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Travelling in time with natural language: Some cross-linguistic considerations*

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Abstract

This paper investigates the grammatical strategies deployed by natural languages in order to express temporal reference. We show that temporal reference is obtained by combining a finite set of pieces of meaning which are constrained by the metaphysics of natural language and which languages distribute differently across functional categories. The paper discusses more specifically temporal adverbial clauses that express the meanings of anteriority and posteriority with respect to some reference time. We consider a relevant set of languages that make use of different strategies in order to generate these meanings, and conclude that the tools that languages may deploy are of a limited number, and include tense, aspect and temporal connectives.

Keywords: *temporal clauses. indigenous languages. cross-linguistic variation. before. after.*

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A (sort of) metaphysical question

As many cognitive psychologists will confirm, it seems impossible, for human minds, to think without time. Whenever we imagine or recall an event or a fact, our mental representations invariably occupy a stretch of time: as Pinker (2007) put it, while we can imagine a stretch of time in which nothing happens, we cannot imagine an event that does not unfold in time. Since time is a basic category of our experience and cognition, and "without efficient communication about [it], no well-coordinated collective action, hence no human society, would be possible" (Klein, 1994, p. 1), besides abstract mental representations people also need to keep track of time by making use of the constructions of their language.

Indeed, the inventory of temporal expressions in language is large: to cite a few, we may use temporal adverbs like *yesterday* or temporal clauses like *after coming home* to locate an event, and many languages also grammaticalize the reference to time in functional categories such as Tense and Aspect, which can be found on both nouns and verbs. All these tools are used to determine what is conventionally called the *temporal reference* of a linguistic expression, that is, the relation between the time of speaking and the time the relevant linguistic expression is about. There are multiple ways in which temporal reference may be expressed in natural language. In principle, if we are provided with the right information, we might ascertain quite precisely when the first Viking boat landed on the American continent or the exact time of John F. Kennedy's death. When we want to talk about events located in the past of the time of speaking, however, we aren't necessarily very precise. Without the help of context, the use of the Simple Past Tense in English is not very informative; to say that *the Vikings discovered the Americas* or that *John F. Kennedy died* merely states that these events occurred at some time in history before the moment in which the two sentences are uttered. We can of course reduce vagueness by adding information that restricts this time span, by locating the two events with respect to other events (such as *The Vikings discovered the Americas before Columbus did* or *John F. Kennedy died after the Second World War)* or by pointing to a shared conventional way of measuring time (*John F. Kennedy died at 1 pm on November 22, 1963).* The reference time does not even need to be explicitly stated but may be inferred by contextual information. Nevertheless, one may wonder how universal these strategies are, and to what extent speakers need to make use of them. These questions have fostered until recently heated debates about the weight of cultural principles and social habits on the representation of time in a language (see e.g. Everett, 2005; 2009; Nevins *et al.*, 2009).

With this paper, we wish to contribute to the understanding of this issue by looking at the way in which basic temporal representations are expressed in the grammar of different languages. As it will become clear, our inquiry is explicitly theory-driven: we will choose relevant phenomena based on recent formal semantic proposals about the

linguistic representation of time, and consider a representative choice of empirical examples that show the extent and the limits of variation with respect to this finite set of phenomena and representations. We believe that such focussed approaches are more effective than studies based on mere collections of data, which often fail to suggest useful generalisations. We therefore chose to question empirical and formal generalisations from the perspective of a representative case study.

Specifically, we discuss in this paper the case of Karitiana, a Tupi language spoken in the state of Rondônia, in north-west Brazil, whose temporal and aspectual semantics are still largely understudied and yet present a number of characteristics that make this language an interesting standpoint for introducing the different strategies of temporal reference, and particularly so when compared to well-studied languages such as Portuguese, English or Japanese. To start with, Karitiana has a split Tense system, since it marks Tense only in matrix affirmative clauses, subordinate clauses being thus unmarked for Tense.[1] This specificity of the language is particularly interesting for two reasons. First, as we shall see, it addresses the analytical choice of describing temporal reference as being determined in absolute or relative terms, two strategies that have been broadly related, respectively, to matrix and subordinate clauses. Secondly, the semantic value of Karitiana tense morphemes has been described as Future-Non Future (Fut-NFt) (Storto, 2012; Muller; Ferreira, 2020). This fact sets the Tense system of Karitiana apart from most of the Tense systems of well-documented languages such as English or other European languages. In addition, since the Fut-NFt contrast is expressed in Karitiana matrix clauses by overt (i.e. phonetically realised) morphemes, the comparison with other Fut-NFt languages becomes particularly relevant in order to test semantic theories of temporal reference; in fact, among the languages that have been claimed to display a Fut-NFt system and that have been described in formal terms, Tense information is often realised by covert tense morphemes (Matthewson, 2006; Sun, 2014, among others). Next, Karitiana subordinate clauses are to our knowledge not introduced by complementisers or subordinating conjunctions, a fact that makes the issue of the semantic contribution of adverbial temporal clauses particularly relevant. In languages that display temporal connectives such as *when, before* or *after,* the choice of Tense marking and the relative ordering of eventualities of the matrix and embedded clause in these constructions has been made largely dependent on the semantics of the connective. We show that Karitiana makes use of a different strategy for ordering the eventualities described in the two clauses, which is based on the semantics of specific morphemes that encode at the same temporal and aspectual information. Most of the Karitiana examples discussed in this paper are original data that has been collected by the authors in collective or individual fieldwork sessions and are presented here for the first time. Data from other researchers are explicitly quoted.

[1] Clauses that display a propositional negation are also unmarked for Tense in Karitiana. We will not discuss negative clauses in this paper, but see Storto (2018) for details.

The paper is organised as follows. In the next section, we first briefly present two different strategies that languages use for specifying what we call "absolute" temporal reference - that is, temporal reference with respect to the time of utterance. In this section we also introduce some of the theoretical assumptions we rely on throughout the paper, and in particular the theoretical notion of Topic Time. As previously mentioned, one apparent problem, noticed by semanticists very early on, is that Tense values such as "past" and "present" appear to be too vague in order to faithfully describe the intuitions of speakers about the precise localisation of the eventualities they are talking about. The time span in which eventualities occur must then be restricted to a relevant interval or point of interest, which has been called Topic Time (Klein, 1994) or Evaluation Time (Pancheva; Zubizarreta, 2023). As we shall see, to this end other pieces of linguistic information about time - both functional and lexical - co-occur with Tense to a different extent. The analysis of Karitiana as a language displaying a Future-Non Future (Fut-NFt) Tense system will be introduced in this section, within the background of two particular cases: that of languages that build a temporal system with tense morphemes that have a Past-non Past (Pst-NPst) semantic value and that of languages that do not display tense morphology at all (the so-called "tenseless" languages). The comparison with tenseless languages is motivated in the light of recent analysis claiming that some of these languages in fact display a null temporal morpheme, which precisely gets a NFt value (Sun, 2014; Sun; Dermidache, 2022). While absolute temporal reference is mostly restricted to matrix clauses in discourse, in section *Relative temporal reference: ordering times and events*, we will turn to the ordering of time or events in complex sentences, where temporal reference may be calculated relative to a time acting like an anchor. We will see that this reference time, which sets the Topic Time of the subordinate clause, is not necessarily identified with the time of utterance, and that it can be conveyed by different (explicit or implicit) pieces of information. As a special case, we will then discuss the relative ordering of events in complex sentences where the Topic Time is specified by means of adverbial clauses. We will show that Karitiana expresses the relative ordering of events with the help of aspectual morphemes, which realise part of the semantic features encoded in the temporal connectives *before* and *after* in English. Finally, in the concluding section, we will state our final remarks.

Temporal reference: Tense and Topic Time

This section focuses on the question of how we locate events in time, and, more specifically, on how we locate the eventualities denoted by matrix sentences in time.[2] We first motivate and define the notion of Topic Time, which will be crucial for the discussion about reducing the vagueness of Tense and lack of Tense. We thus reframe the question of determining the temporal reference of a sentence as a question about

[2] See Thonhauser (2015) for an overview.

its Topic Time. Next, within the background of locating events in time, we discuss obligatory tense languages as opposed to morphologically tenseless languages.

Topic Time

In her classic example reproduced below in (1), Barbara Partee introduced in the linguistic literature the notion of pronominal Tense and, with it, the observation that temporal variables also need restrictions on their interpretation (Partee, 1973).

(1) I didn't turn off the stove.

As Partee notes, the utterance of (1) does not simply mean that there has been some time in the past when the speaker did not turn off the stove, since an utterance of this kind would probably be trivially true, and therefore utterly uninformative. On the contrary, it refers to a particular time or time interval, whose precise location is defined, for the speaker and the hearer, in the context of the utterance. For instance, if the speaker uttered this sentence when she was backing in the garage after leaving the house in a hurry, we understand that the past tense most probably refers to an interval located a few minutes before the utterance time, rather than to an indeterminate past interval.

As we have seen, then, if the context of the utterance is not taken into account, the information conveyed by Tense (in this case, the past tense morpheme in English) is not enough to determine the temporal reference of an utterance or sentence, and it's not even necessary, as attested by the existence of a number of languages that lack tense inflection altogether.[3] The necessity of restricting the interpretation of the temporal intervals denoted by tense morphemes led semanticists to elaborate the notion of Topic Time (TT), intended as "the time span to which the speaker's claim on [one] occasion is confined" (Klein, 1994, p. 4). The question of determining temporal reference can thus be reframed in the following way: how is Topic Time determined? A first theoretical option is to define TT via implicit information in the context, that is, in relation to previous utterances or to the topic of conversation in discourse. Another possibility is to anchor or restrict TT with explicit linguistic information, and in this case two options are available: Topic Time can be defined with the help of dedicated functional categories, like Tense and Aspect, or with the help of lexical expressions. Languages appear to select their options from this restricted inventory of linguistic strategies, very often by combining more than two of them together. As we are interested mainly in grammatical expression of time, we will not, in this paper, discuss discourse-related models, and rather focus on the explicit linguistic tools that speakers may use for determining temporal reference. In the next section, we start by briefly introducing the grammatical category of Tense.

[3] The World Atlas of Language Structures (WALS), the largest online database of structural (phonological, grammatical, lexical) properties of languages gathered from descriptive materials, counts at least 152 languages that do not display inflection for Tense on the verb (see WALS Online - Home).

About Tense

It is well-known by now that Tense inflection is not represented in a uniform way across languages. One of the parameters that one may use to attempt at a classification is the distinction between the presence or absence of tense inflection in matrix clauses; according to this criterion, English, where all matrix clauses are tensed, is opposed to Mandarin Chinese, a so-called "tenseless" language (Smith, 1991; Lin 2006; Sun, 2014, among others). This rough partition is questioned by the existence of "mixed tense" languages like Navajo (Smith *et al.* 2007), which display tensed as well as non-tensed matrix clauses, or "optional tense" languages, which display tense morphemes that are not part of a strict paradigm and therefore do not obligatory mark finite clauses (Plungian; Van Der Auwera, 2006; Bochnak, 2016). A more subtle distinction also shows up if we consider tense marking in subordinate clauses: while some languages are consistent in displaying or lacking Tense morphology in all finite clauses, others make a distinction between matrix and subordinate clauses. The case of subordinate clauses deserves special attention, since finiteness is not obligatory in all subordinate constructions also in languages with obligatory tense marking like English; moreover, as we shall see, the temporal relation of dependency between the subordinate and the matrix clauses can be construed in more than one way. We will discuss subordinate clauses in more detail in the remainder of the paper, and concentrate in the following subsections on Tense in matrix clauses, where we can distinguish between several cases.

Lack of overt Tense

If, following Comrie, we define Tense as "the grammaticalized marking of location in time" (Comrie, 1985, p. 9), languages that lack temporal morphology may be *bona fide* considered tenseless. According to DeCaen (1991), almost half of the world's languages can be described as tenseless in this sense (Decaen, 1991, p. 41; see also ftn. 3), and a quick look at the literature reveals that tenseless languages belong to a wide array of typologically diverse language families, including Sino-Tibetan (Mandarin Chinese, Smith, 1991; Lin, 2006; Sun, 2014, among others), Mayan (Yucatec, Bohnemeyer, 2002), Austronesian (Samoan, Bochnak; Hohaus; Mucha, 2019), Eskimo (Kalaallisut; Bittner, 2005) and Tupi (Paraguayan Guarani; Tonhauser, 2011). Although scholars agree on the descriptive fact that tenseless languages lack morphological Tense marking, the theoretical implication that they lack any grammaticalized marking of temporal reference is more controversial. The origin of the debate is the simple empirical observation that, in at least some tenseless languages as well, clauses and sentences cannot be interpreted in just any possible way. While it is true that in tenseless languages, as in all languages, adverbial phrases or clauses and other functional categories, such as Aspect or Number, play a crucial role in restricting

interpretational possibilities and determining precise temporal reference, certain temporal interpretations seem to be always excluded also for bare (i.e. unmarked) predicates. Bare matrix clauses in many tenseless languages allow either past or present readings, whereas future readings are generally banned in the absence of some type of modal or future marking, and this interpretation is infelicitous also when a future time adverb is present. Donazzan (2008) and Sun (2014) discuss for instance the case of Mandarin bare (i.e. non-aspectually marked) predicates. In Mandarin, stative bare predicates in matrix clauses can be freely interpreted as past or present, but never as future relative to utterance time (2a). As the contrast between (2b) and (2c) shows, the ban on prospective interpretation cannot be overridden by temporal adverbials (2c), which can otherwise be used to restrict the interpretation to past times (2b).

(2) a. *Xiao Li*   *hen*   *lei.*
      Xiao Li   DEG   tired
      Xiao Li is/was/#will be very tired

   b. *Xiao Li zuotian*   *hen*   *lei.*
      Xiao Li yesterday   DEG   tired
      Yesterday Xiao Li was very tired.

   c. #*Xiao Li mingtian*   *hen*   *lei.*
      Xiao Li tomorrow   DEG   tired

One may find a number of different analytical choices accounting for these restrictions. At one extreme, we find theories that posit a genuine absence of tense morphemes, and derive restrictions in interpretation *via* semantic and discourse rules (see e.g. Tonhauser, 2011). Such analyses do not assume covert morphemes restricting temporal reference; rather, a variety of contextual factors, including information conveyed by aspect or adverbials and universal pragmatic rules of interpretation, contribute to define the temporal location of an event. At the other extreme, a number of theories assume a covert operator restricting topic time, which may be directly encoded in a covert morpheme for Tense (see (Sybesma, 2007) for Mandarin Chinese) or rather be introduced by aspectual morphemes ((Lin, 2006) for Mandarin Chinese) or temporal adverbials ((Thomas, 2014) for Mbya Guarani). The common denominator of the latter type of approaches is that Tense information is (perhaps universally) functionally expressed, and cross-linguistic variation depends on individual choices concerning the morpho-syntactic realisation and semantic value of the relevant functional category. Somewhat in between, then, are analyses that posit the existence of minimal functional structure, in the form of a pronoun-like covert operator restricting reference to Topic Time via discourse constraints (see e.g. (Bochnak, 2016; Mucha, 2013; 2017)).

Obligatory Tense Systems

With the term temporal system, we refer here to the way in which the category of Tense grammaticalizes the conceptual relations of Past, Present and Future in the inflectional system of a language. According to Comrie (1985), among many of the languages where Tense is grammaticalized as a functional category, there exist two basic temporal orientations, which divide the temporal axis in either of the following two ways (Comrie, 1985): past vs. non-past (Pst-NPst) intervals and future vs. non-future (Fut-NFt) intervals. Examples of the Pst-NPst morphological dichotomy can be found among many languages, including Japanese or German (3a,b). As we can see in (3b), in German Past Tense morphology on the auxiliary restricts the interpretation to events that precede the utterance time, while the present, as a NonPast, can be used to refer to the complementary portion of the timeline, extending from the present to the future.

(3) a. *Robyn   spricht   Portugiesisch.*
         Robyn   speak-NPST   Portuguese
     (i) Robin speaks/will speak Portuguese.
     (ii) #Robin spoke Portuguese.

   b. *Robyn hat   Portugiesisch   gesprochen*.
       Robyn have-PST   Portuguese   spoken
     (i) #Robin speaks/will speak Portuguese.
     (ii) Robin spoke Portuguese.

On the other side of the coin, a number of the world's languages display a Future-Non Future (Fut-NFt) system, where the grammaticalized opposition splits the time axis in a different way: the intervals that are beyond utterance time are opposed to those that coincide with it or precede it. Karitiana displays one example of an explicit Fut-NFt system (Storto, 1989; Muller; Ferreira, 2020), which we present in detail below.

The TAM system of Karitiana

Since an important part of our discussion concerns Karitiana, in order to help the reader understand the data we will briefly describe the system for marking Tense, Aspect and Mood (TAM) in this language. Our description is mainly based on the descriptions and analyses provided in the literature, especially on Storto's (1989; 2012; 2013) work on the language.

Affirmative main clauses in Karitiana are obligatory marked for Agreement, Mood and Tense; they may optionally display overt aspectual auxiliaries. In declarative main clauses such as the ones in (5) below, the unmarked word order is SVO, but VS is also possible. The morphological structure of the verbal complex is presented in (4); sentences (5a) and (5b) illustrate two basic structures. Note that in (5b), which is modified

by prospective aspect, the tense morpheme may occur at the same time after the aspectual head, where it is always obligatory, and after the verbal head, where it is optional if an aspectual auxiliary is present.

(4) Person–sentence.mood–**verbal.head**-(tense)-apect-tense

(5) a. *Marcelo Ø-naka-'y-tti'y.*[4]
   Marcelo 3-DCL-eat-NFT food
   'Marcelo ate the food'[5]

   b. *Taso Ø-na-oky(j)   pasagng-<ã>j boroja.*
   man 3-DCL-kill-(NFT) PROSP-FUT   snake
   'The man will be killing the snake'.

Subordinate clauses, on the other hand, are verb final and display no agreement, Mood and Tense on the verbal complex (6), aspect being the only functional category of the verbal complex to be overtly expressed.

(6) *[Ti'y Marcelo 'y tykiri] Ø-na-pa'ira-t   João.*
   food Marcelo eat PROG   3-DCL-anger-NFT João
   'When Marcelo ate the food, João got angry'

(Storto, 2012, p.4)

Storto (1989) explains the absence of inflectional morphemes in subordinate clauses as a consequence of verb movement. According to her analysis, the verb head raises to Aspect in all clauses, but main clauses additionally involve movement of the head to the left periphery of the sentence, which is motivated precisely by the necessity of acquiring inflectional morphology. V to Asp raising has one important consequence for the analysis of subordination in Karitiana, since one of the descriptive properties of subordinate clauses that are overtly marked for aspect is precisely the presence of the aspectual heads at the right end of the clause.[6] This descriptive regularity may suggest that aspectual heads act as subordinating morphemes in the language. Even if this generalisation may be useful in descriptive terms, it cannot be entirely adequate, however, as the same aspectual morphemes occurr also in main clauses, and complement clauses often occur without any overt aspectual heads. As has been pointed out by Storto (2012), in temporal adverbial clauses, «[aspectual] subordinators can be roughly translated as 'when/if', 'before', 'after' , but much more work needs to be done on their function and compositional semantics before we fully understand their denotations ».[7] A step in this direction is offered by the analysis provided in the following section; in the remainder of this section we will biefly introduce the semantics of Tense morphemes in the language.

As mentioned in the introduction, Karitiana has an explicit Fut-NFt system, by which speakers consistently interpret the Tense morpheme *-t* as referring either to the (habitual) present or to the past, while the morpheme

[4] The Karitiana data was elicited by either one of the authors or by both of them together, unless otherwise stated.

[5] The elicitation of Karitiana constructions has been conducted following the methodology of semantic fieldwork expounded in Matthewson (2004): sentences were tested for truth conditions and felicity against a context; the informants were then asked to translate the sentence into Portuguese. We call the reader's attention to the fact that the translations to the examples, throughout this paper, are either sentences provided in Portuguese for the Karitiana consultants to translate into their language or provided by the consultants for the Karitiana sentences offered by the researcher. They are by no means to be taken as a literal translation.

[6] For a more detailed analysis of subordination in Karitiana and a comprehensive description of the different types of subordinate clauses, the reader is referred to Storto (2012).

[7] A reviewer points out that some aspectual elements occur away from the verb and could perhaps be analysed as conjunctions. A case in point is *(a)tykiri* in the sentence below:

A-tykiri   i-aka padn-oko
that-when 3-COP NEG-REPET

hak [ta-ty-yt   tykiri]
here [3ANAPH-big-OBL when]

Then, when he became very big, he could no longer live here' (Storto 2014, p. 435)

-j can only refer to events that happen after utterance time (Storto, 1989; Muller; Ferreira, 2020). This is illustrated, respectively, by (7a, b).

(7) a.   *Ana*   *Ø-na-aka-t*   *i-voma-t.*
       Ana   3-DCL-COP-NFT   3-smoke-ADJ[8]

     (i)   Ana smokes/ smoked.
     (ii)   #Ana will smoke.

    b.   *Ana*   *Ø-na-aka-j*   *i-voma-t.*
       Ana   3-DCL-COP-FT   3-smoke-ADJ

     (i)   #Ana smokes/smoked.
     (ii)   Ana will smoke.

Before proceeding, there are two more points we should make. One may argue that the contrast that we describe as Fut-NFt can be rather described as a Realis-Irrealis distinction, related to the grammatical category of Mood rather than Tense, and indeed this point of view has been defended for other languages (Comrie, 1985). We claim that this is not the case in Karitiana, where Fut-NFt are two semantic values of Tense. As illustrated in (7a-b), the two inflections. Fut and NFt are realised in Karitiana by verbal suffixes which occur in complementary distribution, as they occupy exactly the same position in the verbal complex and they never co-occur. In contrast, the morphemes related to mood and modality occur as prefixes with respect to the verb and may co-occur with morphemes realising other functional categories. This is illustrated by the counterfactual sentence in example (8), where the modal affix *-jỹ* (glossed as CF) co-occurs with the NFt suffix *-t.*

(8) *Inacio*   *Ø-jɨɾ-'y-t*   *'ip.*
    Inacio   3-CF-eat-NFT   fish
    'Inácio would eat fish.'

A second important point concerns the interpretation of the NFt morpheme as both past and present. Our data suggest that the NFt is ambiguous rather than semantically vague in Karitiana: while the NFt morpheme can be interpreted, in principle, as either denoting past or present temporal reference, the two interpretations can never be simultaneously encoded by one and the same morpheme. The NFt inflected sentence (9a,b) can only receive an interpretation according to which the two events denoted by the coordination of the NPs either both occur in the past or both occur in the present. In other words, the sentence cannot be interpreted with one of the events occurring in the past and the other one occurring in the present. This is shown by the English paraphrases of example (9a), but also by the infelicity of (9b) in the provided context.

We will not elaborate on the lexical status of *atykiri* and similar items. Nevertheless, it is important to observe that these items only occur in main clauses, which in the sentence above can be perceived by the occurrence of person agreement and by the occurrence of the negation particle *padn*. They seem to function, in this respect, more like discourse connectors than as subordinating conjunctions.

[8] Both the NFt and the ADJunction are expressed by *-t.* We analyse them as distinct morphemes.

(9) a. *Inácio Arnaldo Ø-na-aka-t   i-pon-t   pikon   kyyt.*
    Inácio Arnaldo 3-DCL-COP-NFT   3-shoot-ADJ   monkey   POS

Possible paraphrases:
✓ 'Inácio and Arnaldo (both) shot monkeys.'
✓ 'Inácio and Arnaldo (both) shoot monkeys.'
* 'Inácio shoots monkeys and Arnaldo shot monkeys.'

   b. (Context: You know that Luciana used to smoke but now
      she has quit smoking; Ivã, on the other hand, still smokes.)
      Luciana   Ivã   Ø-na-aka-t   i-fuma-t
      #Luciana   Ivã   DCL-COP-NFT   3-smoke-ADJ
      Intended: Luciana used to smoke and Ivã still smokes

The judgements of our consultants thus contrast sharply with the intuitions of speakers reported in the literature of other NFt languages, such as St'át'imcets Salish (Matthewson, 2006) or Mandarin (Sun, 2014; Demirdache; Sun, under review). Compare, for instance, the Karitiana sentence (9a) with the sentence (10a) in Mandarin, reported by Sun (2014). Sun (2014), following Matthewson (2006), defends an analysis of a covert NFt tense for Mandarin, and observes that some sentences with a bare predicate in Mandarin may describe plural eventualities, where each eventuality is interpreted as occurring at a distinct temporal location. Specifically, in the Mandarin sentences (10a) the bare predicate is interpreted as referring simultaneously both to a past and a present event; Gulun is a writer that died in the 20th Century, and Mo Yan is a writer that is (presently) still alive. Additional evidence is provided by (10b), where the two temporal adverbs refer to distinct (past and present) time intervals to which the predicate must refer.

(10) a. Gulun   he   Mo   Yan   dou   chouyan
        Gulun   and Mo   Yan   both   smoke
        Intended: ✓ 'Gulun used to smoke and Mo Yan smokes.'

    b. Qián-tiān   hé   jīntiān Lùlu dou hěn jǔsàng.
        before-day   and   today   Lulu DOU very frustrated
        Intended: Gulun was very frustrated yesterday and she's
        very frustrated also today.

(Sun, 2014, p. 205)

Each of the sentences in (10a,b) has one predicate, and therefore, according to the hypothesis of a covert NFt tense morpheme, only one Tense Phrase in its structure. Since these sentences have past and present readings simultaneously, the covert tense should select both past and present intervals as TTs for the eventuality described by the predicate.

Conversely, as we have seen in (9), a NFt verb in a similar sentence in Karitiana cannot be understood as referring both to a past and a present eventuality, as the possible paraphrases of (9) provided by our consultants illustrate. This fact suggests that the overt NFt morpheme in Karitiana is rather ambiguous, and realises two distinct morphemes realised alternatively in the Tense phrase. To conclude, it should also be noted that the underspecification of the NFt in Mandarin is restricted to stative/generic readings of bare predicates, but, as argued by Matthewson (2006), St'át'imcets allows for underspecified NFt for bare predicated with episodic readings. Surely there is more to say about the interpretation of underspecified tenses and their association with different predicative structures across languages; what seems to be the case, however, is that Karitiana does not allow such underspecified interpretations of non-future Tense neither in episodic (9a) more in habitual (9b) sentences.

Relative temporal reference: ordering times and events

In this section, we tackle the issue of the way in which temporal reference determines the ordering of temporal indices or of events between subordinate and matrix clauses. The following sections first discuss the types of tense marking found on subordinate clauses; next, the focus is shifted on the role of connectives, and of tense and aspect in generating the relations of anteriority and posteriority of eventualities in temporal adverbial clauses.

Tense in subordinate clauses: ordering times

At first sight, the picture of obligatory presence vs absence of Tense in matrix clauses cannot easily be extended to subordinate clauses, where tense marking follows a different type of optionality, related to structural constraints rather than to paradigmatic choices. That is, if we look at languages that allow for Tense to be marked in subordinate clauses, the presence of tense marking may depend on specific structural constraints in otherwise functionally equivalent constructions, such as the case of Portuguese purpose clauses and temporal adverbial clauses illustrates (11a,b, 12a,b). In Portuguese, for instance, the possibility of tensed or infinitival subordinate clauses seems to be correlated, among possibly other factors, to the presence vs. the absence of a conjunction, as illustrated by the contrast between (11a) vs. (11b) and (12a) vs. (12b).[9]

[9] We thank one of our reviewers for pointing this out to us.

(11) a. *João ped-iu   que   Maria   plant-asse   uma horta.*
John ask-PST COMP Maria plant-SUBJ.PST a   garden
'John asked Mary to plant a vegetable garden.'

  b. *João ped-iu   para   Maria   plant-ar   uma horta.*
John ask-PST for   Maria plant-INF   a   garden
'John asked Mary to plant a vegetable garden.'

(12) a. *João chegou   antes   que   Maria sai-u.*
John arrive-PST   before   COMP   Maria leave- PST
'John arrived before Mary left.'

b. *João chegou   antes de Maria sai-r.*
John arrive-PST   before of Maria leave-INF
'John arrived before Mary left.'

Turning now to subordinate clauses where tense inflection is marked, the interpretation of the embedded tense with respect to the available temporal anchors follows two possible patterns: either Tense is interpreted deictically with respect to utterance time (absolute Tense), or it is interpreted anaphorically with respect to the matrix tense (relative Tense, cf. Comrie 1985).

English provides the example of a language that displays absolute Tense in subordinate clauses. Complement clauses containing a stative predicate in English give rise to two readings: he subordinate tense morpheme appears to be ambiguous between an interpretation where the eventuality is simultaneous to the matrix tense or past-shifted with respect to it. Thus, the sentence in (13) can be interpreted in two ways, paraphrased by the explicit relation between the two matrix predicates in (a) and (b): either the state of Mary being sick is simultaneous with John's speech time (interpreted as past by virtue of the tense of the matrix verb), or it is anterior to it. That is to say, we may infer that past tense in the subordinate just gives the information that the predicate is true in the past of utterance time, there is no explicit relation with the reference time set by the matrix verb.[10]

(13)   *John said that Mary was sick.*

a. John said: "Mary is sick now."

b. John said: "Mary was sick in the past."

A similar ambiguity is not found when the predicate of the subordinate clause is in the present tense (14): in that case, the only available reading is that Mary is sick both at the time of John's saying and at utterance time, but not before (this reading is called the "double access reading" of the embedded present).

(14) *John said that Mary is sick.*

On the other hand, Japanese is a good example of a relative Tense language, that is, a language whose subordinate tense is always computed relative to the matrix tense and never with respect to the time of utterance. A past tense depending on a matrix verb in the past only has a shifted reading: the interpretation by which Hanako was sick at the time of Taroo's utterance is not available (15)

[10] Note that this is not a shared assumption – a different analysis states that the Past is just ambiguous between a past tense and an anaphoric tense, whose semantic value gets deleted in English (but not in Japanese) when embedded under the same tense operator.

(15) *Bernard-wa   [Junko-ga   byooki-dat-ta]-to   it-ta.*
      Bernard-TOP   [Junko-NOM   sick-be-PST]-COMP   say-PST
      Bernard said that Junko was sick.

<div align="right">(Arregui; Kusumoto, 1998, p. 1)</div>

a. #Bernard said: "Junko is sick now".

b. Bernard said: "Junko was sick in the past".

In Japanese, past morphology in the subordinate clause can only express that its predicate is past relative to the eventuality denoted by the matrix clause. Conversely, when the subordinate displays a NonPast tense, the interpretation can only be that the predicate denoted by the subordinate is simultaneous with the predicate of the matrix (16a). The absolute reading by which the present is deictic with respect to utterance time, which, as we have seen, is mandatory for the English embedded present (14), is not possible in Japanese (16b).

(16) *Taroo-wa   [Hanako-ga byooki-da]-to   it-ta*
      Taro-TOP   [Hanako-NOM sick-NPST]-COMP sick-PST

a. Taro said: "Hanako is sick now".

b. #Taro said that Hanako is sick (at the now of the speaker).

<div align="right">(Ogihara, 2011, p. 1476).</div>

As we will see, the distinction between the Japanese and English strategies of marking relative or absolute temporal reference may extend to subordinates beyond complement clauses, and concerns in particular temporal adverbial clauses.

To resume, relative tense gives information about the ordering between the eventualities denoted in the matrix and the subordinate, whereas absolute tense does not: in the latter case, tense relations are construed only between the predicate time and the time of utterance. How is the ordering of events expressed in absolute tense languages then? And what happens when, as it is the case in Karitiana, the subordinate clause does not display tense information at all?

Temporal clauses: ordering events

Temporal adverbial clauses are used to locate the eventuality expressed by the matrix predicate with respect to another eventuality, which is expressed in the subordinate clause (Sæbø 2011). In other words, in complex sentences of this type, the adverbial clause specifies the Topic Time with respect to which the matrix predicate should be evaluated. In this respect, considering only *before-* and *after*-sentences, one could identify two possible relations: anteriority and posteriority between the eventualities expressed by the matrix (A) and by the subordinate (B), as exemplified by the English examples below (17).

(17) a. *John left before Mary spoke.* Anteriority: A before B

     b. *John left after Mary spoke.* Posteriority: A after B

Looking at embedding strategies, languages may mark the ordering relation between the two events via functional markers such as Tense and Aspect or by resorting to temporal connectives whose lexical contribution is explicit enough so as to specify the ordering relation, such as *before, after, when* and their kins across languages. The type of information conveyed by each of these linguistic expressions can then be decomposed into a number of features that are responsible for the observed variation and for the possible cross-linguistic differences in meaning. In the following, we will start by considering the constructions that have received more attention in semantic studies, that of languages that display lexical connectives such as *before* and *after,* and consider the semantic contribution ascribed to these connectives in previous analyses. We will then turn to the case of Karitiana, where such temporal connectives are absent.

As we have seen in the previous sections, English temporal adverbial clauses display obligatory Tense morphology, but an embedded past tense in English does not provide information about the relative ordering of the eventuality with respect to the matrix: both precedence (18a) or subsequence (18b) are allowed.

(18) a. *John left after Maria arrived.*

     b. *John left before Maria arrived.*

Given this, it is generally assumed, in formal analyses, that the ordering relation between the two eventualities in (18) is specified by the temporal connectives *before* and *after* (Anscombe, 1964; Beaver; Condoravdi, 2003; Condoravdi, 2010). Previous analyses argue that *before-* and *after-*clauses in English and most European languages display covert coercion operators, such as EARLIEST and MAX, which create a downward-entailing environment that affects the veridicality of the embedded clause. This accounts for the asymmetry of *after* and *before* clauses with respect to the presence of Negative Polarity Items (NPIs) in English (19), or the use of the indicative vs. the subjunctive in Romance languages (20), among other relevant phenomena.

(19) a. *John left before anyone else.*

     b. **John left after anyone else.*

(20) a. *Gianni è partito prima che Luisa arrivasse/*è arrivata.* ITALIAN
       Gianni leave.PST   before that Luisa arrive-SUBJ / arrive.IND

     b. *Gianni è partito   dopo che   Luisa *arrivasse/è arrivata.*
       Gianni leave. PST after that   Luisa arrive-SUBJ / arrive.IND

Japanese is another language that displays obligatory Tense marking, but, as we have seen, the computation of embedded Tenses is relative to the matrix. According to Ogihara (1996), in temporal adjunct clauses the tense on the embedded predicate is anchored to the tense of the matrix and thus depends on the connector rather than on the location of the eventuality with respect to the utterance time: in *before*-clauses introduced by the connector *mae-* (21), in which the embedded eventuality follows in time the matrix eventuality time, the posteriority relation is signalled with the use of a non-past (present) tense. Conversely, the use of the past in the subordinate clause is necessary to express that the embedded eventuality happens before the one of the matrix, as in the case of after-clauses introduced by *ato-* (22).

(21) [*Ken-ga   ku-ru   mae-ni]   Anna-ga   kaet-ta.*
Ken-NOM   come-NPST   before-in Anna-NOM   leave-PST
'Anna left before Ken arrived'.

(Kubota *et al.* 2009, p. 2)

(22) [*Ken-ga   ki-ta   ato-ni]   Anna-ga   kaet-ta.*
Ken- NOM   come-PST   after-in Anna-NOM   leave-PST
'Anna left after Ken arrived.'

(Kubota *et al.* 2009, p. 2)

Therefore, it appears that, despite different Sequence of Tense (SoT) strategies, in Japanese and in English tense marking and connectives are both used in order to specify temporal location of the eventualities: while Japanese relative tense adds to the information given by connectives (Kubota *et al.* 2009), in English the connectives do the whole job. If we follow this line of reasoning, the relative weight of temporal connectives such as *before* and *after* appears to be even stronger in languages that display non-tensed adjunct temporal clauses. Going back to the example of Portuguese non-finite temporal clauses that we saw before, the only element of variation, in order to define the relation between the matrix and subordinate event, is given by the connective itself: in (23a,b), the connectives *antes* (before) and *depois* (after) are alone responsible for the ordering of the embedded event with respect to the matrix one.

(23) a. *João sai-u   depois de Maria cheg-ar.*
John leave-PST   after of Maria arrive.INF
John left after Mary arrived.

b. *João saiu   antes de Maria cheg-ar.*
John leave- PST   before of Maria arrive-INF
John left before Mary arrived.

Temporal adverbial temporal clauses and event ordering in Karitiana

In the remainder of this section, we discuss a case that seems, at first sight, at the opposite end of those presented so far. As we have seen in the previous sections, Karitiana has an obligatory Tense language in affirmative matrix clauses, where all predicates are inflected either for Fut or NFt tense (see examples (7a,b) and discussion). On the other hand, as we have seen in the previous section, Karitiana does not display any type of tense marking or connectives in subordinate clauses (Storto, 2013). The example below (24) illustrates again this point for complement clauses. In (24), the presence of the temporal adverb *koot* "yesterday" in the embedded complement clause (which is itself marked by the morpheme *ty*) does not trigger NFt tense marking on the predicate *pymyn* "busy", despite the fact that it is interpreted as past with respect to utterance time.[11]

(24) (Context: Yesterday Ana invited you and some friends to her place. You are talking with Maria about the party. Maria wonders why Ivã was not invited – You say :)

y-py-sondyp-yn   yn [koot   Ivã   pymyn pitat]-ty.
1sg-AST-know-NFT   I   [yesterday Ivan busy very]-OBL
'I know that Ivan was very busy yesterday'.

Looking now at temporal adverbial clauses, tenselessness combines in Karitiana with the absence of dedicated temporal connectives. What is then responsible for the ordering relation between the eventualities denoted by the matrix and the subordinate clauses? In the following, we will show that the Topic Time of the matrix clause is set in Karitiana by ordering the eventuality denoted by the matrix with respect to the eventuality denoted by the subordinate clause, and this is conveyed entirely by aspectual marking. Specifically, aspectual morphemes in the subordinate introduce the Topic Time by delimiting a temporal interval with respect to which the eventuality of the matrix has to be ordered. Thus, the meaning of *after*-clauses - namely, that the event of the matrix happens after that of the subordinate - is conveyed by perfect aspect in the subordinate, while in complex sentences with *before*-clauses - in which the event of the matrix happens before the one of the subordinate possibly occurs - the anteriority relation is expressed by a negative perfective aspect in the embedded clause. Since, strictly speaking, Karitiana temporal adverbial clauses cannot be defined as *after* or *before* clauses, in the following we will make reference to these adverbial clauses as constructions expressing, respectively, a subsequence or precedence relation between the matrix and the subordinate clause.

[11] While the subordinate in (21) translates as a complement clause in English, it is marked by oblique case in Karitiana, a fact that led Storto and Rocha (2014) to characterise structurally these constructions as either adverbial or relative clauses. On the other hand, Muller (p.c.) analyses sentences such as (24) as legitimate complement clauses, since the morpheme-*ty* is also an indirect object marker, and relative and adverbial clauses are not marked by *ty.*

Subsequence relation in Karitiana

Adverbial clauses that set the Topic Time for the matrix as an interval following a given eventuality do so by marking their predicate with the morpheme *byyk* (25).

(25) *[boroja taso popi byyk]-t   Ø-na-otam-Ø   João.*
    [snake man kill   PERF]-ADJ 3-DCL-come-NFT   João
    'João arrived after the men had killed the snakes.'

We claim that *byyk* is a perfect aspect marker in Karitiana, and not a lexical item similar to the conjunction *after.* Evidence that *byyk* is an aspectual auxiliary in the language comes from a number of facts. First, *byyk* can be found as an aspectual morpheme also in independent matrix clauses, where it denotes the completion of an event. Second, in matrix affirmative clauses it is inflected for tense and occurs in a typical aspectual position, which is next to the main verb. All these properties are illustrated in (26), where *byyk* is inflected with the Fut Tense morpheme.

(26) *Jonso   Ø-na-amang byyk-i   dibm   gok*
    Woman 3-DCL-plant   PERF-FUT tomorrow manioc
    'The woman will have planted (all) the manioc by tomorrow.'

The perfect aspect in the adverbial clause is able to do the work of the connective *after* without the help of tense, by expressing the meaning that the event of the subordinate occurs within an interval that strictly precedes the one of the matrix. We follow here the standard analysis for the denotation of Perfect aspect developed by formal studies, by which Perfect aspect expresses an ordering relation between two intervals or between an interval and a point in time, and conveys the information that the interval of the marked eventuality is located strictly before the other one (Klein, 1994), as illustrated by (27a-b). In sentence (27a), the temporal adverbial phrase introduces a point in time (5 pm) and the perfect aspect locates the event denoted by the sentence as occurring before this reference point. The temporal adverbial thus contributes to the interpretation of the sentence by introducing a Topic Time, that is, a temporal interval that restricts the interpretation of the past morpheme in English by locating the matrix event within a time span (e.g. the set of time intervals following 5 pm on a relevant day).

(27) a. *By 5:00 pm, João had arrived home.*

    b. *João arrive home* -----------5:00pm-----------UttTime--------→

The interpretation of (26) is illustrated with the help of temporal markers as in the schema (28). Perfect aspect has a standard interpretation

in Karitiana: *byyk* locates the interval corresponding to the event denoted by the predicate it modifies as occurring strictly before a temporal reference point, which is made explicit in (26) with the help of the deictic *tomorrow*. The reference point acts as a boundary for the interval defining the Topic Time of the sentence, that is, the interval restricting the interpretation conveyed by the Fut Tense morpheme that the eventuality is located after Utterance Time.

(28) [UT]—-------------[planting manioc]—-------------tomorrow--→
    UT   event time   RT

In temporal adverbial clauses, the perfect aspectual marker in the subordinate contributes the same information. Let's consider sentence (25) again.

(29) *[boroja   taso   popi byyk]-t   Ø-na-otam-Ø   João.*
     [snake   man   kill   PERF]-ADJ 3-DCL-come-NFT João
     'João arrived after the men had killed the snakes.'

The aspectual marker *byyk* in (25) orders the interval corresponding to the eventuality of the predicate it modifies (the killing of snakes) strictly before an implicit point in time. This reference point is then taken as the Topic Time for determining the occurrence of the event in the matrix clause, which, being tensed, specifies the occurrence of the two events with respect to Utterance Time. Literally, the meaning of (25) could be paraphrased in English as 'The men having killed the snakes, João arrived': the event of João arriving happened in the past, and more specifically it is located after a point in time that follows the killing of the snakes.

(30) a. *The men having killed the snakes, João arrived*

    b. [*the men kill the snakes*] ----RT ----[João arrive] ----UT----→

It is thus the meaning of anteriority to a Topic Time contributed by the Perfect Aspect that is responsible for expressing anteriority to the main clause event. Consequently, it is Aspect that does the job of the *after*-type connectives that we observe *across* languages.

Sentence (30a) illustrates the fact that the perfect aspect in the adverbial clause is able to do the work of the connective *after* without the help of tense, by expressing the meaning that the event of the subordinate occurs within an interval that strictly precedes the one of the matrix. (30b) illustrates how the perfect aspect locates the event denoted by the matrix as occurring after the event denoted by the subordinate, while both the eventualities are located before Utterance Time.

(31) a. *The men having killed the snakes yesterday at 5:00pm, João arrived at 6:00pm.*

   b. [*kill the snakes*]----*yesterday at 5:00----João arrive----*UT----→

Precedence relation in Karitiana

We now turn to clauses expressing a precedence relation, that is, to structures where the eventuality denoted by the predicate of the matrix clause precedes the one of the adverbial clauses, which defines the Topic Time for evaluating the temporal reference of the sentence. We claim that this temporal relation is also obtained in Karitiana by means of an aspectual morpheme in the subordinate clause, which, in this case, is the negative perfect morpheme *ki*, as in (31). The morpheme *-ki* is a negative aspectual auxiliary – it only generates negative statements. It is important to note that its negative contribution is not necessarily explicitly stated in the English translations, which follow the Portuguese translations offered by the consultants.

(32) *[João yry ki]-t Ø-na-otam-Ø Maria.*
[João come NEG.PERF]-ADJ 3-DCL-arrive-NFT Maria
'Maria arrived before João came.'
(Literally: 'João not having come, Maria arrived.')

Again, *ki* is not an adverbial subordinator that can be compared to the English connective *before*, nor a morpheme that merely expresses a type of propositional negation restricted to subordinate clauses (pace Vivanco; Vanrell, 2021). First, just like *byyk*, it may occur in independent clauses after the lexical verb, in the typical position of aspectual markers. Second, and again like *byyk,* in affirmative matrix clauses *ki* must be inflected for Fut or NFt Tense. These two properties are illustrated in the examples (32a-b).

(33) a. *Jonso Ø-na-amang ki-t gok koot.*
woman 3-DCL-plant NEG.PERF-NFT manioc yesterday
'The woman had not (yet) planted (all) the manioc yesterday.'

   b. *Jonso Ø-na- amangã ki-j dibm gok.*
woman 3-DCL-plant NEG.PERF-FT tomorrow manioc
'The woman will not have planted (all) the manioc tomorrow.'

The meaning of *ki* is slightly more complex than that of *byyk*. This aspectual negation does not express a relation between two intervals, but rather negates the occurrence of the subordinate event at the time the matrix event occurs. As we have just mentioned with respect to *byyk*, perfect aspect expresses that the interval of some eventuality is located strictly before some Topic Time. Accordingly, the Negative Perfect

states the non-occurrence of an eventuality before an interval or point in time that defines the TT for the sentence. Sentence (33a) states the non-occurrence of the event denoted by the matrix before an established Topic Time (5pm), which is represented in (33b).

(34) a. *At 5:00 pm, João had not arrived home.*

     b. *-- NOT João arrive home ---------5:00pm---------UT---------→*

Accordingly, the interpretation of sentence (32a) is explicated below, with the help of an explicit timeline.

(35) -------[NOT planting manioc] ------- yesterday -------[UT]----→
             event time   RT   UT

With this in mind, let's get back to sentence (31), which informants freely give as a translation of a *before*-clause.

(36) *[João   yry   ki]-t   Ø-na-otam-Ø   Maria.*
     [João   come NEG.PERF]-ADJ 3-DCL-arrive-NFT Maria
     'Maria arrived before João came.'

Sentence (31) states the occurrence of the matrix event before a Topic Time established by the subordinate clause - the time interval in which John has not come - as illustrated by the representation in (35). The aspectual marker *ki* in (31) orders the interval corresponding to the eventuality of the predicate it modifies (the coming of João) strictly before an implicit point in time, which defines a temporal interval that acts as the Topic Time for the matrix clause, which, being tensed, specifies the occurrence of the eventuality denoted by its predicate with respect to Utterance Time. Being a negative morpheme, *ki* also asserts that the eventuality did not occur within the TT. Literally, then the meaning of (31) could be paraphrased in English as 'João having not come, Maria arrived'[12]: the event of Maria arriving happened in the past, and more specifically it is located before a point in time that delimits an interval within which the eventuality of João coming had not happened.

(37) a. *João not having come, Maria arrived.*

     b. *João not coming-----------Maria arrive------------UT------------*

In other words, the negative perfect states that the subordinate clause event has not occurred until the main clause event occurred. This result is in accordance with the fact that *before*-clauses do not entail the occurrence of the events they denote: it is well-known that the occurrence of the eventuality denoted by the *before*-clause is implicated rather than implied and that its non-occurrence can be stated without contradiction,

[12] The choice of the perfect instead of the plain gerund (i.e. *João not coming, Maria arrived)* to paraphrase the Karitiana subordinate clause has been made to stress that we are dealing with a perfect aspect. The perfect value of -ki is demonstrated by the fact that it only occurs when the predicate is taken to precede some Topic Time.

as shown by the perfect acceptability of a sentence such as (36) (Beaver; Condoravdi, 2003).

(38) *Mozart died before he finished the Requiem.*

The inference that Mozart finished the Requiem after he died is not pragmatically accessible for the hearer of (36), and yet the sentence is perfectly fine; this inference is then more determined by the context of the assertion than by the logical properties of the connective. In Karitiana, the direction of the pragmatic inference seems, so to speak, to be the opposite: it is the non-occurrence of the eventuality which is implicated, and it is the assertion of its occurrence *after* the occurrence of the main clause which may be asserted without contradiction, as attested by the judgments that informants give for sentence (37a) and its continuation in (37b).

(39) *[Director otam ki]-t* *Ø-na-amejn* *owã*
Director come NEG.PERF-OBL 3-DCL-enter children
'The director not having arrived, the kids entered,
[…] *ambyyk 4 hora-t* *Ø-na-otam* *diretor.*
then 4 hour-ADJ 3-DCL-arrive director
but then at 4pm the director arrived'

The non-veridicality of *before*-clauses in English, as opposed to the veridicality of *after*-clauses, has been given different accounts in the literature. According to one line of analysis, *before* and *after* should be assigned different quantificational force as part of their lexical content (Ogihara, 1996, Arregui; Kusumoto, 1998). As observed by Kubota, Lee Smirnova & Tonhauser (2009), however, an account based on lexical idiosyncrasy does not account for the cross-linguistic pervasiveness of the contrast. While our analysis of Karitiana is still in need of a proper formal development, our data would support a different approach, defended e.g. by Beaver & Condoradvi (2003), by which the non-veridicality of *before* is fundamentally modal in nature and should not be attributed to the meaning of the temporal connective, but rather be imputed to more general constraints depending on the asymmetry between events occurring before or after the time of evaluation, which in the case of complex sentences is defined by the temporal clause.

Final remarks

In this paper, we set out to investigate how languages make use of grammatical strategies in order to express temporal reference. We brought to the foreground the case of Karitiana, an understudied indigenous language of Brazil, and focussed on temporal adverbial clauses that express the meanings of anteriority and posteriority to some reference time.

Of the set of languages we have discussed - English, Portuguese, Japanese and Karitiana - all of them, except Karitiana, make use of temporal connectives with meanings similar to *before* and *after.* These connectives locate the main clause eventuality relative to the subordinate clause. Among these languages, Japanese makes use of relative tense. Relative tense, like temporal connectives, locates the tense of the subordinate clause relative to the tense of the matrix clause. Finally, among the four languages, only Karitiana makes use of the perfect aspect to express anteriority or posteriority of the subordinate clause eventuality relative to the main clause eventuality. We thus conclude that natural languages choose among a restricted array of grammatical tools at their disposal in order to express the meanings of anteriority and posteriority - tense, aspect and temporal connectives. To conclude our discussion about the resolution of temporal reference, then, we should add an important disclaimer: we remind readers that, for methodological reasons, this paper has only focussed on the role of grammatical tools, setting aside the very important role of context and pragmatic reasoning.

Abbreviations

1s: 1st person singular	cop: copula	obl: oblique
3: third person	IND: indicative	PART: participle
ADJ: adjunct	INFT: infinitive	PST: past
COMP: complementizer	FUT: future tense	PERF: perfect
COMP: complementizer	NEG.PERF: negative.perfect	POS: postposition
DCL:declarative.mood	NFT: non-future tense	PROG:progressive
DEG: degree	NPST: non-past tense	SUBJ: subjunctive
	NOM: nominative	TOP: topic

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Viajando no tempo: algumas considerações interlinguísticas

Resumo

Este artigo investiga as estratégias gramaticais que as línguas naturais empregam para expressar a referência temporal de sentenças. Mostramos que essa referência temporal é gerada através da combinação de um conjunto de mecanismos que são limitados pela metafísica da linguagem natural e que são distribuídos de modo distinto através das línguas. Mais especificamente, o artigo discute as orações adverbiais temporais que expressam significados de anterioridade e de posterioridade em relação a um determinado tempo de referência. Levamos em consideração um conjunto relevante de línguas que fazem uso de estratégias distintas para gerar esses significados e concluímos que essas ferramentas que as línguas empregam consistem em um número restrito que inclui tempo, aspecto e conectivos temporais.

Palavras-chave: *orações temporais. línguas indígenas. variação entre línguas. antes. depois.*