation of a matrix clause translated as ϕ of type $\langle \omega, \langle \iota, \langle \iota, \tau \rangle \rangle \rangle$
        is $\exists t(\phi(w_0, t_{rt}, t))$ of type τ.

Applying the rule to the translation in (49) results in the final translation in (51).
This translation is dynamically interpreted in (52), with the AT relation spelled out
as the reference time being a non-final interval of the eventuality time.

(51)   Final translation of the matrix clause *a-jahu* (A1sg-bathe):
        $\exists t(AT(t_{rt}, bathe'(sp, w_0, t)))$

(52) $\sigma[\exists t(AT(t_{rt}, bathe'(sp, w_0, t)))]$
        $= \sigma[\exists t(t_{rt} \subset_{nf} t \wedge bathe'(sp, w_0, t))]$ [AT relation spelled out]
        $= \sigma[t][t_{rt} \subset_{nf} t \wedge bathe'(sp, w_0, t)]$
        $= \{i \in \sigma[t] : \langle g_i(t_{rt}), g_i(t) \rangle \in f_i(\subset_{nf}) \& \langle g_i(sp), g_i(w_0), g_i(t) \rangle \in f_i(bathe')\}$

According to the final line of (52), the result of updating an information state σ with the translation of the matrix clause *a-jahu* (A1sg-bathe) is the set of possibilities i of σ where a new discourse referent t has been introduced, the speaker bathes at t in w_0 and t_{rt} is a non-final subinterval of t. The familiarity requirement of the discourse referent t_{rt} is satisfied if t_{rt} can be identified with an antecedent reference time in the domain of the possibilities of σ. Since the antecedent reference time is not required to be temporally related to the utterance time in a particular way, any contextually given reference time can be the antecedent. This correctly predicts that finite matrix clauses in Guaraní are in principle compatible with past, present and future temporal reference (but recall that only two constructions have been identified so far that make available absolute future reference times).

Temporal adverbials may impose constraints on the antecedent reference time. The lexical entry for *kuehe* 'yesterday' in (53b) constrains the time t' (which in matrix clauses is the temporal anaphor t_{rt}) to be temporally included within or identified with the denotation of *yesterday'*.

(53) Kuehe   **a-jahu**.   (= (5a))
      yesterday   A1sg-bathe
      'Yesterday I bathed/was bathing.'
      a. *a-jahu* $\Longrightarrow \lambda w \lambda t' \lambda t [AT(t', bathe'(sp, w, t))]$
      b. *kuehe* 'yesterday' $\Longrightarrow \lambda P_{\langle \omega, \langle \iota, \langle \iota, \tau \rangle \rangle \rangle} \lambda w \lambda t' \lambda t [t' \subseteq yesterday' \wedge P(w, t', t)]$
      c. (53) $\Longrightarrow kuehe(a\text{-}jahu)$
         $\Longrightarrow \lambda w \lambda t' \lambda t [t' \subseteq yesterday' \wedge AT(t', bathe'(sp, w, t))]$
         $\Longrightarrow$ (after application of the matrix clause rule in (50))
             $\exists t (t_{rt} \subseteq yesterday' \wedge AT(t_{rt}, bathe'(sp, w_0, t)))$
         $\Longrightarrow$ (after spelling out the AT relation according to the third line of (15))
             $\exists t (t_{rt} \subseteq yesterday' \wedge t \subseteq t_{rt} \wedge bathe'(sp, w_0, t))$

The dynamic interpretation of the final translation of (53) is as follows:

(54) $\sigma[\exists t (t_{rt} \subseteq yesterday' \wedge t \subseteq t_{rt} \wedge bathe'(sp, w_0, t))]$
      $= \sigma[t][t_{rt} \subseteq yesterday' \wedge t \subseteq t_{rt} \wedge bathe'(sp, w_0, t)]$
      $= \{i \in \sigma[t] : \langle g_i(t_{rt}), g_i(yesterday') \rangle \in f_i(\subseteq) \& \langle g_i(t), g_i(t_{rt}) \rangle \in f_i(\subseteq)$
          $\& \langle g_i(sp), g_i(w_0), g_i(t) \rangle \in f_i(bathe') \}$

According to the final line of (54), updating an input information state with the translation of (53) results in an information state where a new discourse referent t has been introduced, the speaker bathes at t in w_0, t_{rt} temporally subsumes t and t_{rt} is temporally included within or identified with the denotation of *kuehe* 'yesterday'. The familiarity requirement of the discourse referent t_{rt} is satisfied here if t_{rt} can be identified with an antecedent reference time in the domain of the possibilities of σ that is temporally included within or identified with the denotation of *kuehe* 'yesterday'. This correctly predicts that (53) is compatible only with past time reference.

The analysis of (55) with the temporal adverb *ko'ẽro* 'tomorrow' differs from that of *kuehe* 'yesterday': as illustrated in (55b), *ko'ẽro* 'tomorrow' constrains the temporal location of the (eventuality) time t, not of the (reference) time t'. In the

final translation of (55) in (55c), the (eventuality) time t is thus required to be temporally subsumed by the denotation of *ko'ẽro* 'yesterday' and additionally required to temporally overlap with the reference time t_{rt} (by the *AT* relation). This predicts that (55) is acceptable only in contexts that make available an absolute future antecedent reference time. Since (55) does not occur in one of the two matrix clause constructions that make available an absolute future reference time, it is correctly predicted that (55) is unacceptable.

(55)   #Ko'ẽro   **a-jahu**.   (= (5c))
              tomorrow   A1sg-bathe
              (Intended: Tomorrow I bathe.)
   a.   *a-jahu* $\Longrightarrow \lambda w \lambda t' \lambda t [AT(t', bathe'(sp, w, t))]$
   b.   *ko'ẽro* $\Longrightarrow \lambda P \lambda w \lambda t' \lambda t [t \subseteq tomorrow' \wedge P(w, t', t)]$
   c.   (55) $\Longrightarrow ko'ẽro(a\text{-}jahu)$
         $\Longrightarrow \lambda w \lambda t' \lambda t [t \subseteq tomorrow' \wedge AT(t', bathe'(sp, w, t))]$
         $\Longrightarrow$ (after application of the matrix clause rule in (50))
                 $\exists t (t \subseteq tomorrow' \wedge AT(t_{rt}, bathe'(sp, w_0, t)))$

There is independent, Guaraní-internal evidence for this analysis of the temporal adverb *ko'ẽro* 'tomorrow'. The first piece of evidence comes from the combination of the adverb with epistemic modals, where it is the eventuality time, not the reference time, that is temporally located by the adverb:

(56)   Context: A farmer is looking at the clouds.
              Ko'ẽro   o-ký-**ne**.
              tomorrow   A3-rain-might
              'It might rain tomorrow.'

In this example, the (present) reference time is the time relevant for determining the farmer's epistemic state: there is a world that is compatible with what the farmer currently knows and that develops as expected in which it is going to rain tomorrow. This shows that an analysis according to which *ko'ẽro* 'tomorrow' temporally locates the eventuality time is independently needed.

A second piece of evidence comes from examples like (57) where *ko'ẽro* 'tomorrow' is compatible with past time reference (see also Tonhauser, to appear):

(57)   Context: Maria had been hired to sing at the town festival tomorrow but
              the town ran out of money and had to cancel her performance. She tells
              her friend:
              A-purahéi-ta   ko'ẽro   kuri.
              A1sg-sing-PROSP tomorrow back.then
              'I was going to sing tomorrow.'

In this example, the adverb *kuri* constrains the reference time to a past time and the eventuality of Maria singing is temporally located in the future of the past reference time by the prospective aspect/modal *-ta*. The temporal adverb *ko'ẽro* 'tomorrow'

additionally constrains the temporal location of the eventuality time. If *ko'ẽro* 'tomorrow' constrained the temporal location of the reference time to a future time, this example would be incorrectly predicted to be unacceptable.

The English adverb *tomorrow* can likewise be argued to temporally locate the eventuality time, on the basis of the translation of (57) and the example in (41b) *Jared is going to sing tomorrow*. If the auxiliary *will* is analyzed as a future tense, *tomorrow* in (41a) *Jared will sing tomorrow* needs to constrain the temporal location of the reference time. Since Guaraní does not have a future tense, it suffices for *ko'ẽro* 'tomorrow' to only receive an analysis according to which it temporally locates the eventuality time, as in (55b).

The unacceptability of B's response in (6c), repeated below, also follows from the observed restrictions on antecedent reference times. Since A's question contains *ko'ẽro* 'tomorrow' and the prospective aspect/modal *–ta*, it inquires about an eventuality that is temporally located in the future of the present reference time. B's response is thus anaphoric to this present reference time. Since the verb in B's response is only compatible with (im)perfective aspectual reference, B's response asserts that B's bathing is ongoing at the present reference time, which does not felicitously address A's question.[23]

(6c) A: Mba'é-pa re-japó-ta   ko'ẽro   dié-pe?   B: #**A-jahu**.
        what-QU A2sg-do-PROSP tomorrow ten-at   A1sg-bathe
      A: 'What are you going to be doing   B: (Intended: I am going to bathe.)
        tomorrow at 10?'

The analysis developed here also correctly predicts that finite matrix clauses are compatible with absolute future time reference when the construction makes available a future antecedent reference time, as I argue is the case with (29) and (30). Why these constructions, but not others, allow matrix clauses to have future time reference is a question for future research. For the coordination constructions in (29), one of which is repeated below, I propose that the rule in (58) is responsible for making available a future reference time for the non-initial conjuncts, thus licensing the future time reference of such conjuncts.

(29a)   Context: Friends are waiting for me in the next city over. I'm running
        late and call them:
        A-jahú-ta   ha   (upéi)   **a-jupi**   kolektívo-pe.
        A1sg-bathe-PROSP   and   then   A1sg-get.on   bus-at
        'I'm going to shower and then I'll get on the bus.'

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[23] This suggests that, in some cases at least, data pertaining to temporal reference should be presented in target language contexts, not in meta-language contexts (see Matthewson 2004b for discussion): in (6c), for example, it is crucial that the reference time of A's question in Guaraní is the utterance time, not a time in the future of the utterance time, as an English translation with *will* might suggest.

(58) **Temporal reference in Guaraní coordination constructions**
      If an utterance U consists of conjoined sentences S_1 to S_n (for $1 < n$) and
      the eventuality time of S_i $(1 \leq i < n)$ is temporally located in the future
      of the utterance time, then the reference time for S_{i+1} is a time shortly
      after the eventuality time of S_i.

Applied to e.g. (29a), this rule specifies that the temporal reference of the second
conjunct is a time shortly after the (absolute future) eventuality time of the first
conjunct, thus correctly predicting that the second conjunct is compatible with
absolute future time reference.

   For the constructions in (30), I argue that the temporal/causal adverbial intro-
duces the future reference time of the matrix clause. The analysis of (30a) is spelled
out in (59).

(30a) 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.'

The translation of the temporal/causal adverbial of (30a) is given in (59a), with the
causal meaning ignored. It introduces an absolute future time t'' that serves as
the reference time for the matrix clause, whose translation is given in (59b). The
translation derivation of (30a) is given in (59c).

(59)   a. *Ja'ú-ta-re ko gánso ko'ẽro* 'Since we are going to eat this goose
           tomorrow'
           $\Longrightarrow \lambda P_{\langle \omega, \langle \iota, \langle \iota, \tau \rangle \rangle \rangle} \lambda w \lambda t' \lambda t [\forall w' (w' \in best(MB, OS, \langle w, t' \rangle)$
           $\rightarrow t' < t \wedge AT(t, eat'(\xi, g, w', t)) \wedge t \subseteq tomorrow'$
           $\wedge \exists t'' (t' < t'' \wedge \exists t''' (P(w', t'', t'''))))]$
       b. *a-juka ko ka'arú-pe* 'I kill (the goose) this afternoon'
           $\Longrightarrow \lambda w \lambda t' \lambda t [t \subseteq this.afternoon' \wedge AT(t', kill'(sp, g, w, t))]$
       c. (29a) $\Longrightarrow$ *Ja'ú-ta-re ko gánso ko'ẽro(a-juka ko ka'arú-pe)*
           $\Longrightarrow \lambda w \lambda t' \lambda t [\forall w' (w' \in best(MB, OS, \langle w, t' \rangle) \rightarrow t' < t$
           $\wedge AT(t, eat'(\xi, g, w', t)) \wedge t \subseteq tomorrow'$
           $\wedge \exists t'' (t' < t'' \wedge \exists t''' (t''' \subseteq this.afternoon'$
           $\wedge AT(t'', kill'(sp, g, w', t''))))))]$
           $\Longrightarrow$ (after application of the matrix clause rule in (50))
           $\exists t \forall w' (w' \in best(MB, OS, \langle w_0, t_{rt} \rangle) \rightarrow t_{rt} < t$
           $\wedge AT(t, eat'(\xi, g, w', t)) \wedge t \subseteq tomorrow'$
           $\wedge \exists t'' (t_{rt} < t'' \wedge \exists t''' (t''' \subseteq this.afternoon'$
           $\wedge AT(t'', kill' sp, g, w', t''))))) $
           $\Longrightarrow$ (after spelling out the AT relations according to (15))
           $\exists t \forall w' (w' \in best(MB, OS, \langle w_0, t_{rt} \rangle) \rightarrow t_{rt} < t \wedge eat'(\xi, g, w', t)$
           $\wedge t \subseteq tomorrow'$
           $\wedge \exists t'' (t_{rt} < t'' \wedge \exists t''' (t''' \subseteq this.afternoon'$
           $\wedge t''' \subseteq t'' \wedge kill'(sp, g, w', t''))))$

According to the last line of (59c), (30a) updates an information state to those possibilities where in all best worlds w' there is a time t in the future of the reference time and included within the denotation of *ko'ẽro* 'tomorrow' at which the group eats the goose and a time t'' also in the future of the reference time that subsumes the (eventuality) time t''' at which the speaker kills the goose this afternoon.

In sum, the temporal reference of Guaraní matrix clauses is contextually restricted to a past or present time, unless a future reference time is introduced by the construction.

4.3 The temporal reference of Guaraní subordinate clauses

While the temporal reference of matrix clauses in Guaraní is constrained only by context and temporal adverbials, the temporal reference of finite subordinate clauses is additionally affected by the subordinating construction. The various constructions differ in their effect on the temporal reference of the subordinate clauses: the temporal reference of complement and relative clauses is the matrix eventuality time, that of temporal adjunct clauses is a time prior or subsequent to the matrix eventuality time (depending on the temporal connective) and that of antecedents of conditionals and clauses subordinate to *i-katu* 'it's possible' may be a past, present or future time. The temporal analyses of the five constructions are discussed in the following.

The temporal reference of complement clauses depends on the matrix eventuality time in the analysis developed here, just like in the analysis in section 3. The crucial difference is that since a complement clause, like that in (31d) repeated below, does not contain a NONFUT tense, the temporal relation between the matrix eventuality time and the time at which the complement clause is interpreted is one of temporal overlap. Thus, no back-shifted interpretation is licensed. In (31d), the complement clause is temporally interpreted in the future of the utterance time since the matrix eventuality is temporally located in the future. The formal analysis is given in (60).

(31d) Context: To play a trick on Mario, we plan to call him to ask directions to his house.

Mário   oi-mo'ã-ta   **ja-ju**-ha.
Mario   A3-think-PROSP   A1pl.incl-come-NOM
'Mario is going to think that we are coming.'

The lexical entry of the verb *oi-mo'ã* (A3-think) in (60a) existentially binds the (eventuality) time t of its complement R and specifies that its eventuality time t^3 is the (reference) time of its complement. The lexical entry of the prospective aspect/modal marker *–ta* in (60b) is the same as in the analysis in Sect. 3. The crucial difference in the translation derivation of (31d) given in (60c) is that the temporal reference of neither the matrix clause nor the complement clause is affected by a non-future tense morpheme.

(60) a. *oi-mo'ã* (A3-think) $\implies \lambda R_{\langle \omega, \langle \iota, \langle \iota, \tau \rangle \rangle \rangle} \lambda w \lambda t^4 \lambda t^3$
$$[AT(t^4, think'(m, \lambda w'' \exists t(\underline{R(w'', t^3, t)}), w, t^3))]$$

b. -*ta* presupposes an epistemic modal base with stereotypical ordering
    source or a circumstantial modal base with an ordering source that
    specifies the relevant agent's intentions. If defined,
    $$-ta \implies \lambda P_{\langle \omega, \langle \iota, \langle \iota, \tau \rangle \rangle \rangle} \lambda w \lambda t' \lambda t'' [\forall w'(w' \in best(MB, OS, \langle w, t' \rangle)$$
    $$\rightarrow t' < t'' \wedge P(w', t'', t''))]$$

    (adapted from Tonhauser, to appear)

c. (31d) $\implies -ta(oi\text{-}mo'\tilde{a}(mario)(ja\text{-}ju))$
    $\implies -ta(oi\text{-}mo'\tilde{a}(mario)(\lambda w \lambda t' \lambda t[AT(t', come'(\xi, w, t))]))$
    $\implies -ta(\lambda w \lambda t^4 \lambda t^3[AT(t^4, think'(m, \lambda w''\exists t(AT(t^3, come'(\xi, w'', t))),$
    $\quad w, t^3))])$
    $\implies \lambda w \lambda t' \lambda t''[\forall w'(w' \in best(MB, OS, \langle w, t' \rangle) \rightarrow$
    $\quad t' < t'' \wedge AT(t'', think'(m, \lambda w''\exists t(AT(t'', come'(\xi, w'', t))), w', t''))))]$
    $\implies$ (after application of the matrix clause rule in (50) and spelling
    $\quad$ out the AT relations by (15))
    $\exists t'' \forall w'(w' \in best(MB, OS, \langle w_0, t_{rt} \rangle)$
    $\quad \rightarrow t_{rt} < t'' \wedge think'(m, \lambda w''\exists t(t'' \subseteq t \wedge come'(\xi, w'', t)), w', t''))$

According to the last line of (60c), (31d) updates an information state to those
possibilities where there is a time t'' such that in all best worlds w' this time t'' is in
the future of the reference time and Mario thinks in w' at t'' that the group denoted
by ξ comes at a time t that temporally subsumes t''. The analysis thus correctly
predicts that the group comes to Mario's house at Mario's future thinking time.

Relative clauses are likewise temporally interpreted at the matrix eventuality
time. In (31e), repeated below, where the matrix eventuality time is a future time,
this means that the relative clause is temporally interpreted in the future, i.e. both
the eventuality time t' of the child seeing things and the eventuality time t'' at which
the child tells its mother about these times are temporally included within the time t
that is temporally located in the future of the reference time in the translation in
(61). (For reasons of space, a compositional analysis is not provided.)[24]

(31e) Context: A child was born blind but has just undergone an operation to
       restore her eyesight. This morning is the first time she's allowed to take
       of her bandages. She says:

       | Ko | pyharé-pe | a-mombe'ú-ta | che-sý-pe | o-pa |
       | this | night-at | A1sg-tell-PROSP | B1sg-mother-to | A3-complete |

       | mba'e | **a-hechá**-va | ko | ára-pe. |
       | thing | A1sg-see -RC | this | day-at |

       'Tonight I am going to tell my mother about all the things I see today.'

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[24] In some languages, relative clauses may be interpreted at times other than the matrix eventuality time
(see e.g. Abusch 1997b; Lin 2005). Whether this is the case in Guaraní is a question for future research.

(61) $\exists t \forall w'(w' \in best(MB, OS, \langle w_0, t_{rt} \rangle)$
  $\rightarrow t_{rt} < t \land \forall x \exists t'(t \subseteq t' \land t' \subseteq today' \land see'(sp, x, w', t'))$
  $\rightarrow \exists t''(t'' \subseteq t \land t'' \subseteq tonight' \land tell.about'(sp, mother, x, w', t'')))$

As discussed in Sect. 3, the temporal reference of a clause under the modal *i-katu* (B3-possible) or the antecedent of a conditional is unrestricted, i.e. it can be a past, present or a future time (cf. the examples in (31c), (35a) and (35b) for the former, and the examples in (31a), (36a) and (36b) for the latter). In the formal analysis, this is achieved by asserting the existence of the reference time of the subordinate clause without imposing constraints on its temporal location (although context may well make certain temporal locations more salient). The modal *i-katu* (B3-possible), featured in (62a), thus receives the lexical entry in (62b). The derivation of (62a) is given in (62c).

(62) a. I-katu   Mário   **o-jahu**.
          B3-possible   Mario   A3-bathe
          'It's possible that Mario bathed/Mario is bathing/Mario will bathe.'
      b. *i-katu* (B3-possible)
          $\implies \lambda P_{\langle \omega, \langle \iota, \langle \iota, \tau \rangle \rangle \rangle} \lambda w \lambda t'' \lambda t' [\exists t''' \exists w'(w' \in best(MB, OS, \langle w, t'' \rangle)$
          $\land P(w', t''', t'))]$
      c. (62a) $\implies$ *i-katu(Mario o-jahu)*
          $\implies i\text{-}katu(\lambda w \lambda t' \lambda t[AT(t', bathe'(m, w, t))])$
          $\implies \lambda w \lambda t'' \lambda t'[\exists t''' \exists w'(w' \in best(MB, OS, \langle w, t'' \rangle)$
          $\land AT(t''', bathe'(m, w', t')))]$
          $\implies$ (after application of the matrix clause rule in (50))
          $\exists t \exists t''' \exists w'(w' \in best(MB, OS, \langle w_0, t_{rt} \rangle) \land AT(t''', bathe'(m, w', t)))$
          $\implies$ (after spelling out the AT relation according to the third line of (15))
          $\exists t \exists t''' \exists w'(w' \in best(MB, OS, \langle w_0, t_{rt} \rangle) \land t \subseteq t''' \land bathe'(m, w', t))$

The final translation of (62a) given in the last line of (62c) thus correctly predicts that (62a) updates an input information state to those possibilities in which there are times t and t''' and an epistemically accessible best world w' such that Maria bathes in w' at the time t that is included in the (past, present or future) time t'''.

The analysis of the conditional in (31a), repeated below, is given in (63b). According to the lexical entry for –*ramo* 'if' in (63a), the translation of the antecedent Q is interpreted at worlds w' that are best with respect to an epistemic modal base MB and a stereotypical ordering source OS and at an existentially quantified time t'' (the variable *add* denotes the addressee).

(31a) Context: Paloma has a terrible voice but still wants to sing at tonight's event. Maria says:
      Re-purahéi-ramo, a-sẽ-ta.
      A2sg-sing-if   A1sg-leave-PROSP
      'If you sing, I am going to leave.'

(63) a. $-ramo$ 'if' $\implies \lambda Q_{\langle\omega,\langle\iota,\langle\iota,\tau\rangle\rangle\rangle} R_{\langle\omega,\langle\iota,\langle\iota,\tau\rangle\rangle\rangle} \lambda w \lambda t \lambda t' [\forall w'(w' \in (MB, OS, \langle w, t\rangle)$
$\wedge \exists t''(Q(w', t'', t')) \to \exists t^4(R(w, t, t^4)))]$

  b. (31a) $\implies -ramo(re\text{-}purahei)(-ta(a\text{-}s\tilde{e}))$
$\implies -ramo(\lambda w \lambda t^3 \lambda t^4 [AT(t^3, sing'(add, w, t^4))])$
$(\lambda w \lambda t^3 \lambda t^4 [\forall w''(w'' \in best(MB, OS, \langle w, t^3\rangle)$
$\to t^3 < t^4 \wedge AT(t^4, leave'(sp, w'', t^4)))])$
$\implies \lambda w \lambda t \lambda t' [\forall w'(w' \in best(MB, OS, \langle w, t\rangle)$
$\wedge \exists t''(AT(t'', sing'(add, w', t')))$
$\to \exists t^4 \forall w''(w'' \in best(MB, OS, \langle w, t\rangle)$
$\to t < t^4 \wedge AT(t^4, leave'(sp, w'', t^4))))]$
$\implies$ (after application of the matrix clause rule in (50))
$\exists t' \forall w'(w' \in best(MB, OS, \langle w_0, t_{rt}\rangle)$
$\wedge \exists t''(AT(t'', sing'(add, w', t')))$
$\to \exists t^4 \forall w''(w'' \in best(MB, OS, \langle w_0, t_{rt}\rangle)$
$\to t_{rt} < t^4 \wedge AT(t^4, leave'(sp, w'', t^4))))$
$\implies$ (after spelling out the AT relations according to (15))
$\exists t' \forall w'(w' \in best(MB, OS, \langle w_0, t_{rt}\rangle)$
$\wedge \exists t''(t' \subseteq t'' \wedge sing'(add, w', t'))$
$\to \exists t^4 \forall w''(w'' \in best(MB, OS, \langle w_0, t_{rt}\rangle)$
$\to t_{rt} < t^4 \wedge leave'(sp, w'', t^4)))$

According to the last line of (63b), (31a) updates an information state to those possibilities where there is a time t' such that in all epistemically accessible best worlds w' where the addressee sings in w' at the time t' that is temporally subsumed by a (past, present or future) time t'', there is a time t^4 such that in all best worlds w'', t^4 is in the future of the reference time and the speaker leaves in w'' at t^4.

In temporal adjunct clauses, the matrix event time and the reference time of the temporal adjunct clause are temporally related by the temporal connective. In the lexical entry for $-mboyve$ 'before', given in (64), the translation of the matrix clause P is temporally located at a time t'' in the future of the time t' at which the translation of the temporal adjunct clause R is temporally located. The translation derivation of (31c), repeated below, is given in (65).

(64) $-mboyve$ 'before'
$\implies \lambda P_{\langle\omega,\langle\iota,\langle\iota,\tau\rangle\rangle\rangle} R_{\langle\omega,\langle\iota,\langle\iota,\tau\rangle\rangle\rangle} \lambda w \lambda t' \lambda t[R(w, t', t') \wedge \exists t''(t' < t''$
$\wedge \exists t^3(P(w, t'', t^3)))]$

(31c) Context: I'm getting ready to leave the house. Maria tells me:
  Re-ho-mboyve, re-karú-ta.
  A2sg-go-before   A2sg-eat -PROSP
  'Before you go, you are going to eat.'

(65) (31c) $\implies$ –ta(–mboyve(re-ho)(re-karu))

$\implies$ –ta(–mboyve($\lambda w \lambda t' \lambda t[AT(t', go'(add, w, t))]$)

$\quad$ ($\lambda w \lambda t' \lambda t[AT(t', eat'(add, w, t))]$))

$\implies$ –ta($\lambda w \lambda t' \lambda t[AT(t', eat'(add, w, t')) \wedge \exists t''(t' < t''$

$\quad \wedge \exists t^3(AT(t'', go'(add, w, t^3))))]$)

$\implies$ $\lambda w \lambda t''' \lambda t'[\forall w'(w' \in best(MB, OS, \langle w, t''' \rangle)$

$\quad \rightarrow t''' < t' \wedge AT(t', eat'(add, w', t'))$

$\quad \wedge \exists t''(t' < t'' \wedge \exists t^3(AT(t'', go'(add, w', t^3))))))]$

$\implies$ (after application of the matrix clause rule (50))

$\quad \exists t' \forall w'(w' \in best(MB, OS, \langle w_0, t_{rt} \rangle)$

$\quad \rightarrow t_{rt} < t' \wedge AT(t', eat'(add, w', t'))$

$\quad \wedge \exists t''(t' < t'' \wedge \exists t^3(AT(t'', go'(add, w', t^3))))))$

$\implies$ (after spelling out the AT relations according to (15))

$\quad \exists t' \forall w'(w' \in best(MB, OS, \langle w_0, t_{rt} \rangle) \rightarrow t_{rt} < t' \wedge eat'(add, w', t')$

$\quad \wedge \exists t''(t' < t'' \wedge \exists t^3(t^3 \subseteq t'' \wedge go'(add, w', t^3))))))$

According to the derivation in (65b), updating an input context with (31c) results in an output context consisting of information states i where a time t' has been added to the domain and all best worlds w' are such that the addressee eats at t' and leaves at a time t'' after t'. Thus, the temporal reference of a temporal adjunct clause is determined by the temporal connective in relation to the time at which the matrix clause is interpreted.[25]

4.4 Summary

This section has explored the hypothesis that temporal reference in Guaraní is not constrained by a phonologically empty non-future tense. According to the tenseless analysis developed in this section, finite Guaraní clauses are in principle compatible with past, present and future reference times. In matrix clauses, only context and (optional) temporal adverbials constrain temporal reference. Since absolute future antecedent reference times are made available only by two matrix clause constructions, matrix clauses are interpreted at past and present reference times, except in those constructions. The temporal reference of subordinate clauses, on the other hand, is affected by the subordinating constructions, with such constructions differing in whether the temporal reference is the matrix eventuality (complement and relative clauses), a time prior or subsequent to the matrix eventuality time (temporal adjunct clauses), or an epistemically accessible time (antecedents of conditionals and clauses subordinate to *i-katu* 'it's possible').

5 Comparison of the two analyses of temporal reference in Guaraní

This paper set out to explore how temporal reference is determined in Guaraní, a tenseless language with apparent temporal reference restrictions. Sections 3 and 4

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[25] This analysis does not capture the fact that a temporal adjunct clause is temporally interpreted at a past (future) time whenever the matrix clause is temporally interpreted at a past (future) time; see footnote 17.

explored two hypotheses about temporal reference in the language, both based on the observation that, cross-linguistically, temporal reference is restricted by context, tenses and temporal adverbials. According to the first hypothesis (Sect. 3), temporal reference in Guaraní is constrained by a phonologically empty non-future tense morpheme that constrains the temporal location of the antecedent reference time to a (relative) non-future time. In the analysis developed in this section, the temporal reference of matrix clauses is thus constrained by context, optional temporal adverbials and the non-future tense morpheme. According to the second hypothesis (Sect. 4), temporal reference in Guaraní is not constrained by a phonologically empty non-future tense morpheme and the temporal reference of matrix clauses is constrained solely by context and temporal adverbials.

A comparison of the two analyses reveals many similarities. Both analyses recognize the possibility of contextual restrictions on temporal reference, formally captured by the temporal anaphor t_{rt}, which is associated with a familiarity requirement. Both analyses also recognize the contributions temporal adverbials make to constraining and resolving temporal reference. For subordinate clauses, both analyses assume that subordinating constructions contribute in different ways to the temporal reference of finite subordinate clauses. And both analyses can account for the data considered in the paper, albeit in quite different ways.

The two analyses can be compared on a number of dimensions, including conceptual complexity, theoretical assumptions and empirical coverage. With respect to conceptual complexity, I maintain that the tenseless analysis is simpler since it, unlike the tensed analysis, does not evoke a phonologically empty non-future tense morpheme. Assuming such covert morphemes is not always conceptually costly: if some members of a particular paradigm are overt, postulating a covert morpheme for some cell of the paradigm is a suitable technical solution for semantically composing the meaning of that member of the paradigm with other, overt expressions of the utterance. But Guaraní is a tenseless language (assuming the definition of Sect. 1), which means that there is no paradigm of tenses the non-future member of which is not overt. Postulating a phonologically empty non-future tense morpheme is thus not merely a technical solution. Consequently, an analysis that does not assume such a morpheme is more parsimonious than one that does.[26]

Assessing the theoretical adequacy of the two analyses is harder, since this depends on one's theoretical assumptions. One consideration here is whether it is reasonable to assume a phonologically empty non-future tense once the contextual restrictions on temporal reference are taken into consideration. That is, if the formal analysis assumes a temporal anaphor t_{rt} that is resolved to contextually available antecedent reference times (as is done in both Sects. 3 and 4), and if context makes available absolute future antecedent reference times only in a very limited set of constructions (as argued in Sect. 4), one can ask whether it is theoretically adequate to also assume a phonologically empty non-future tense morpheme that constrains temporal reference to a non-future time. This consideration, however, depends on one's willingness to accept the proposal that absolute future antecedent reference times are not contextually available in languages that primarily (or exclusively) use

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[26] I thank Jürgen Bohnemeyer (personal communication) for this point.

the eventuality time option to realize future discourse, such as Guaraní and Kalaallisut.

In assessing the empirical adequacy of the two analyses, it is useful to ask whether the analysis of Sect. 3, which assumes a phonologically empty non-future morpheme, makes better empirical predictions than the second analysis, which does not assume such a morpheme. Two pieces of data suggest that this is not the case. First, it was observed in Sect. 3 that matrix clauses can have absolute future time reference (see the examples in (29) and (30)). These kinds of examples are problematic for the tensed analysis since the non-future morpheme categorically requires absolute non-future temporal reference for finite matrix clauses. Since the tenseless analysis of Sect. 4 does not assume a phonologically empty tense, the availability of future time reference in these constructions can be attributed to the effect of the constructions on the reference time, thus allowing for the non-categoricity of non-future temporal reference. A second piece of data that is relevant for comparing the two analyses is the temporal reference of subordinate clauses. The tensed analysis of Sect. 3 assumes a Sequence-of-Tense rule that results in the tense not being interpreted in subordinate clauses, to avoid predicting unattested back-shifted interpretations in relative and complement clauses and to avoid having to stipulate an absolute future evaluation time for temporal adjunct clauses, antecedents of conditionals and clauses subordinate to *i-katu* (B3-possible). Since the tenseless analysis of section 4 does not assume a non-future tense in the first place, the temporal reference of subordinate clauses can be constrained by the subordinating constructions without having to remove the undesired contributions of the non-future tense morpheme by an additional rule.

In sum, assuming the theoretical adequacy of both analyses, I take the tenseless analysis to be conceptually superior to the tensed analysis and to make better empirical predictions (but, as noted above, further exploration of the tensed analysis might lead to improvements). I therefore conclude that the tenseless analysis of temporal reference in Guaraní is more suitable than the tenseless one.

6 Concluding remarks on cross-linguistic variation in temporal reference

Whether the temporal reference of a particular tenseless language is best given a tensed or a tenseless analysis is an empirical question. The literature has shown that tenseless languages can receive tensed analyses (e.g. Lin 2005; Ritter and Wiltschko 2005; Matthewson 2006), i.e. analyses where an (overt or covert) expression introduces a constraint on the temporal relation between the antecedent reference time and the utterance time, as well as tenseless analyses (e.g. Bohnemeyer 2002; Bittner 2005 and the analysis of Guaraní in Sect. 4). This suggests that there may be semantic variation among tenseless languages with respect to how the temporal relation between the reference and the utterance time is constrained: by context and temporal adverbials alone, or additionally by a covert tense. But this paper has also shown that identifying whether a tensed or a tenseless analysis is suitable for a particular tenseless language requires consideration of a wide variety of contexts, temporal adverbial constructions as well as subordinating constructions. In the case

of Guaraní, considering this wide range of data provided evidence in favor of the tenseless analysis over the tensed one. Thus, the type of data considered in this paper may prove useful for future research on tenseless languages in identifying whether the language is best given a tensed or a tenseless analysis.

The paper concludes with a brief discussion of two implications for cross-linguistic variation in temporal reference. The first implication concerns the question of whether the morphological differences between tensed and tenseless languages have consequences for temporal reference. In this paper, this question is answered negatively. According to both the tensed and the tenseless analysis of Guaraní, temporal reference in Guaraní is anaphoric to a contextually given antecedent reference time, just as in tensed languages like English. Thus, on this view, Guaraní and English differ only in the inventory of (covert or overt) expressions that constrain the temporal location of the antecedent reference time. Crucially, temporal reference in tenseless languages is not un- or under-determined because of the lack of tense morphemes once the contribution of the context to temporal reference is properly taken into consideration (for similar conclusions see e.g. Kiparsky 2005; Bittner 2008; Bohnemeyer 2009; Lee and Tonhauser 2010).

The second implication emerges from the observation that languages differ in how future discourse is realized. In Kalaallisut, future discourse is only realized by the eventuality time option (Bittner 2005), and this paper empirically motivated that future discourse in Guaraní is realized predominantly by the eventuality time option, with the reference time option in use in only two kinds of matrix clause constructions. Bohnemeyer (2002) shows that in Yucatec Maya, a tenseless Mayan language, future discourse is realized with both the eventuality and reference time options with stative eventualities, but only the eventuality time option is available for perfective eventive eventualities (unless topicalized, p.254).[27] In English, future discourse is realized by the reference time option only with scheduled eventualities (see Sect. 4.1 above) and the auxiliary *will*, if it is analyzed as a future tense rather than a future-oriented modal (see references above).

This suggests that there is cross-linguistic variation in the extent to which future discourse is realized by the reference time option. The four languages mentioned above seem to fall on a cline, with Kalaallisut at one extreme, Guaraní and English in the middle, and Yucatec Maya showing the most extensive use of the reference time option. Whether these four languages belong to three clearly distinguishable language types with respect to the realization of future discourse is a question for future research.

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[27] Bohnemeyer (2002) accounts for these temporal reference restrictions with the Modal Commitment Constraint (p.259), which precludes perfective reference to an event following the reference time without specifying the speaker's modal attitude to the event.

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