

# Variation in Tense and Aspect, and the Temporal Interpretation of Complement Clauses

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## Abstract

In this paper, we investigate the temporal interpretation of propositional attitude complement clauses in four typologically unrelated languages: Washo (language isolate), Medumba (Niger-Congo), Hausa (Afro-Asiatic), and Samoan (Austronesian). Of these languages, Washo and Medumba are optional-tense languages, while Hausa and Samoan are tenseless. Just like in obligatory-tense languages, we observe variation among these languages when it comes to the availability of so-called simultaneous and backward-shifted readings of complement clauses. For our optional-tense languages, we argue that a Sequence of Tense parameter is active in these languages, just as in obligatory-tense languages. However, for completely tenseless clauses, we need something more. We argue that there is variation in the degree to which languages make recourse to *res*-movement, or a similar mechanism that manipulates LF structures to derive backward-shifted readings in tenseless complement clauses. We additionally appeal to cross-linguistic variation in the lexical semantics of perfective aspect to derive or block certain readings. The result is that the typological classification of a language as tensed, optionally tensed, or tenseless, does not alone determine the temporal interpretation possibilities for complement clauses. Rather, structural parameters of variation cross-cut these broad classes of languages to deliver the observed cross-linguistic picture.

## 1 INTRODUCTION AND BACKGROUND

### 1.1 *The Phenomenon*

Let's start with an old observation. In English, a past tense in a stative or progressive complement clause embedded under a past-marked attitude verb can be used to report (1-a). However, it can also be used to report (1-b), a phenomenon referred to as sequence of tense (SoT). Let us call (1-a) a backward-shifted reading, and (1-b) a simultaneous reading.<sup>1</sup>

- (1) *Mary said [that John was sick].*  
 a. Mary said: "John was sick." (backward-shifted reading, SHIFT)  
 b. Mary said: "John is sick." (simultaneous reading, SIM)

But such a configuration is not compatible with a simultaneous reading in all languages. Take Japanese, for instance. The sentence in (2) can only have a backward-shifted reading (Kusumoto, 1999, 2005; Ogihara, 1989, 1995, 1996; Ogihara & Sharvit, 2012). Present tense morphology is required on the embedded verb to convey the simultaneous reading, as illustrated in (3).

- (2) *Taro-wa [Hanako-ga byooki-dat-ta to] it-ta.*  
 Taro-TOP. Hanako-NOM. sick-be-PAST that say-PAST  
 'Taro said that Hanako was sick.' (SHIFT only)
- (3) *Taro-wa [Hanako-ga byooki-da to] it-ta.*  
 Taro-TOP. Hanako-NOM. sick-PRES that say-PAST  
 'Taro said that Hanako was sick.' (SIM only)

While English and Japanese differ when it comes to the tense morphology they use to convey the simultaneous reading, both have in common that they grammaticalize tense. Not all languages do, however. Morphologically overt tense marking may be entirely absent in a language (Bittner, 2005; Jóhannsdóttir & Matthewson, 2008; Lin, 2012; Matthewson, 2006; Mucha, 2013; Shaer, 2003; Tonhauser, 2011) or it may be optional (Bochnak, 2016; Cable, 2017; Mucha, 2017; Mucha & Fominyam, 2017; van Egmond, 2012). In this paper, we examine to what extent this variation affects the temporal interpretation of attitude complements. To this end, we contribute data from four typologically unrelated and under-researched languages, the optional-tense languages Washo (language isolate) and Medumba (Niger-Congo), and the tenseless languages Hausa (Afro-Asiatic) and Samoan (Austronesian). Our main finding is that the observed variation in tense systems is not a decisive factor when it comes to the availability of backward-shifted and simultaneous readings in complement clauses. Whatever mechanisms the grammar employs to derive

1 In adopting the term "reading" here, we follow the widespread assumption in the literature that the distinct paraphrases in (1-a) and (1-b) amount to a structural ambiguity. Several authors have rejected this assumption in recent work (Altshuler, 2016; Altshuler & Schwarzschild, 2013; Gennari, 2003), questioning the extent to which the perceived simultaneous reading has distinct truth conditions from the backward-shifted reading. We would like to thank one of our reviewers for extensive discussion of this point.

the two readings appears to independently be subject to variation across languages. These include a mechanism for not interpreting an embedded tense, and a mechanism for deriving a backward-shifted interpretation for tenseless embedded clauses.

More specifically, our analysis makes use of two mechanisms that derive the cross-linguistic patterns we observe. The first is a syntactic licensing rule (Sequence of Tense rule) that prevents an embedded morphological tense from inducing a semantic backward shift, i.e., it derives a simultaneous interpretation for a past-under-past configuration (e.g., Ogihara 1989; Stowell 1996). Just as in the more familiar obligatory-tense languages, this mechanism is subject to cross-linguistic variation in optional-tense languages as well. The second mechanism is one that allows an embedded temporal pronoun to be interpreted outside the scope of the attitude verb. In this paper, we model this as *res*-movement (e.g., Abusch 1997; Heim 1994). Whereas the existence of a Sequence of Tense rule is categorical (either a language has this rule in its grammar or it does not), we find that variation in the second mechanism is non-categorical: languages differ in the *extent* to which a *res*-movement-type mechanism is available to derive the relevant interpretations. Our analysis furthermore depends on the inventory of temporal and aspectual operators available in each language. For instance, variation in the perfective operators in Hausa *vs.* Samoan is at least partially responsible for the observed variation between these languages. The paper thus complements the cross-linguistic picture that is already familiar from the literature, and provides new insights into what governs the availability of simultaneous and shifted readings cross-linguistically.

The paper is structured as follows: The next subsection outlines a variant of what we consider a standard analysis of English (1) and of the variation that results in the unavailability of the simultaneous reading for Japanese (2). Subsection 1.3 zooms out and surveys cross-linguistic variation in tense systems, as well as our analytical assumptions regarding tenseless and optional-tense languages. Sections 2 and 3 constitute the empirical core of the paper, where we discuss the interpretative possibilities of complement clauses in optional-tense and morphologically tenseless languages. All data presented in these sections come from original fieldwork conducted independently by the authors, unless otherwise noted. Data were elicited following the methodology outlined in Matthewson (2004, 2011) using translation, production and acceptability judgment tasks. Section 4 then discusses our findings in the light of the broader underlying question of how variation in tense systems interacts with the temporal interpretation of embedded structures. Section 5 concludes.

## 1.2 A Structural Analysis of the Variation between English and Japanese

In this section, we spell out our assumptions about the analysis of past-under-past in complement clauses in English and Japanese. We adopt a quantificational approach to tense and a structural approach to the perceived ambiguity between the simultaneous and the backward-shifted reading, which derives them from two distinct Logical Forms (LFs).

**The Semantics of Past.** Following, among many others, Ogihara (1989, 1995, 1996), Kusumoto (1999, 2005) and von Stechow (2009) (building on the early work of Prior (1967), Montague (1973), and Dowty (1979)), we assume here that past tense in English is a quantificational operator with the semantics in (4). The presence of this operator at Logical Form licenses past tense verbal morphology and existentially quantifies off the

time argument that the main predicate introduces.<sup>2,3</sup> A simple sentence like (6-a) (and its Japanese equivalent) under this analysis receives the interpretation in (6-b), based on the LF sketched in (7).

- (4)  $\llbracket \text{PAST} \rrbracket = \lambda p_{(i,t)}. \lambda t_i. \exists t' [t' < t \ \& \ p(t')]$   
 (5)  $\llbracket \text{sick} \rrbracket = \lambda w_s. \lambda t_i. \lambda x_e. x \text{ is sick at } t \text{ in } w$   
 (6) a. *John was sick.*  
 b.  $\llbracket (6\text{-a}) \rrbracket = 1 \text{ iff } \exists t' [t' < t^* \ \& \ J \text{ is sick at } t' \text{ in } w_{@}]$   
     with  $t^*$  the utterance time and  $w_{@}$  the actual world  
     ‘There is a time before the utterance time  
     such that John was sick at that time in the actual world.’  
 (7) LF for matrix sentence with past tense:  
 $[t^* [_{\text{TP}} \text{PAST} [_{(i,t)} \lambda t [_{\text{VP}} \text{John sick}_{w_{@},t} ]]]]$

A couple of remarks on the LF structure in (7): Following, in particular, Kusumoto (1999, 2005) and von Stechow & Beck (2015), we assume that the utterance time is syntactically represented as a deictic temporal proform in the highest level of the clause structure (see section 1.3 for details). While such an assumption is also plausible for the world proform that represents the actual world, we simplify in (7) and plug this variable directly into the world argument slot of the verb. The temporal argument of the verb is syntactically represented and then abstracted over. A non-overt representation would be possible and derive the same truth conditions. With these basic ingredients for temporal interpretation in place, we now turn to the temporal interpretation in embedded environments in English.

**The Interpretation of Past-under-Past in English.** Structural approaches treat the two readings of English sentences like (1), where a past tense is embedded in a complement clause under an attitude verb that is marked for past, as exactly that, the result of a structural ambiguity (Abusch, 1997; Grønn & von Stechow, 2010; Kratzer, 1998; Kusumoto, 1999, 2005; Ogihara, 1989, 1995, 1996; Ogihara & Sharvit, 2012; von Stechow, 2009). Under the quantificational approach to past tense, our example in (1) is then assigned two distinct LFs, sketched in (8) and (9). Crucially, the LF for the simultaneous reading lacks a PAST-operator in the embedded clause. We will come back to this in a moment, after we have introduced the semantics we assume for attitude verbs.

- (1) *Mary said [that John was sick].*  
 a. Mary said: “John was sick.” (SHIFT)  
 b. Mary said: “John is sick.” (SIM)  
 (8) LF for backward-shifted reading:  
 $[\text{PAST}_{t^*} \lambda t [\text{Mary say}_{w_{@},t} [_{(s,(i,t))} \lambda w \lambda t' [\text{PAST}_{t'} [_{(i,t')} \llbracket \text{John sick}_{w,t'} \rrbracket ]]]]]]$

- 2 For the time being, our semantic ontology consists only of four basic types,  $e$  for entities,  $t$  for truth values,  $i$  for times, and  $s$  for possible worlds. We introduce events (type  $v$ ) in section 3. For now, we abstract away from the role of aspect as a mediator between events and times.  
 3 Throughout the paper, this quantificational operator lacks the contextual domain restriction that would account for the pronominal behavior of past tense (see, e.g., Kusumoto, 1999, 2005; Musan, 1997, 2002; von Stechow, 2009), i.e.,  $\llbracket \text{PAST}_C \rrbracket^g = \lambda t_i. \lambda p_{(i,t)}. \exists t' [t' \in g(C) \ \& \ t' < t \ \& \ p(t')]$ . This is a simplification.

(9) LF for simultaneous reading:

$$[\text{PAST}_{t^*} \lambda t [\text{Mary say}_{w@,t} [\lambda p_{(s,(i,t))} \lambda w \lambda t' [\text{John sick}_{w,t'}]]]]$$

A semantics for *say* is provided in (10). Here, the verb is a modal operator that universally quantifies over the worlds that are compatible with what speaker  $x$  says in the evaluation world  $w$  at the evaluation time  $t$ , and asserts that its propositional argument is true in these worlds at the time that the speaker represents to themselves as their now (Abusch, 1997), which, for any individual  $x$ , any world  $w$  and any time  $t$ , we write as  $\text{NOW}_x(w, t)$ .<sup>4</sup>

- (10)  $\llbracket \text{say} \rrbracket = \lambda w_s. \lambda t_i. \lambda p_{(s,(i,t))}. \lambda x_e. \forall w' [w' \in \text{SAY}(x, w, t) \rightarrow p(w')(\text{NOW}_x(w', t))]$   
with  $\text{SAY}(x, w, t)$  the set of worlds that are compatible with what  $x$  said in  $w$  at  $t$   
and  $\text{NOW}$  a function relating  $t$  to the attitude holder  $x$ 's now in a world  $w'$

With this semantics for attitude verbs, we derive from (8) the truth conditions in (11) for the backward-shifted reading, and from (9) the truth conditions in (12) for the simultaneous reading (see below for discussion). While the LF that generates *SHIFT* in (8) is true to the morphology that we see on the surface, deriving the LF for the simultaneous reading in (9) relies on an auxiliary mechanism by which the lower past is not interpreted as such.

- (11)  $\llbracket (8) \rrbracket = 1$  iff  $\exists t [t < t^* \ \& \ \forall w [w \in \text{SAY}(\text{M}, w@, t) \rightarrow \exists t' [t' < \text{NOW}_{\text{M}}(w, t) \ \& \ \text{J is sick at } t' \text{ in } w]]]$  (SHIFT)

“There is a time  $t$  before the utterance time such that in all worlds  $w$  that are compatible with what Mary said at  $t$  in the actual world, there is a time  $t'$  that precedes the time that Mary identifies as  $t$  in  $w$  and John is sick at that time  $t'$ .”  
(time of saying > time of sickness)

- (12)  $\llbracket (9) \rrbracket = 1$  iff  $\exists t [t < t^* \ \& \ \forall w [w \in \text{SAY}(\text{M}, w@, t) \rightarrow \text{J is sick at } \text{NOW}_{\text{M}}(w, t) \text{ in } w]]]$  (SIM)

“There is a time  $t$  before the utterance time such that in all worlds  $w$  that are compatible with what Mary said at  $t$  in the actual world, John is sick at the time that Mary identifies as  $t$  in  $w$ .”  
(time of saying = time of sickness)

Several implementations of such a mechanism exist in the literature, ranging from an explicit deletion operation for the PAST-operator under certain conditions (Grønn & von Stechow, 2010; Ogihara, 1989, 1995, 1996) to a more refined view of how the past morphology on the embedded verb is licensed (Kauf & Zeijlstra, 2017; Kusumoto, 1999, 2005; von Stechow, 2009). Assuming a deletion rule like (13) adopted from the work of Toshiyuki Ogihara, the LF for the simultaneous reading in (9) is generated from the LF in (8) by deleting the lower PAST-operator. As a result, the embedded tensed proposition will be interpreted as true at the attitude holder's now at the reference time.

(13) Past-under-Past Deletion Rule:

A past tense operator  $\alpha$  may be deleted if and only if  
 $\alpha$  is locally c-commanded by another past tense operator  $\beta$ .

4 In most cases, the time that the speaker represents to themselves as their now will be the time of saying, the evaluation time for the verb, that is  $\llbracket \text{say} \rrbracket = \lambda w_s. \lambda t_i. \lambda p_{(s,(i,t))}. \lambda x_e. \forall w' [w' \in \text{SAY}(x, w, t) \rightarrow p(w')(t)]$  under this simplified view. For the semantics of propositional attitude verbs, we also refer the reader to Hintikka (1969) and Lewis (1979).

Under a slightly different view of the derivation of the LF for the simultaneous reading, the past tense morphology that we see on the surface in the complement clause may also be licensed by the PAST-operator in the matrix clause. More specifically, under an account along the lines of Stowell (1996) and Kusumoto (1999, 2005), past tense morphology on the verb translates to a tense variable at LF that needs to be licensed by some c-commanding past tense operator, (14).

(14) Tense Licensing Rule:

A tense variable that translates to past tense morphology on the verb may be licensed by any c-commanding past tense operator.

In the case of the LF for the simultaneous reading in (9), the upper PAST licenses both the past tense morphology on the attitude verb and on the embedded verb. For concreteness, we will mostly talk about sequence of tense as involving a deletion operation targeting the lower tense operator, though we remain agnostic to the choice between (13) and (14). Before we move on to the variation between English and Japanese when it comes to this operation, let us point out that, regardless of the mechanism adopted for enforcing that the lower past be not interpreted as such, the prevalent approaches to sequence of tense in the literature have in common that they treat the two readings as the result of a structural ambiguity.

**Capturing the Variation between English and Japanese.** Under the structural approach to sequence of tense, the unavailability of a simultaneous interpretation for Japanese past-under-past is conceptualized as the unavailability of the structural mechanisms that derive the relevant LF. In (2), the embedded past tense thus necessarily translates to a past tense operator in the embedded clause, yielding the backward-shifted reading. Japanese is thus morphologically transparent when it comes to the temporal interpretation of embedded complement clauses.

(2) *Taro-wa [Hanako-ga byooki-dat-ta to] it-ta.*

Taro-TOP. Hanako-NOM. sick-be-PAST that say-PAST

‘Taro said that Hanako was sick.’ (SHIFT only)

The variation between English and Japanese when it comes to the temporal interpretation of past-under-past in complement clauses can therefore be thought of as reflecting a parametric point of morpho-syntactic variation. We capture this descriptive generalization as the Sequence of Tense parameter in (15).

(15) The Sequence of Tense Parameter [ $\pm$  SoT]:

A language {does/ does not} allow for Past-under-Past Deletion.

The [ $\pm$  SoT] parameter describes a dependent point of cross-linguistic variation: languages that lack temporal operators (and a past tense operator in particular) lack the prerequisites for Past-under-Past Deletion and thus can plausibly only have a (vacuously) negative setting of the parameter in (15). Variation in the composition underlying simultaneous readings thus in principle interacts with variation in the temporal architecture of languages. The next section provides a brief survey of variation in this area of the grammar, introduces the LF structures we are assuming, and discusses the predictions of the variation for temporal interpretation in embedded environments.

### 1.3 *Cross-linguistic Variation in Tense Systems*

Although the temporal interpretation of complement clauses has been studied in a variety of obligatory-tense languages (see references above), relatively little is known about complement clause interpretation in tenseless or optional-tense languages. Given the recent uptick in formal semantics research on tenseless and optional-tense languages, we should ask to what extent these typological differences in the grammaticalization of tense systems play a role in deriving cross-linguistic variation in the temporal interpretation of complement clauses. Previewing our conclusion, we will show that variation in the availability of backward-shifted and simultaneous readings is largely independent of whether a language has obligatory or optional tense, or is tenseless altogether.

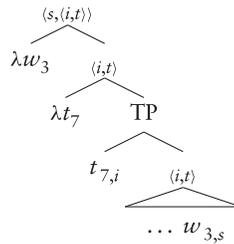
Languages without morphological tense marking have been examined quite extensively in the last decade (Bittner, 2005, 2014; Bohnemeyer, 2002, 2009; Jóhannsdóttir & Matthewson, 2008; Lin, 2003, 2006, 2010; Matthewson, 2006; Mucha, 2013; Shaer, 2003; Tonhauser, 2011). How exactly morphologically tenseless languages should be analyzed is a matter of debate. Whereas certain authors have proposed analyses positing covert tenses (Jóhannsdóttir & Matthewson, 2008; Matthewson, 2006), others propose genuinely tenseless analyses without temporal operators (Mucha, 2013; Smith & Erbaugh, 2005; Smith *et al.*, 2007; Tonhauser, 2011). The same point can be made for optionally tenseless languages, which differ from the above mentioned languages in that their grammar contains overt functional tense morphemes. In contrast to languages such as English and Japanese, finite clauses in optional-tense languages are grammatical without morphological tense marking. Morphologically tenseless clauses in these languages have also received analyses with covert semantic tenses (Cable, 2017) or without (Bochnak, 2016; Mucha, 2017).

In the present paper, we are concerned with Washo and Medumba, both optional-tense languages, as well as with two languages that, on a descriptive level, qualify as tenseless, namely Hausa and Samoan. Before examining the individual languages in detail, let us first lay out our assumptions about the structure of morphologically tenseless clauses in both tenseless and optional-tense languages. We work on the assumption of a uniform LF structure for morphologically tenseless clauses. As illustrated in (16), we assume that tenseless clauses contain a phonologically covert, indexed temporal pronoun that represents the reference time. In the matrix case, this temporal pronoun is free and receives its value from context via the variable assignment function.<sup>5</sup>

5 As pointed out by a reviewer, assuming a free reference time pronoun as in (16) makes the prediction that future interpretations are available for matrix clauses, unlike in Matthewson (2006)'s analysis of *S'tát'imcets*, where a covert non-future tense is proposed to rule out future interpretations. It is true that, according to our consultants' judgments, future interpretations are dispreferred in simple matrix clauses in all the languages in our sample. However, as discussed in more detail in Mucha (2015), Bochnak (2016), and Hohaus (2017, to appear), future interpretations in the absence of morphological future marking are attested in Washo, Hausa, Medumba, and Samoan. A tensed analysis of temporally unmarked clauses along the lines of Matthewson (2006) thus is not plausible for these languages. Since similar observations have been made for other languages as well (see, e.g., Tonhauser (2011) for Paraguayan Guaraní), we consider this a more general open issue for research on superficially tenseless languages that goes beyond the scope of this paper, and maintain the uniform analysis of tenseless clauses sketched in (16) for simplicity.

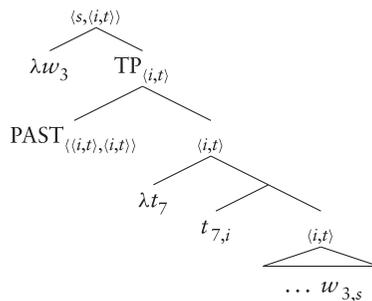


- (18) LF-structure of a tenseless complement clause:  
 Predicted reading: SIM



As for complement clauses containing (optional) past tense, we follow [Ogihara \(1996\)](#) and [Kusumoto \(2005\)](#) in assuming that deictic pronouns such as  $t^*$  cannot occur in attitude complements since “the speech time (i.e., the time of context) is fully accessible only from the speaker of the entire sentence” ([Ogihara, 1996](#), p. 211). A past-marked complement clause will thus denote a property of times with no reference to the time of utterance. Therefore, given our semantic background assumptions laid out in section 1.2, the reading that we generate without additional machinery is the backward-shifted reading for the structure given in (19).

- (19) LF-structure of a past-marked complement clause:  
 Predicted reading: SHIFT



To summarize this section, our background assumptions about the LF architecture of tense, along with the semantics of past tense and attitude verbs, predict that semantic composition yields the simultaneous reading for tenseless complement clauses and the backward-shifted reading for past-marked complement clauses. As extensively discussed in the previous literature on SoT phenomena, simultaneous readings of past-under-past complements require an additional mechanism such as an SoT deletion rule or long-distance licensing (see section 1.2). In the remainder of this paper, we show that there is variation in the availability of simultaneous readings of past-under-past in languages without obligatory tense marking, and we propose an analysis of this variation. For our purposes, it is important to point out that backward-shifted readings of tenseless complement clauses require additional assumptions as well. To the best of our knowledge, cross-linguistic variation in this area has not been discussed in the literature so far. However, since the

languages in our sample also differ in the availability of backward-shifted readings of bare complements, we make a proposal for the source of this variation in section 2.3.

With the above background at hand, we are now in a position to discuss the relevant data for each language in turn, starting with the optional-tense languages in the next section.

## 2 THE VIEW FROM OPTIONAL-TENSE LANGUAGES

In this section, we present data from two optional-tense languages that differ with respect to the available temporal readings of complement clauses. In Medumba, past-under-past configurations only allow for a backward-shifted interpretation, while in Washo, both the simultaneous and the backward-shifted interpretation are attested. We also observe variation between these languages with respect to the readings available for tenseless complement clauses. On the basis of these observations, we argue for two points in this section. First, appeal to the SoT Parameter in (15) can capture the difference between optional-tense languages in the interpretation of past-marked complement clauses. Second, variation in the interpretative possibilities for covert reference time pronouns in morphologically tenseless clauses points to variation in the mechanisms targeting temporal pronouns in embedded clauses to derive backward-shifted interpretations.

Section 2.1 focuses on Washo, which we argue is a +SoT language. We also argue that embedded temporal pronouns in Washo can freely undergo *res*-movement in order to derive backward-shifted readings for morphologically tenseless complement clauses. Meanwhile in section 2.2, we argue that Medumba is a –SoT language in which *res*-movement of embedded temporal pronouns is much more restricted. Thus, variation between the two languages can be accounted for by variation in the SoT parameter settings, and the general applicability of a mechanism to derive backward-shifted readings, which for concreteness we will assume is *res*-movement (Abusch, 1997; Heim, 1994).

### 2.1 The Case of Washo

2.1.1 *Background* Washo is a highly endangered language spoken in California and Nevada, USA (Jacobsen, 1964). It is considered a language isolate, though has been linked to the hypothesized Hokan family (Mithun, 1999). Washo is an optional-tense language: a morphologically unmarked (tenseless) clause can receive a past or present interpretation, while adding the past marker *-uŋil* forces a past interpretation (Bochnak, 2016). For instance, morphologically tenseless clauses like in (20-a) can receive a past or present interpretation, while (20-b) can only receive a past interpretation. The morpheme *-uŋil* in Washo is a general past tense, and carries no information about temporal remoteness. Following Bochnak (2016), we treat *-uŋil* as a past tense, and assign it the same semantics as the English past tense as in (21).<sup>7</sup>

- (20) a.  $\emptyset$ -háʔaš-i  
           3-rain-IND  
           ‘It is raining.’ / ‘It rained.’ / ‘It was raining.’  
       b.  $\emptyset$ -háʔaš-uŋil-i  
           3-rain-PAST-IND  
           ‘It rained.’ / ‘It was raining.’

7 Bochnak (2016) works within a pronominal rather than quantificational framework for tense in Washo, but this point is not relevant for us here.

$$(21) \llbracket -u\eta il \rrbracket = \llbracket \text{PAST}_{(\text{English})} \rrbracket = \lambda p_{(i,t)}. \lambda t_i. \exists t' [t' < t \ \& \ p(t')]$$

Note that aspect is also not obligatorily marked in Washo, and aspectually unmarked sentences can receive perfective or imperfective interpretations (Bochnak, 2016). Past and present interpretations of morphologically tenseless clauses are freely available, depending only on context and not on the lexical aspectual class of the predicate, as shown in (22) and (23).

(22) Present and past interpretation of statives (adapt. from Bochnak 2016)

a. Context: Discussing today's weather.

*wá:dín wa-yák'aš-i*

today STATIC-warm-IND

'It (the weather) is warm now.'

b. Context: What did you eat for dinner last night?

*léw di-bišápu?-i-š-ηa démlu-ηa dáηal-a ?-i?i-yé:s-i*

1PRO.PL 1-be.hungry-IND-SR-but food-NC house-LOC 3-exist-NEG-IND

'We were hungry, but there was no food in the house.'

(23) Present and past interpretation of eventives (adapt. from Bochnak 2016)

a. Context: You just finished dinner, and everyone left the kitchen except for Mona.

You ask someone what she is up to now. They tell you:

*zí:gín hénuη ∅-guwáwa?-i-š-ge mó:na mí?le? ∅-gáma?-i*

chicken little.bit 3-remain-IND-SR-OBJ.REL Mona all 3-eat.up-IND

'Mona is eating up all the little bits of chicken that are left over.'

b. Context: You just finished dinner; chicken was served, your favorite food.

*zí:gín di-gáma?-i*

chicken 1-eat.up-IND

'I ate up the chicken.'

Future interpretations of morphologically tenseless clauses are more restricted, but also not systematically absent (see Bochnak 2016 for examples and discussion). In many contexts, speakers require an overt future marker, such as the prospective aspect *-aša?*, as in (24).

(24) Context: I ask you what the weather will be like later today.

*wá:dín dewp'áwíd ∅-há?aš #(-aša?-i)*

today evening 3-rain-PROSP-IND

'It's going to rain tonight.'

(adapt. from Bochnak 2016)

Washo furthermore has no dedicated present tense. Following the framework laid out in section 1.3, we assume that morphologically tenseless clauses also lack a semantic tense operator, but contain a reference time pronoun, which is generally constrained to non-future times. Given this analysis, as well as the analysis of *-uηil* as a past tense, the simplified LFs and truth conditions we assume for (20-a) and (20-b) are given in (25-a) and (25-b), respectively.

(25) a.  $[\text{TP } t_{3,i} \lambda t [\text{VP } \text{rain}_{t,w@}]]$   
 $\llbracket (20\text{-a}) \rrbracket^g = 1$  iff it rains in  $w@$  at  $g(3, i)$

b.  $[\text{TP } \text{PAST}_{t*} \lambda t_3 t_{3,i} \lambda t [\text{VP } \text{rain}_{t,w@}]]$   
 $\llbracket (20\text{-b}) \rrbracket^g = 1$  iff  $\exists t [t < t* \ \& \ \text{it rains in } w@ \ \text{at } t]$

2.1.2 *The Temporal Interpretation of Complement Clauses in Washo* Moving on to complement clauses, we find that both tensed and tenseless clauses with past reference may be embedded under tensed or tenseless matrix clauses with past reference (Bochnak, 2017). This gives us four combinations of tensed and tenseless clauses, and two readings to test for each combination. Let us first consider simultaneous readings. Considering the past-under-past configuration, where both the matrix and complement clauses contain the past tense *-uŋil*, we find that a simultaneous reading is possible in this case. In (26), the context is biased towards SIM, and the backward-shifted reading is quite implausible. We find that past-under-past is acceptable for speakers.

- (26) Context: When you were a child, you thought that Reno was a really big city.  
 But since then, you've visited Sacramento and San Francisco, which are both much bigger, so you now know that Reno isn't that big after all. (SIM)  
*di-mé:hu-ya?* [*lí:nu t'í:yeli? k'-é?-uŋil-a?*] *di-hámu-yuŋil-i*  
 1-boy-DEP Reno big 3-be-PAST-DEP 1-think-PAST-IND  
 'When I was a boy, I thought Reno was big.'

We furthermore find that simultaneous readings are also possible when a tenseless clause is embedded under a past-marked matrix clause. This is shown in (27-b), alongside a version in (27-a) with past-under-past, in a context biasing the simultaneous reading. In other words, past-under-past allows for a simultaneous reading, although the unmarked option is also available. Finally, the simultaneous reading can also be expressed using tenseless matrix and embedded clauses, as shown in (27-c).

- (27) Context: You see a man in the street and say "Hi Tim!"  
 He tells you his name isn't Tim. You apologize and say: (SIM)  
 a. [*Tim de-gum-dí?ye?* *M-é?-uŋil-a?*] *di-hámu-yuŋil-i*  
 Tim NMLZ-REFL-name 2-be-PAST-DEP 1-think-PAST-IND  
 'I thought your name was Tim.'  
 b. [*Tim de-gum-dí?ye?* *M-é?-a?*] *di-hámu-yuŋil-i*  
 Tim NMLZ-REFL-name 2-be-DEP 1-think-PAST-IND  
 'I thought your name was Tim.'  
 c. [*Tim de-gum-dí?ye?* *M-é?-a?*] *di-hámu-yi*  
 Tim NMLZ-REFL-name 2-be-DEP 1-think-IND  
 'I thought your name was Tim.'

Note that past-under-past in Washo can also receive a backward-shifted interpretation, as shown in (28-a). A backward-shifted interpretation can also be expressed by using a tenseless embedded clause with a matrix past as in (28-b), a tenseless embedded clause with a tenseless matrix clause as in (28-c), or a tensed embedded clause with a tenseless matrix clause as in (28-d).

- (28) Context: You run into your old friend. His name used to be Tim,  
 but you heard that he changed his name since you last saw him. (SHIFT)  
 a. [*Tim de-gum-dí?ye?* *M-é?-uŋil-a?*] *di-hámu-yuŋil-i*  
 Tim NMLZ-REFL-name 2-be-PAST-DEP 1-think-PAST-IND  
 'I thought your name used to be Tim.'  
 b. [*Tim de-gum-dí?ye?* *M-é?-a?*] *di-hámu-yuŋil-i*  
 Tim NMLZ-REFL-name 2-be-DEP 1-think-PAST-IND  
 'I thought your name used to be Tim.'

- c. [Tim de-gum-dí?ye? M-é?-uŋil-a?] di-hámu-i  
 Tim NMLZ-REFL-name 2-be-PAST-DEP 1-think-IND  
 ‘I thought your name used to be Tim.’
- d. [Tim de-gum-dí?ye? M-é?-a?] di-hámu-yi  
 Tim NMLZ-REFL-name 2-be-DEP 1-think-IND  
 ‘I thought your name used to be Tim.’

The only case where an embedded clause cannot receive a simultaneous interpretation is when the past occurs in the embedded clause with a tenseless matrix clause, as shown in (29). Only a backward-shifted interpretation is available for this configuration.

- (29) Context: You see a man in the street and say “Hi Tim!”  
 He tells you his name isn’t Tim. You apologize and say: (SIM)  
 #[Tim de-gum-dí?ye? M-é?-uŋil-a?] di-hámu-i  
 Tim NMLZ-REFL-name 2-be-PAST-DEP 1-think-IND  
 Intended: ‘I thought your name was Tim.’

The possible combinations and interpretations of tensed and tenseless complement clauses in Washo are summarized in Table 1.

**Table 1** Interpretations of past-oriented tensed and tenseless clauses in Washo

	past-under-past	bare-under-past	bare-under-bare	past-under-bare
simultaneous	✓	✓	✓	#
backward-shifted	✓	✓	✓	✓

Given that past-under-past configurations are compatible with both backward-shifted and simultaneous readings, this would suggest that Washo is a +SoT language according to the parameter in (15). An embedded past tense in the complement of a matrix past-tense attitude verb may be optionally not interpreted, yielding a simultaneous reading just like in English. Adopting a view of Washo as +SoT language correctly predicts the constellation of (un)available readings for embedded past tenses in the language, i.e., the first and last columns in Table 1.

First, the backward-shifted and simultaneous readings of past-under-past sentences can be given the same analysis as past-under-past in English in (11) and (12) in section 1.2. Thus, in (30), the backward-shifted reading of (28-a) contains two instances of the past tense, while the simultaneous reading of (27-a) has no semantic past tense in the complement clause.

(30) Readings of past-under-past in Washo:

- a. SHIFT reading, (28-a):

$$[\text{PAST}_{t^*} \lambda t [\text{I think}_{w_{@},t} [{}_{(s,(i,t))} \lambda w \lambda t' [\text{PAST}_{t'} [\lambda t'' [\text{you be.named.Tim}_{w,t''}]]]]]] ]$$

$$\exists t [t < t^* \ \& \ \forall w [w \in \text{THINK}(\text{sp}, w_{@}, t)$$

$$\rightarrow \exists t' [t' < \text{NOW}_{\text{SP}}(w, t) \ \& \ \text{add be named Tim at } t' \text{ in } w]]]$$

- b. SIM reading, (27-a):

$$[\text{PAST}_{t^*} \lambda t [\text{I think}_{w_{@},t} [{}_{(s,(i,t))} \lambda w \lambda t' [\text{you be.named.Tim}_{w,t'}]]]] ]$$

$$\exists t [t < t^* \ \& \ \forall w [w \in \text{THINK}(\text{sp}, w_{@}, t) \rightarrow \text{add be named Tim at } \text{NOW}_{\text{SP}}(w, t) \text{ in } w]]]$$

Next, in the crucial case of past-under-bare, (28-c), only SHIFT is available; compare (29). The LF for this case would be as in (31), where there is a semantic past tense in the complement clause, but no temporal operator in the matrix clause. We assume that in the absence of a tense operator, the reference time of the clause is given by a silent temporal pronoun, which receives its reference from the assignment function  $g$  (see Bochnak 2016; Cable 2013; Mucha 2013). The truth conditions for (28-c) are also given in (31).

(31) Past-under-bare in Washo (28-c):

$$\begin{aligned} & [I \text{ think}_{w@t} [{}_{(s,(i,t))} \lambda w \lambda t' [\text{PAST}_{t'} [\lambda t'' [\text{you be.named.Tim}_{w,t''}]]]]] \\ & \forall w [w \in \text{THINK}(\text{sp}, w, g(1, i)) \rightarrow \exists t [t < \text{NOW}_{\text{SP}}(w, t) \ \& \ \text{add be named Tim in } w \text{ at } t]] \end{aligned}$$

In this case, the time  $t$  in the embedded clause must be in the past of the attitude holder's now, i.e., a backward-shifted reading. This is the only reading derived by this LF. Recall that under the structural approach that we are assuming, an embedded past can be semantically empty (i.e., either deleted at LF or morphologically licensed), yielding the simultaneous reading, only if there is also a past tense operator in the matrix clause. Since there is no past tense in the matrix clause in (28-c)/(31), the embedded past must be interpreted, yielding only a backward-shifted reading. The structural conditions for a simultaneous reading of the embedded past are not met in a past-under-bare configuration. This is a welcome prediction of a structural SoT rule for an optional-tense language.

Let us now consider embedded tenseless clauses, i.e., the second and third columns in Table 1. For the simultaneous readings in (27-b) and (27-c), repeated below, we assume that the temporal variable in the embedded clause is  $\lambda$ -bound as in (18), creating a property of times that can serve as the argument of the embedding attitude verb. The reference time of the embedded clause is thus bound by the attitude predicate, and is identified with the attitude holder's now. The only difference between (27-b) and (27-c) is whether there is a past tense in the matrix clause.

(32) Simultaneous readings for embedded tenseless clauses:

- a. [*Tim de-gum-diŋye?* *M-éŋ-a?*] *di-hámu-yuŋil-i*  
Tim NMLZ-REFL-name 2-be-DEP 1-think-PAST-IND  
'I thought your name was Tim.'
- b. [PAST<sub>t\*</sub>  $\lambda t$  [I think<sub>w@t</sub> [{}\_{(s,(i,t))}  $\lambda w \lambda t'$  [you be.named.Tim<sub>w,t'</sub>]]]]  
 $\exists t [t < t^* \ \& \ \forall w [w \in \text{THINK}(\text{sp}, w@, t) \rightarrow \text{add be named Tim at NOW}_{\text{SP}}(w, t) \text{ in } w]]$
- c. [*Tim de-gum-diŋye?* *M-éŋ-a?*] *di-hámu-yi*  
Tim NMLZ-REFL-name 2-be-DEP 1-think-IND  
'I thought your name was Tim.'
- d. [I think<sub>w@t\_1</sub> [{}\_{(s,(i,t))}  $\lambda w \lambda t'$  [you be.named.Tim<sub>w,t'</sub>]]]  
 $\forall w [w \in \text{THINK}(\text{speaker}, w, g(1, i)) \rightarrow \text{add be named Tim in } w \text{ at NOW}_{\text{SP}}(w, g(1, i))]$

For the backward-shifted readings of embedded tenseless clauses, we need something more. Given that we analyze morphologically tenseless clauses as containing a covert reference time pronoun, we follow much previous literature in assuming that the embedded temporal pronoun can undergo *res*-movement to the matrix clause (Abusch, 1997; Heim, 1994), so that it is interpreted outside of the scope of the attitude verb. The result of movement is

a trace that receives a bound variable interpretation, while giving the attitude predicate a property of times argument.<sup>8</sup>

To make this work, we require three additional ingredients.<sup>9</sup> The first is the Upper Limit Constraint (ULC) or similar, which prevents the lower temporal variable from denoting a time after the eventuality time of the higher clause (Abusch, 1997). We adopt the formulation in (33).

- (33) Upper Limit Constraint: (following Abusch 1997)  
The local evaluation time (the attitude-holder's now in attitude complement clauses) is an upper limit for the denotation of temporal pronouns.

The second ingredient is a temporal acquaintance relation  $R$ , the content of which is a description of how the attitude holder represents the *res*-moved time from the embedded clause to herself (Abusch, 1997; Heim, 1994). According to Abusch (1997), a temporal acquaintance relation  $R$  should be causal, i.e., some state of affairs caused the attitude holder to have a particular belief about the *res* at the attitude time. For instance, a suitable  $R$  for (28-b) and (28-d) might be the one in (34). In this case,  $t_{res}$  is a time (located at or before the attitude time) when  $x$  met with Tim in  $w$  and came to have the belief that Tim was in fact the interlocutor's name.

- (34)  $R = \lambda w_s. \lambda x_e. \lambda t_{res}. \lambda t_i. t_{res}$  is the last time since  $t$  that  $x$  met with Tim in  $w$   
(where  $t_{res} \leq t$  by the ULC)

Finally, we need a relational version of the attitude verb that can take the *res*-moved temporal pronoun as an argument, and integrates an acquaintance relation. We adopt a relational version of *think* adapted from Heim (1994) as in (35).

- (35)  $\llbracket think_{(relative)} \rrbracket = \lambda w_s. \lambda R_{(s, (e, (i, t)))}. \lambda t_{res}. \lambda t_i. \lambda p_{(i, (s, t))}. \lambda x_e.$   
 $\forall w' [w' \in THINK(x, w, t_{res}, t) \ \& \ R(w', x, t_{res}, NOW(x, w', t)) \rightarrow p(t_{res})(w')]$

With these three ingredients in place, let us turn back to the analysis of backward-shifted readings for embedded tenseless clauses in Washo. These are illustrated in (36), with a schematic representation of (36-d) given in Figure 1 (for simplicity, we equate the past reference time in the embedded clause with the attitude holder's now).<sup>10</sup>

- 8 Arguments abound in the literature against using *res*-movement to analyze *de re* attitude ascriptions for embedded pronouns. A popular alternative to *res*-movement is to posit concept generators, including time-concept generators along the lines of what Percus & Sauerland (2003) and Charlow & Sharvit (2014) propose for individuals (see also Deal 2018 for further discussion). We adopt *res*-movement as a concrete implementation for deriving backward-shifted interpretations for embedded temporal pronouns, but do not offer any new arguments for or against doing things in this way. Our claims about cross-linguistic variation on the basis of the availability of *res*-movement equally apply to its analytical alternatives.
- 9 See Abusch (1997) and Heim (1997) for more technical discussion of these aspects of the temporal *de re* analysis.
- 10 Note that LF structures for *de re* interpretations like (36-b) "...require a non-standard way of executing movement" (Heim 1994: p. 154, fn. 25), where the lambda abstractor is not generated adjacent to the moved constituent.

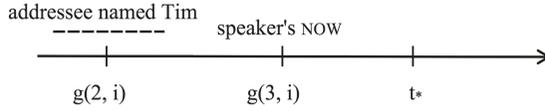


Figure 1 The shifted reading of (36-d) in Washo.

(36) Backward-shifted readings for embedded tenseless clauses:

- a. [Tim de-gum-dí?ye? M-é?-a?] di-hámu-yuŋíl-i  
 Tim NMLZ-REFL-name 2-be-DEP 1-think-PAST-IND  
 ‘I thought your name used to be Tim.’ = (28-b)
- b. [PAST<sub>t\*</sub> λt [I think<sub>w@,R,t2,t</sub> [λw λt2 [you be.named.Tim<sub>w,t2</sub>]]]]  
 $\exists t [t < t* \ \& \ \forall w [w \in \text{THINK}(w, \text{speaker}, t, g(2, i)) \ \& \ R(w, \text{speaker}, g(2, i), \text{NOW}_{\text{sp}}(w, t)) \rightarrow \text{your name is Tim in } w \text{ at } g(2, i)]]$   
 (with  $g(2, i)$  before the matrix evaluation time)
- c. [Tim de-gum-dí?ye? M-é?-a?] di-hámu-yi  
 Tim NMLZ-REFL-name 2-be-DEP 1-think-IND  
 ‘I thought your name used to be Tim.’ = (28-d)
- d. [I think<sub>w@,R,t2,t3</sub> [λw λt2 [you be.named.Tim<sub>w,t2</sub>]]]  
 $\forall w [w \in \text{THINK}(w, \text{speaker}, g(3, i), g(2, i)) \ \& \ R(w, \text{speaker}, g(2, i), \text{NOW}_{\text{sp}}(w, g(3, i))) \rightarrow \text{your name is Tim in } w \text{ at } g(2, i)]$   
 (with  $g(3, i) < t*$  and  $g(2, i)$  before the matrix evaluation time)

In sum, by borrowing fairly standard assumptions from the structural accounts of embedded tense – namely an SoT rule and a temporal *de re* analysis of backward-shifted readings – we can derive all the available readings of complement clauses in Washo, and importantly we can also rule out the availability of the simultaneous reading for a past-marked complement clause under a tenseless matrix clause.<sup>11</sup>

### 2.2 The Case of Medumba

Medumba belongs to the Grassfields Bantu branch of the Niger-Congo language family, and it is spoken by approximately 210,000 people mainly in the (francophone) West Region of Cameroon. This section is concerned with the temporal interpretation of stative complement clauses embedded under attitude verbs in Medumba, also an optional-tense language. We demonstrate that Medumba differs from Washo in that past-under-past complement clauses do not license simultaneous readings, indicating that Medumba is an example of an optional-tense language without an SoT rule in its grammar. We also show that, although the tense paradigm of Medumba includes a marker that arguably encodes present temporal reference, temporally unmarked forms are the preferred means to express simultaneity of an embedded state with the matrix evaluation time. Moreover, Medumba differs from Washo in that shifted readings of bare stative complements are notably marked (although not categorically excluded). We will conclude that the –SoT property correlates with a more general semantic rigidity in the temporal system of this language, in the sense that temporal

11 Now that we have introduced *res*-movement as an option for the temporal interpretation of embedded clauses, there is a worry about over-generating simultaneous readings where we want to rule them out, e.g., in past-under-bare configurations in Washo. Specifically, as a reviewer points out, if we allow PAST-operators to *res*-move in addition to temporal pronouns, we may over-generate simultaneous readings. We take up this issue in section 2.3.

reference is tied closely to the output of semantic composition at the surface structure level, while syntactic mechanisms manipulating the interpretation at the level of Logical Form are more restricted.

2.2.1 *Background* Before we discuss the embedding cases, we provide an overview of the basic properties of temporal reference in Medumba by example of matrix clauses. Just like in Washo, tense is optional in Medumba, i.e., sentences can contain functional morphemes that encode tense semantics, but can also occur without any overt temporal marking. Temporally unmarked event predicates such as (37-a) receive a past interpretation (immediate past by default).<sup>12</sup> Tense in Medumba is not only optional, but also graded. There is no general past tense marker; all past morphemes convey information about temporal remoteness. For the purposes of this paper, we focus on the most commonly used markers for near and remote past in (37-b) and (37-c). The use of the near past marker *fə* requires that the eventuality expressed by the predicate took place on the day surrounding the local evaluation time (i.e., the utterance time in matrix clauses) or a few days before that. The remote past marker *ná'* is used if the eventuality is located at least a few days before the evaluation time.

(37) Context: Where is Elise?

a. *Elise nén Douala.*

Elise go Douala

‘Elise went to Douala.’

b. *Elise fə nén Douala.*

Elise NEAR go Douala

‘Elise went to Douala (recently).’

c. *Elise ná' nén Douala.*

Elise REM go Douala

‘Elise went to Douala (some time ago, not recently).’

Present interpretation with event predicates is most commonly expressed by use of the morpheme *cwəd*, as illustrated in (38).

(38) Context: What are the kids doing?

*Bú cwəd ná ηkwún.*

they PRES cook beans

‘They are cooking beans.’

The *cwəd*-form is incompatible with past interpretation (39-a). In order to express past progressive meaning, the general imperfective marker *kó* must be used, (39-b).

(39) Context: What were the kids doing when you left?

a. # *Bú cwəd ná ηkwún.*

they PRES cook beans

Intended: ‘They were cooking beans.’

12 Mucha (2017) accounts for the fact that eventive sentences receive past interpretations based on an analysis of aspect that parallels the proposal for Hausa sketched in section 3.1. Since we are focusing on stative complement clauses in this paper, we will not spell out the temporal interpretation of eventive sentences here.

- b. *Bú kǝ ná ηkwún.*  
 they IPFV cook beans  
 ‘They were cooking beans.’

Stative sentences without overt temporal or aspectual marking most naturally receive present interpretations, as in (40) and (41).

- (40) Context: How is Marie doing?  
 Marie búut mayəm.  
 Marie tired much  
 ‘Marie is very tired.’
- (41) Context: How does Marie feel about Patrick?  
 Marie kǝ Patrick.  
 Marie love Patrick  
 ‘Marie loves Patrick.’

The combination of stative predicates with *cwɛd* is somewhat marked but grammatical, and can be used to highlight the present interpretation of a stative sentence, as in (42), where the second conjunct containing *cwɛd* is contrasted with the first conjunct which contains a remote past marker.

- (42) Context: Last year Carine and Yves met at their workplace. Yves is a lovely person and Carine loved him instantly when they met. She never changed her mind about it and she still loves him now.  
*Carine ná’ kǝ Yves, à mɛn cwɛd kǝ Yves.*  
 Carine REM love Yves, she still PRES love Yves  
 ‘Carine loved Yves, and she still loves Yves.’

Based on the observations that *cwɛd* is incompatible with past interpretation in matrix clauses, we analyze it as a present progressive marker with the semantics in (43) (see also Mucha 2015, ch. 6).

- (43)  $[[\textit{cwɛd}]] = \lambda p_{(i,t)}. \lambda t_i. \exists t' [t' \supset t \ \& \ p(t')]$

The temporal morpheme *cwɛd* is part of the tense paradigm of the language that also contains the past markers, and this is reflected in its semantics in that it denotes the same type of operator (i.e., an existential quantifier over times). The temporal relation specified by *cwɛd*, however, is temporal inclusion, which captures its progressive interpretation with event predicates.<sup>13</sup>

Stative sentences without temporal marking also allow for past interpretation, although speakers often report a preference for past marking in these cases. The example in (44) illustrates that a contextually given reference time combined with a past temporal

13 An additional motivation for analyzing *cwɛd* as a tense marker comes from the observation that two out of three speakers we consulted accept a combination of *cwɛd* with overt aspect marking on event predicates as in (i).

- (i) Context question: What is Evelyne doing?  
*Evelyne cwɛd kǝ ná cəŋ.*  
 Evelyne PRES IPFV cook food  
 ‘Evelyne is cooking food.’ (Mucha, 2015, p. 155)

*when*-clause can license past interpretation of unmarked statives. At least for some speakers, a past context time is sufficient for past interpretation of stative clauses, as shown in (45).

- (44) Context: Marie is asking Louise how Nana was doing when he came home yesterday. Louise says:  
 (ɨgə laŋ Nana (fə) sə 'ə lá) á (fə) búut.  
 time Nana NEAR come PRT he NEAR tired  
 ‘When Nana came home he was tired.’
- (45) Context: How were you doing when I called you?  
 ?/✓ Mə búut mayəm.  
 I tired much  
 ‘I was very tired.’

Below we sketch an analysis of temporal interpretation of past-marked and bare matrix clauses in Medumba. As in our discussion of Washo in section 2.1, our focus is on stative sentences. For an account of the temporal and aspectual interpretation of eventive sentences, we refer the reader to Mucha (2017).

The framework we are assuming is realized in Medumba as follows: the reference time of a sentence is syntactically represented as an indexed temporal pronoun which is phonologically covert. In tenseless matrix clauses, this pronoun is interpreted as a free variable which refers to the utterance time by default, leading to a present interpretation unless a non-present interpretation is contextually enforced as in (45). In (46), we provide the LF structure as well as the truth conditions for the temporally unmarked stative sentence in (40), repeated as (46).

- (46) a. Marie búut mayəm.  
 Marie tired much  
 ‘Marie very tired.’
- b.  $[_{TP} t_{5,i} \lambda t [_{VP} \text{Marie very\_tired}_{t,w_{@}}]]$
- c.  $[[ (46\text{-a}) ]]^g = 1$  iff Marie is very tired in  $w_{@}$  at  $g(5, i) (= t^*)$

Past tense semantics is overtly encoded in temporal morphemes such as *fə* (near past) and *ná'* (remote past), and formalized as in (47) and (48), respectively.<sup>14</sup>

- (47)  $[[ fə ]] = \lambda p_{(i,t)} \cdot \lambda t_i \cdot \exists t' [t' \text{ precedes } t \text{ by } \leq \text{ a few days } \& p(t')]$
- (48)  $[[ ná' ]] = \lambda p_{(i,t)} \cdot \lambda t_i \cdot \exists t' [t' \text{ precedes } t \text{ by } \geq \text{ a few days } \& p(t')]$

Note that the main difference between these lexical entries and the semantics of a general past tense as in the system of English or Washo is that the truth conditions in (47) and (48) are more specific. Both morphemes encode past shifting with respect to their evaluation time, but the near past marker *fə* adds the restriction that the time introduced by the PAST-operator precedes the local evaluation time by a few days or less, and the temporal specification of the remote past marker *ná'* covers the time before that.

The example in (49) gives the truth conditions and the LF of the same stative matrix clause with the remote past marker *ná'*. As stated in section 1.3, we follow Kusumoto (1999, 2005) in assuming that the past tense operator is interpreted relative to a deictic temporal

14 The lexical entries are adopted from Mucha (2017). The symbol  $\leq$  stands for “at most” and the symbol  $\geq$  for “at least”.

pronoun  $t^*$ . The reference time pronoun ( $t_5$ ) is  $\lambda$ -bound in order to create the right type of argument for the tense operator, as shown explicitly in (49) (and simplified in subsequent examples). This results in the truth conditions given in (49-c), which temporally locate the state of Marie being tired a few days before the utterance time or further in the past.

- (49) a. *Marie ná' búut mayam.*  
 Marie REM tired much  
 'Marie was very tired.'
- b.  $[\text{TP } \mathbf{ná'}_{t^*} \lambda t_5 t_{5,i} \lambda t [\text{VP Marie very\_tired}_{t,w@}]]$
- c.  $\llbracket (49\text{-a}) \rrbracket = 1$  iff  $\exists t$  [ $t$  precedes  $t^*$  by  $\geq$  a few days  
 & Marie is very tired in  $w@$  at  $t$ ]

For the sake of completeness, (50) presents the LF and truth conditions of a stative sentence with the optional present morpheme *cwəd*. Composition parallels the past-marked case in (49), and the temporal interpretation is in the present just like in the unmarked case in (46).

- (50) a. *Marie cwəd búut mayam.*  
 Marie PRES tired much  
 'Marie is very tired.'
- b.  $[\text{TP } \mathbf{cwəd}_{t^*} \lambda t [\text{VP Marie very\_tired}_{t,w@}]]$
- c.  $\llbracket (50\text{-a}) \rrbracket = 1$  iff  $\exists t$  [ $t \supset t^*$  & Marie is very tired in  $w@$  at  $t$ ]

### 2.2.2 The Temporal Interpretation of Complement Clauses in Medumba

**Past Tense in Complement Clauses.** Let us now consider the interpretation of past tense in complement clauses. The crucial observation is that Medumba patterns with languages such as Japanese in that past-under-past induces obligatory backward-shifting, and that a simultaneous reading is not available for past-marked complement clauses. For instance, the past-under-past sentence in (51) is felicitous in the given context, which triggers the backward-shifted interpretation.

- (51) Context: You went to visit Louise and Marie a week ago, right?  
 Did they tell you why they were in such a bad mood **two weeks ago**? (SHIFT)  
*Bú ná' cúb [mbə bú ná' búut].*  
 they REM say that they REM tired  
 'They said that they had been tired.'

As shown in (52-a), the same sentence is infelicitous in a context that induces a simultaneous reading. To express simultaneity, past-marking in the embedded clause must be omitted, as in (52-b). Expressing simultaneous readings of embedded stative sentences with the present marker *cwəd* is possible, but dispreferred, (52-c).

- (52) Context: You went to visit Louise and Marie a week ago, right?  
 Did they tell you why they were in such a bad mood **that day**? (SIM)
- a. *#Bú ná' cúb [mbə bú ná' búut].*  
 they REM say that they REM tired  
 Intended: 'They said that they were tired.'
- b. *Bú ná' cúb [mbə bú búut].*  
 they REM say that they tired  
 'They said that they were tired.'

- c. <sup>2</sup>*Bú ná' cúb [mbə bú cwəd búut].*  
 they REM say that they PRES tired  
 'They said that they were tired.'

The examples in (53) and (54) below illustrate that embedded past is incompatible with simultaneous readings in the case of near past marking as well. Just like the remote past marker *ná'*, the near past marker *fə* can only be used in the embedded clause if the context triggers a backward-shifted reading, (53). It is infelicitous in a context that brings out the simultaneous interpretation, (54).

- (53) Context: You went to visit Louise and Marie yesterday, right?  
 Did they tell you why they were in such a bad mood the day before? (SHIFT)  
*Bú fə cúb [mbə bú fə búut].*  
 they NEAR say that they NEAR tired  
 'They said that they were tired.'
- (54) Context: You went to visit Louise and Marie yesterday, right?  
 Did they tell you why they were in such a bad mood yesterday? (SIM)
- a. #*Bú fə cúb [mbə bú fə búut].*  
 they NEAR say that they NEAR tired  
 Intended: 'They said that they were tired.'
- b. *Bú fə cúb [mbə bú búut].*  
 they NEAR say that they tired  
 'They said that they were tired.'
- c. <sup>2</sup>*Bú fə cúb [mbə bú cwəd búut].*  
 they NEAR say that they PRES tired  
 'They said that they were tired.'

The examples above reveal the difference between Washo and Medumba that is most crucial for our purposes: Past-under-past complement clauses do not allow for simultaneous readings. Given that the evaluation time of past tense in complement clauses is the attitude holder's NOW rather than the utterance time, the data in (51)–(54) directly reflect the truth conditions derived by semantic composition. To see this, consider the LFs and truth conditions of the sentences in (54-a) and (54-b), which are given in (55) and (56), respectively.

(55) LF and truth conditions for (54-a), near past-under-near past:

- a.  $[\mathbf{f}_{\partial t^*} \lambda t [\text{they say}_{w@,t} [{}_{(s,(i,t))} \lambda w \lambda t' [\mathbf{f}_{\partial t'} [\lambda t'' [\text{they tired}_{w,t''}]]]]]]]$   
 b.  $\llbracket (54\text{-a}) \rrbracket = 1$  iff  $\exists t [t \text{ precedes } t^* \text{ by } \leq \text{a few days} \ \& \ \forall w [w \in \text{SAY}(\text{they}, t, w@) \rightarrow \exists t' [t' \text{ precedes } \text{NOW}_{\text{they}}(w, t) \text{ by } \leq \text{a few days} \ \& \ \text{they are tired in } w \text{ at } t']]]]$

(56) LF and truth conditions for (54-b), null-under-near past:

- a.  $[\mathbf{f}_{\partial t^*} \lambda t [\text{they say}_{w@,t} [{}_{(s,(i,t))} \lambda w \lambda t' [\text{they tired}_{w,t'}]]]]]$   
 b.  $\llbracket (54\text{-b}) \rrbracket = 1$  iff  $\exists t [t \text{ precedes } t^* \text{ by } \leq \text{a few days} \ \& \ \forall w [w \in \text{SAY}(\text{they}, t, w@) \rightarrow \text{they are tired in } w \text{ at } \text{NOW}_{\text{they}}(w, t)]]]$

According to the truth conditions in (55), Louise and Marie were tired a few days before their subjective NOW, which is (their representation of) a time located a few days before the utterance time. This is the backward-shifted reading. According to the truth conditions in (56), the state of Marie and Louise being tired holds at their subjective NOW, which corresponds to the simultaneous reading. The same applies to (complement) clauses that

contain a remote past marker. In (57-b), we give the LF for the remote-under-remote past sentence in (51), repeated as (57-a). The truth conditions are given in (57-c).

- (57) a. *Bú ná' cúb [mbə bú ná' búut].*  
 they REM say that they REM tired  
 'They said that they were tired.'
- b.  $[\mathbf{na}'_{ts} \lambda t [\text{they say}_{w@,t} [_{(s,(i,t))} \lambda w \lambda t' [\mathbf{na}'_{t'} [\lambda t'' [\text{they tired}_{w,t''}]]]]]]$
- c.  $[[\mathbf{(57-a)}]] = 1 \text{ iff } \exists t [t \text{ precedes } t^* \text{ by } \geq \text{ a few days} \ \& \ \forall w [w \in \text{SAY}(\text{they}, w@, t) \rightarrow \exists t' [t' \text{ precedes } \text{NOW}_{\text{they}}(w, t) \text{ by } \geq \text{ a few days} \ \& \ \text{they are tired in } w \text{ at } t']] ]]$

The truth conditions of the bare-under-remote past sentence repeated in (58-a) are identical to the truth conditions in (56-b) except for the remoteness condition on the matrix clause. Crucially, the state expressed in the complement clause holds at the attitude holders' NOW, and the resulting interpretation is simultaneity.

- (58) a. *Bú ná' cúb [mbə bú búut].*  
 they REM say that they tired  
 'They said that they were tired.'
- b.  $[\mathbf{na}'_{ts} \lambda t [\text{they say}_{w@,t} [_{(s,(i,t))} \lambda w \lambda t' [\text{they tired}_{w,t'}]]]]$
- c.  $[[\mathbf{(58-a)}]] = 1 \text{ iff } \exists t [t \text{ precedes } t^* \text{ by } \geq \text{ a few days} \ \& \ \forall w [w \in \text{SAY}(\text{they}, w@, t) \rightarrow \text{they are tired in } w \text{ at } \text{NOW}_{\text{they}}(w, t)]] ]]$

Summarizing so far, Medumba crucially differs from Washo in that past-under-past complement clauses do not allow for simultaneous readings. Since the structural mechanism one would assume to license the simultaneous interpretation of past-under-past complement clauses seems to be unavailable in Medumba just like it is unavailable in Japanese, past marking has to be omitted in Medumba in order to express the simultaneous reading of a stative complement clause. In the particular approach we are taking here, this difference can be captured by assuming that Medumba, in contrast to Washo, is a – SoT language according to the parameter in (15), and that tense in Medumba complement clauses is always interpreted. Thus, Medumba can be considered the “optional-tense version” of languages such as Japanese, and we can conclude that the  $[\pm \text{SoT}]$  variation that is attested in languages with obligatory tense marking can also be found in optional-tense languages. In the next paragraph, we add a brief discussion of the interpretation of bare complement clauses in Medumba and provide an overview of the distribution of simultaneous readings in the language.

**The Interpretation of Bare Complement Clauses.** As shown in the preceding section, Medumba differs from Washo in that it does not allow for simultaneous readings of past-marked attitude complements. However, the two languages also differ with respect to the interpretation of temporally unmarked complements. In particular, the backward-shifted interpretation of bare complement clauses is not as freely available in Medumba as it is in Washo, i.e., the backward-shifted reading of sentences like (59) seems clearly marked (see also Mucha 2017, p. 25).

- (59) *Bú fə /ná' cúb [mbə bú búut].*  
 they NEAR/REM say that they tired  
 'They said that they were tired.' (✓ SIM, ?? SHIFT)

In other words, while the simultaneous reading is unavailable for past-under-past constructions in Medumba, for the backward-shifted reading speakers prefer past-under-past.

However, the status of the interpretational restrictions is different. While all of our Medumba consultants consistently reject past-marked complement clauses in contexts that trigger a simultaneous reading, the acceptability of unmarked complement clauses in SHIFT contexts is subject to variation. In the first part of this section, we presented similar observations for temporally unmarked stative matrix clauses, which are preferably interpreted in the present, although past interpretation can be contextually enforced. This observation extends to attitude predicates as well, which complicates comparison with past-under-bare and bare-under-bare embeddings in Medumba and Washo. While bare matrix clauses are possible and felicitous if the matrix attitude time is an unspecified past interval, as in (60), they are dispreferred and their acceptability is subject to speaker variation in all of the examples we have considered above where the context specifies the attitude time to be in the near or remote past.

- (60) Context: You met Beatrice and Roger. Did they tell you why they have been so quiet?  
*Bú cúb [mbə bú búut].*  
 they say that they tired  
 ‘They said that they were tired.’

Since we could not obtain conclusive data on embeddings with bare matrix clauses in Medumba, we exclude them from the overview in Table 2. Recall, however, that in the crucial case of past-under-past embeddings, Medumba differs from Washo in that simultaneous readings are unavailable. This is the constellation where a deletion rule can apply in SoT languages such as English and Washo. Since in Medumba, no such deletion mechanism seems to be available in the first place, the presence of matrix tense is not expected to make a difference with respect to simultaneous readings of embedded past.

**Table 2** The interpretations of complement clauses in Medumba

	past-under-past	bare-under-past
simultaneous	#	✓
backward-shifted	✓	??

The other interesting difference between Medumba and Washo alluded to above is that backward-shifted readings of bare complement clauses are marked. Under our analysis, this difference will boil down to variation regarding the availability of the mechanism that derives the backward-shifted reading in the absence of an embedded tense operator (see section 2.3 below for further discussion).

At the same time, the pattern we find in Medumba is reminiscent of the Guaraní language Mbyá, which is an optional-tense language under the analysis proposed by Thomas (2014) (although the author himself does not use this term). Thomas (2014) reports that temporally unmarked attitude complement clauses in Mbyá must be simultaneous with the attitude holder’s now, irrespective of whether the matrix clause is temporally located in the past, present or future. An example is given in (61), where a temporally unmarked (nominalized) complement clause is embedded under a matrix clause that contains a past adverbial. According to Thomas, this sentence is true “...only if there was a time yesterday when Juan said ‘I am working’...” (p. 364).

- (61) Only SIM reading with bare complement clauses in Mbyá (Thomas, 2014, p. 364)  
*Kuee ka'aru Juan h-e'i chevy pe o-mba'eapo-a.*  
 yesterday afternoon Juan 3-say me to 3-work-NMLZ  
 'Yesterday afternoon Juan said to me that he was working.'

Thomas accounts for this observation by proposing that bare clauses in Mbyá are truly tenseless in the sense that, unlike tenseless clauses under our analyses, they do not contain a syntactically represented reference time pronoun. In Mbyá matrix clauses, the reference time is provided by a covert temporal (non-future) adverbial which, by assumption, is banned from propositional attitude complements. Therefore, the evaluation time of the complement clause is always bound by the matrix verb (see Thomas 2014, p. 371 for details). We think that an analysis along these lines is not applicable to Medumba since it predicts that shifted readings with bare matrix clauses are excluded. As explicated above, this is not the case in Medumba, where shifted readings without past marking are possible, but marked. This suggests that the mechanism that derives this interpretation is in principle available. We therefore maintain the assumption that reference times are represented as syntactic variables in all tenseless clauses.

It is important to keep in mind that, under the common assumption that the evaluation time of an attitude complement must be bound to the matrix attitude time, shifted readings of bare complement clauses require additional machinery such as *res*-movement of the embedded reference time pronoun, which we proposed for Washo in section 2.1. The simultaneous reading directly reflects the truth conditions derived by semantic composition for bare complement clauses and is therefore, in a way, their expected default interpretation. A hypothesis worth considering is that the languages in our sample differ with respect to their propensity to resort to mechanisms that shift temporal interpretation away from the output of the semantics, be it a syntactic SoT rule, *res*-movement, or the contextual shift to non-present interpretation of bare stative matrix clauses. In Medumba, this results in a system where optional temporal morphemes tend to be used if and only if they shift the interpretation away from the default. This is reflected in our consultants' preference to use optional past tense morphemes to express past shifting with statives, but to omit the present tense for simultaneous readings, although neither past interpretation of bare stative clauses nor present-marked statives are excluded by the grammar. We will come back to this in section 4.

### 2.3 Interim Summary: The Temporal Interpretation of Complement Clauses in Optional-Tense Languages

Let us summarize the take-away points from this section on the temporal interpretation of attitude complement clauses in optional-tense languages. The first is that an SoT parameter as in (15) can be naturally extended to optional-tense languages to capture variation in the available interpretations of past-marked embedded clauses.

- (13) Past-under-Past Deletion Rule:  
 A past tense operator  $\alpha$  may be deleted if and only if  
 $\alpha$  is locally c-commanded by another past tense operator  $\beta$ .
- (15) The Sequence of Tense Parameter [ $\pm$  SoT]:  
 A language {does/ does not} allow for Past-under-Past Deletion.

Thus, Washo is a +SoT language, where past-under-past can receive a simultaneous or backward-shifted reading, whereas Medumba is a -SoT language, where past-under-past must receive a backward-shifted interpretation. That Washo is a +SoT language further makes the welcome prediction that a past-marked embedded clause under a tenseless matrix clause can only receive a backward-shifted reading; the structural conditions for an SoT rule to apply, yielding a simultaneous reading, are not met in this case. The important take-away here is that the SoT parameter is independent of the distinction between optional and obligatory tense languages.<sup>15</sup>

We also observed variation in the available or preferred readings of tenseless complement clauses. As outlined in section 1.3, the system we are adopting predicts a simultaneous reading of the embedded clause, since the temporal variable would be bound by the attitude verb. We observed that this is generally the case in Medumba, whereas in Washo both the simultaneous and backward-shifted readings are equally available. We analyzed the Washo pattern by appealing to *res*-movement of the embedded temporal pronoun, following Abusch (1997), Heim (1994) and others. We furthermore suggested that such a mechanism is much more constrained – though not completely absent – in Medumba. We therefore tentatively suggest a point of cross-linguistic variation along the lines of (62).<sup>16</sup>

(62) Res-Movement Variation:

Languages vary in the degree of availability of *res*-movement.

Such an account can indeed handle the variation observed between Washo and Medumba, but the natural question that arises is the following: what is the grammatical status of such non-categorical variation, which cannot be translated into a hard parameter governing the absolute (un-)availability of a certain operation, but rather seems to be about a language's propensity for making use of such a mechanism? We take up this question in more detail in section 4. For now, we note that the idea that a *de re* interpretation of embedded tenses in certain languages is possible but quite restricted has also been suggested by Ogihara & Sharvit (2012). They discuss this possibility for Hebrew, which like Medumba is also analyzed as a -SoT language. Given that Hebrew is an obligatory-tense language, it seems that the variation observed for *de re* interpretations of embedded tenses is also independent of the distinction between obligatory and optional-tense languages. We furthermore note that our findings in this section also serve as further evidence that an SoT parameter and a *de re* mechanism for embedded temporal pronouns are independent factors affecting the temporal interpretation of embedded clauses (Ogihara & Sharvit, 2012; Sharvit, 2018).

As pointed out by a reviewer, our analysis as we have presented it thus far rests on the assumption that *res*-movement can only target temporal pronouns, but not temporal operators.<sup>17</sup> We have so far closely followed Heim's (1994) implementation of *res*-movement, which is couched within a pronominal theory of tense, and so does indeed only target temporal pronouns. However, Ogihara (1996) proposes that temporal operators

15 Other optional-tense languages also appear to support this conclusion. Tlingit (Na-Dene) would appear to be a +SoT language (Cable, 2017), while Awing (Grassfields Bantu) would be a -SoT language (Mucha & Fominyam, 2017), though this is not how these authors frame the discussion of the data in their work.

16 Recall that *res*-movement is used here as a concrete placeholder for whatever analysis is used to derive the backward-shifted readings of embedded tenseless clauses.

17 We also thank associate editor Yael Sharvit for discussion on this point.

can also be subject to *res*-movement, but that when they move, they leave behind a copy, effectively ensuring that the temporal operator is interpreted in both positions. If we then follow Ogihara's theory, an embedded PAST-operator in Washo and Medumba like in (63) (cf. (29) and (52-a)) could potentially also undergo *res*-movement, as sketched in (64), deriving a backward-shifted interpretation.<sup>18</sup>

- (63) *Mary say-∅ that John be-PAST sick.* – Washo, Medumba –  
 (64) LF for *de re* interpretation of PAST-under-bare:  

$$[\lambda^* [\text{PAST} [\lambda t_3 [\text{TP } t_7 [\lambda t_4 \text{ Mary say}_{w_{@}, R, t_3, t_4} [\lambda w_1 [\text{TP } \text{PAST}_{(\text{copy})} [\lambda t_2 \text{ John sick}_{w_1, t_2} ]]]]]]]]]]]$$

$$\uparrow \text{-----} \uparrow \text{-----} |$$

Note that interpreting the downstairs copy of the temporal operator is crucial for avoiding an unwanted simultaneous reading for Washo and Medumba past-under-bare configurations (as well as for past-under-past configurations in Medumba). If the moved operator were only interpreted upstairs, its interpretation would only be restricted by the Upper Limit Constraint, which would in principle derive a simultaneous reading, contrary to the facts. Having the downstairs copy interpreted as well ensures that the embedded PAST still introduces a backwards shift relative to the attitude time, avoiding unwanted simultaneous readings even for *de re* interpreted embedded PASTs.<sup>19</sup> Hence, following Ogihara (1996) and Ogihara & Sharvit (2012), if *res*-movement in Washo and Medumba can also target an embedded PAST-operator, this movement leaves behind a copy in the complement, resulting in a backward-shifted interpretation.

Interestingly, the availability of this lower copy might also be subject to cross-linguistic variation, as argued by Ogihara & Sharvit (2012). Evidence for this variation comes from languages such as Hebrew and Russian, where simultaneous readings of past-under-past are marginally allowed although these languages arguably lack an SoT-rule (see section 4 for some further discussion). Ogihara & Sharvit (2012) propose that in Hebrew and Russian, accidental simultaneous readings can be derived with *de re* LFs under certain (restricted) circumstances. This assumption entails, however, that *res*-movement of embedded tense does not leave behind a copy in these languages. Hence, Ogihara & Sharvit (2012) formulate the Tense-Copy Parameter below.

- (65) Tense-Copy Parameter (Ogihara & Sharvit 2012, p. 662)  
 A *res*-moved tense morpheme {leaves/ does not leave} a copy.

Whereas the data in our languages could in principle be accounted for by assuming that only temporal pronouns can *res*-move and that temporal interpretation of complement clauses is subject to (15) and (62), existing analyses of obligatory-tense languages suggest that the additional parameter in (65) is necessary to capture the whole range of cross-linguistic variation.

We now turn to examining the temporal interpretation of complement clauses in morphologically tenseless languages, where we will also observe variation in the availability of simultaneous and backward-shifted readings.

18 Note that, for type reasons, the operator would then have to move out of this position again, and adjoin higher up, quantifying off the *res*-argument slot of the attitude verb.

19 This is also how Ogihara (1996) avoids deriving simultaneous readings for Japanese embedded past tense.

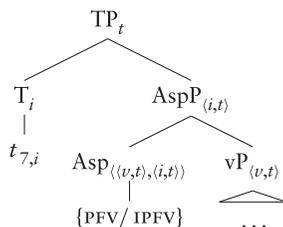
### 3 THE VIEW FROM TENSELESS LANGUAGES

Both Hausa and Samoan have been described as languages without grammatical tense marking (and are thus languages that plausibly lack temporal operators). Both languages do however overtly mark the aspectual distinction between imperfective and perfective. Despite these common properties, they vary in the temporal interpretation of attitude complements. While a perfective embedded under a perfective in Hausa is ambiguous between a shifted and a simultaneous interpretation (section 3.1), Samoan only allows for a shifted interpretation in this configuration (section 3.2). Simultaneous readings in Samoan require the imperfective aspect in the complement clause.

In order to meaningfully talk about the composition underlying these temporal interpretations in Hausa and Samoan, we need to take aspect into account (which we have conveniently ignored so far). In the remainder of this section, we introduce our background assumptions about aspect at the syntax-semantics interface. We will then turn to the analyses of Hausa and Samoan. We argue that differences in the precise semantic contribution of (perfective) aspect and variation in the availability of an additional mechanism for backward-shifted readings (e.g., *res*-movement) in the two languages account for the variation we observe in the temporal interpretation of complement clauses.

At Logical Form, the aspectual operators sit above the verb phrase and below the TP, as standardly assumed. We capture the tenselessness of Hausa and Samoan in the sections that follow by suggesting that both languages lack temporal operators and realize temporal reference via a temporal proform in T, parallel to tenseless clauses in Medumba and Washo. Depending on the structural configuration, this proform can either be interpreted as a free variable and receive a value from the utterance context via the assignment function, or it can be  $\lambda$ -abstracted over.

(66)



The relevant difference between the temporal systems of the languages under our consideration thus amounts to the following: In Medumba and Washo, but not in Hausa and Samoan, the reference time pronoun can be quantified over by optional (past) tense operators both in matrix and in complement clauses. In the absence of morphological tense operators, the reference of the temporal pronoun is contextually resolved (in the matrix case), or the pronoun is bound (in embedded environments like the complement clause of an attitude verb). Under our analysis, the latter option is available for all four languages that we discuss in this paper.

Under the setup in (66) and in the absence of PAST-operators to which an SoT-rule could apply in tenseless languages, any variation in the availability of simultaneous readings between the two languages is unexpected: Complement clauses are predicted to receive a simultaneous interpretation (recall the discussion in section 1.3). This is not what we find for embedded stative predicates with the perfective, however. Perfective-marked

stative verbs embedded under attitude predicates allow for simultaneous readings in Hausa (section 3.1), but not in Samoan (section 3.2). We present an analysis of this contrast which locates the variation between Hausa and Samoan in the lexical semantics of the perfective aspect in the two languages and in variation regarding the availability of *res*-movement.

### 3.1 *The Case of Hausa*

3.1.1 *Background* Hausa is an Afro-Asiatic language of the Chadic phylum spoken by approximately thirty-five million people mostly in Nigeria and the south of Niger (Newman, 2000). The language is morphologically tenseless, i.e., it does not have overt tense marking. Crucially, Hausa is also semantically tenseless, meaning that temporal reference is not covertly restricted by phonologically empty tense morphemes, unlike what has been proposed by Matthewson (2006) for St’át’imcets and by Jóhannsdóttir & Matthewson (2008) for Gitksan.

Aspect in Hausa is obligatorily marked on a preverbal subject-agreement pronoun, creating what the reference grammars abbreviate as PAC (“person-aspect complex” in Jaggar 2001, “pronoun-aspect complex” in Newman 2000).<sup>20</sup> The aspectual form which is marked by vowel-lengthening on the pronoun in (67) is referred to as ‘completive’ by Newman (2000) and as ‘perfective’ by Jaggar (2001). We adopt Jaggar’s terminology and refer to the form as perfective.

- (67) *Hàwwa tā gudu.*  
 Hawwa 3SG.F.PFV run  
 ‘Hàwwa ran.’  
 NOT: ‘Hàwwa is running.’

As illustrated in (67), durative event predicates marked for perfective aspect are incompatible with present interpretations. We adopt the analysis from Mucha (2013), which accounts for this observation with reference to the ‘Bounded Event Constraint’ proposed in Smith & Erbaugh (2005); Smith *et al.* (2003, 2007), and reproduced in (68).

- (68) Bounded Event Constraint: (Smith *et al.*, 2003, p. 186)  
 Bounded events are not located in the Present. Speakers follow a tacit convention that communication is instantaneous. The present perspective is incompatible with the report of a bounded event, because the bounds would go beyond the moment.

The analysis is based on the assumption that perfective aspect, when applied to an event predicate, forces the event to be temporally included in the reference time of the sentence (Klein, 1994; Kratzer, 1998). Assuming further that the utterance time is instantaneous (Bennett & Partee, 1978), it cannot fully include a durative event and can therefore not serve as the reference time of a perfective eventive sentence, to the effect that the reference time is shifted to the past (see Mucha 2013, p. 389ff. for details of the implementation in Hausa). As will become important for the comparison with Samoan below, the Hausa perfective is also compatible with future reference times, (69), which supports the conclusion that it does not encode past tense semantics.

20 For empirical evidence for the claim that Hausa is a genuinely tenseless language with obligatory aspect marking, see Mucha (2013).

- (69) Context: What time can I call you tonight?  
*Kāfin arfè shidà, nā gamà aikīnā.*  
 Before clock six 1SG.PFV finish work.my  
 ‘I will have finished my work by 6 o’clock.’ (Mucha, 2013, p. 387)

The perfective in Hausa contrasts with an imperfective form which is used to express present progressive readings with events. Depending on discourse context, however, its reference time can be shifted to the past or to the future as well.<sup>21</sup>

- (70) *Hāwwa ta-nā gudù.*  
 Hawwa 3.SG.F-IPFV run  
 ‘Hāwwa is running.’/ (‘Hāwwa was running.’)/ (‘Hāwwa will be running.’)

In the case of stative predicates such as *gàji* (‘(be) tired’) and *sani* (‘know’), the perfective form is used to express present readings as illustrated in (71) and (72-a), but past interpretations are also possible, (72-b).

- (71) *Yāra sun gāji.*  
 children 3PL.PFV be.tired  
 ‘The children are tired.’ (Jaggar, 2001, p. 159)

- (72) Context: Does Hawwa know Audu?  
 a. *I, tā san shi.*  
 yes 3SG.F.PFV know him  
 ‘Yes, she knows him.’  
 b. *Tā san shi à dā*  
 3SG.F.PFV know him once/ previously  
 (āmmā yānzū san tā bà tà gānè shi ba).  
 but now know 3.SG.F.PFV NEG she recall him NEG  
 ‘She once knew him (but now she won’t recognize him anymore...).’

According to the typological study presented in Bybee *et al.* (1994), it is a cross-linguistically stable observation that perfective aspect forms, when combined with stative predicates, typically yield present interpretations, while forcing past interpretations with eventive predicates. This is exactly what we find in Hausa, as shown in the examples in (67) and (72). This behavior, as well as future uses such as (69), differentiates perfective aspect from past tense, which forces past interpretation with both stative and eventive predicates. Since we are primarily concerned with the interpretation of (embedded) stative predicates, and since with the predicates we investigated both past and present temporal reference is expressed with perfective aspect in Hausa, we focus on the perfective cases here.<sup>22</sup> To capture the

21 The TAM paradigm of Hausa includes a variety of other forms which we do not discuss here, including a habitual aspect and a purported future tense. The reader is referred to Newman (2000) and Jaggar (2001) for comprehensive descriptions of the Hausa TAM system, and to Mucha (2013) for a modal/aspectual analysis of the future form.

22 Another generalization of Bybee *et al.* (1994) that is exemplified by Hausa is that not all statives combine with the perfective. According to Jaggar (2001, p. 172), certain non-verbal stative predicates such as locatives and common nouns combine with imperfective rather than perfective aspect in Hausa. Since our consultants rejected the imperfective forms with the predicates we tested, we set these cases aside.

observation that perfective aspect triggers past interpretation with eventive verbs but present interpretation with stative verbs, we assume that in Hausa the temporal relation encoded by the perfective varies with the eventuality type of the predicate it applies to. This is captured by the Aktionsart-distinguished perfective in (73). If the vP-predicate denotes a set of events, perfective aspect imposes inclusion of the eventuality time in the reference time (in line with Klein 1994; Kratzer 1998). If the predicate denotes a set of states, the perfective merely requires *overlap* of the eventuality time and the reference time.<sup>23</sup>

(73) Semantics of the Hausa perfective

$\llbracket \text{PFV} \rrbracket = \lambda p_{\langle v, t \rangle} \cdot \lambda t_i \cdot \exists e [p(e) \ \& \ \tau(e) \subseteq t]$  if  $p$  denotes a set of events

$\llbracket \text{PFV} \rrbracket = \lambda p_{\langle v, t \rangle} \cdot \lambda t_i \cdot \exists s [p(s) \ \& \ \tau(s) \circ t]$  if  $p$  denotes a set of states

The effect of this variation in the interpretation of perfective aspect is that the truth conditions we derive for unembedded stative sentences with perfective aspect marking are compatible with a present interpretation. For illustration, (74) provides the truth conditions of (72-a) (simplifying resolution of the individual pronouns for readability).

(74)  $\llbracket (72\text{-a}) \rrbracket^g = 1$  iff  $\exists s$  [s is a state of Hawwa knowing Audu &  $\tau(s) \circ g(7, i)$ ]  
(where by default  $g(7, i) = t^*$ )

These truth conditions state that (72-a) is true if there is a state of Hawwa knowing Audu which temporally overlaps with the value assigned to the temporal pronoun  $t_7$  by the assignment function  $g$ . We assume that in the default case, the reference time is identified with the utterance time, resulting in a present interpretation like in (72-a), while the past interpretation must be enforced by context or past adverbials (e.g., *à dā* in (72-b)). In the next subsection, we discuss the interpretation of perfective-marked statives embedded under *say*.

3.1.2 *The Temporal Interpretation of Complement Clauses in Hausa* Looking at the interpretation of complement clauses in Hausa, we observe that the perfective-under-perfective embedding with a stative complement in (75) is compatible with a simultaneous reading (triggered by context no. 1) as well as with a backward-shifted reading (triggered by context no. 2).

(75) Context no. 1:

Audu, you met Binta and Hawwa yesterday, how were they doing? (SIM)

Context no. 2:

Audu, you met Binta and Hawwa yesterday.

Did they tell you why they were in such a bad mood last week? (SHIFT)

23 We assume that the domain of eventualities (type  $v$ ) includes both states and events, for which we use distinct variables here for readability. The Aktionsart-specific perfective semantics in (73) is adopted from Mucha (2015) and based on the AT-relation proposed in Condoravdi (2002), which formalizes the idea that the temporal relation between eventuality times and reference times depends on the distinction between events and states (see, e.g., Kamp & Reyle 1993).

(ii)  $AT(t, w, P) =$  (Condoravdi, 2002, p. 70, no. (19))  
 a.  $\exists e [\tau(e)(w) \subseteq t \ \& \ P(e)(w)]$  if  $P$  is eventive  
 b.  $\exists s [\tau(s)(w) \circ t \ \& \ P(s)(w)]$  if  $P$  is stative  
 c.  $P(w)(t)$  if  $P$  is temporal

Hàwwa dà Binta sun cê [sun gâji].  
 Hawwa and Binta 3PL.PFV say 3PL.PFV be.tired  
 ‘Hàwwa and Binta said that they were tired.’

In the case of simultaneous readings, the embedded temporal pronoun is bound by the matrix attitude verb. The temporal pronoun in the matrix clause remains free for contextual resolution, and in the case of (75) refers to the past time interval provided by the context (i.e., *yesterday*). In (77), we give the LF and the truth conditions for the simultaneous reading of (75), taking into account the meaning contribution of aspect assumed in (73). To do this, we need to modify the lexical entry for the attitude verb to incorporate eventualities. For completeness, we provide the adapted semantics of *say* in (76).

(76)  $\llbracket \text{say} \rrbracket = \lambda w_s . \lambda e_v . \lambda p_{(s,(i,t))} . \lambda x_e .$

$\forall w' [w' \in \text{SAY}(x, w, e) \rightarrow p(w')(\text{NOW}_x(w', \tau(e)))]$

(77) Simultaneous reading of perfective-under-perfective in Hausa:

a.  $[\text{PFV}_{t_7} [\lambda e [\text{H\&B say}_{e,w_{@}} [\lambda w \lambda t_3 [\text{PFV}_{t_3} [\lambda s \text{ they tired}_{s,w}]]]]]]]$

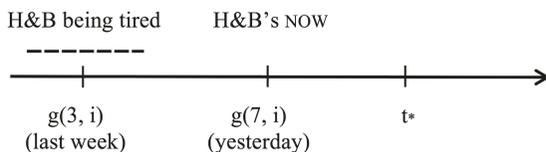
b.  $\llbracket (75) \rrbracket^g = 1 \text{ iff } \exists e [\tau(e) \subseteq g(7, i) \ \& \ \forall w' [w' \in \text{SAY}(\text{H\&B}, w_{@}, e) \rightarrow \exists s [\text{NOW}_{\text{H\&B}}(w', \tau(e)) \circ \tau(s) \ \& \ s \text{ is a state of H\&B being tired in } w']]]]$

Like in the tenseless sentences in Washo (see section 2.1), we propose that the shifted interpretation is derived by *res*-movement of the embedded temporal pronoun ( $t_3$ ) to an argument position of the matrix verb where it can refer to a time interval prior to the matrix evaluation time (i.e., *last week* in (75)). The LF for the backward-shifted reading is given in (78),<sup>24</sup> and the relation between the matrix reference time  $g(7, i)$  and the value assigned to the *res*-moved temporal pronoun,  $g(3, i)$ , in the SHIFT context is illustrated in Figure 2.

(78) Backward-shifted reading of perfective-under-perfective in Hausa:

a.  $[\text{PFV}_{t_7} [\lambda e [\text{H\&B say}_{e,w_{@},R,t_3} [\lambda w \lambda t_3 [\text{PFV}_{t_3} [\lambda s \text{ they tired}_{s,w}]]]]]]]$

b.  $\llbracket (75) \rrbracket^g = 1 \text{ iff } \exists e [\tau(e) \subseteq g(7, i) \ \& \ \forall w' [w' \in \text{SAY}(\text{H\&B}, w_{@}, e, g(3, i)) \ \& R(w', \text{H\&B}, g(3, i), \text{NOW}_{\text{H\&B}}(w', \tau(e))) \rightarrow \exists s [g(3, i) \circ \tau(s) \ \& \ s \text{ is a state of H\&B being tired in } w']]]]$



**Figure 2** The shifted reading in Hausa

To summarize, in the tenseless language Hausa both shifted and simultaneous interpretations are available for stative predicates with perfective aspect embedded in attitude complement clauses. Given our assumption that the reference time is syntactically represented

<sup>24</sup> Like in the Washo case, we assume a relational version of the attitude verb involving additional argument positions for the moved temporal pronoun and the acquaintance relation *R*. We furthermore assume the Upper Limit Constraint (Abusch, 1997; Heim, 1994) prevents the temporal pronoun of the embedded clause from referring to a time after the matrix event time.

as a free variable, the mechanisms employed to derive simultaneous and shifted readings in approaches involving temporal pronouns (Abusch, 1997; Heim, 1994) straightforwardly account for the existence of backward-shifted and simultaneous readings in tenseless clauses. Since the reference time pronoun is not restricted by semantic past tense in Hausa, no syntactic deletion mechanism must be posited to derive simultaneous readings.

We get the simultaneous reading for free under the assumption that perfective aspect interacts with stative predicates as proposed in (73). Hence, being a genuinely tenseless language, Hausa falls outside the scope of any SoT deletion mechanism, since there are no tenses that this mechanism could apply to. What is interesting is that Hausa behaves like Washo (and unlike Medumba) in that backward-shifted readings are freely available for bare complement clauses. Note, however, that the languages differ in the range of means they have at their disposal to express this reading. While in Washo, the backward-shifted reading can be expressed by a past-marked or by a bare complement clause, Hausa only has the bare complement option. In light of the observation that the perfective form in Hausa seems to express nothing but temporal overlap with the stative predicates we considered, the grammar of Hausa does not provide a compositionally transparent way to express the backward-shifted reading. Therefore, applying an additional mechanism (*res*-movement, under our analysis) seems inevitable in this language.

We continue with this section by showing that even within the typological class of morphologically tenseless languages we find variation in the interpretative possibilities of perfective-marked stative predicates in complement clauses. In the next subsection we analyze the case of Samoan, which does not allow for simultaneous interpretations in examples parallel to (75).

### 3.2 *The Case of Samoan*

3.2.1 *Background* Samoan is an aspect-prominent Polynesian language with approximately 300,000 speakers worldwide, the majority of whom live on the Pacific islands of Western and American Samoa (Simons & Fennig, 2017). Basic word order is VSO. Aspect is encoded in pre-verbal free functional morphemes. Apart from generic *e* and prospective ‘*o le’ā*, the inventory of morphological markers comprises three aspectual markers, the inchoative ‘*ua*, the imperfective ‘*o lo’o* and the perfective *na/sā*<sup>25</sup> (see also Mosel & Hovdhaugen 1992, Mosel 2000 and Hohaus 2017). The evaluation time of an imperfective or inchoative-marked sentence may be in the past, present or future, as shown in (79) and (80), although there is a strong preference for the utterance time. Irrespective of their eventuality type, perfective-marked predicates are restricted in their interpretation to past evaluation times, as is illustrated in (81).<sup>26</sup>

- (79) a. ‘*O lo’o siva le teine.*  
 TAM(ipfv) dance the girl  
 ‘The girl {is/ was/ will be} dancing.’

25 “There are two particles for the past [*sic*], *sā* and *na*, which are more or less interchangeable, but *na* is preferred for events that happened unexpectedly and had a short duration.” (Mosel & So’o, 1997, 21)

26 All examples are reported in the orthography elicited, resulting in variation in the use of diacritics.

- b. *'O lo'ō ita Sina.*  
 TAM(ipfv) angry Sina  
 'Sina {is being/ was/ will be} angry.'
- (80) *Ua pu'upu'u Sina.*  
 TAM(inch.) short Sina  
 'Sina {then became/ is now/ will then be} short.'
- (81) a. *Sā siva le teine.*  
 TAM(past.pfv) dance the girl  
 'The girl danced.'  
 NOT: 'The girl is dancing.'  
 NOT: 'The girl will have danced.'
- b. *Sā nofo Ioane i Apia.*  
 TAM(past.pfv) stay/ live John in Apia  
 'John lived in Apia.'  
 NOT: 'John lives/ is living in Apia.'  
 NOT: 'John will have lived in Apia.'
- c. *Sa ita le tama.*  
 TAM(past.pfv) angry the boy  
 'The boy was angry.'  
 NOT: 'The boy is angry.'  
 NOT: 'The boy will have been angry.'

Crucially, though, the perfective marker cannot be analyzed as just a past tense or just a perfective aspect. It cannot combine with the imperfective to yield a past imperfective, as shown in (82). It is however also unacceptable in on-going event descriptions, as shown in (83). As the consultant's comment also indicates, the event described by the verb must have been completed within the reference time, and may not be on-going.

- (82) \**'O lo'ō sā siva Malia.*  
 TAM(ipfv) TAM(past.pfv) dance Mary  
 intended: 'Mary was dancing.'
- (83) a. Description of picture context: Yesterday, Tupe was at a roadside stall that sells coconuts for three tala each. At the time of the picture, she was in the process of picking up a coconut.
- b. *#Sa faatau e Tupe i le niu.*  
 TAM(pfv) buy ERG. Tupe PREP. the coconut  
 intended: 'Tupe was buying a coconut.'  
 Consultant's comment: "She already bought a coconut."

Perfective readings with a reference time that is not in the past of the evaluation time are however also ruled out. Crucially, future perfective readings are unavailable with the perfective marker, as illustrated in (84).<sup>27</sup>

27 Present perfective readings are standardly considered to be unavailable for independent reasons, as discussed in section 3.1.1 in the context of Hausa (see also the discussion in Kai von Fintel & Irene Heim's lecture notes for their 24.973 Spring 2016 class at the Massachusetts Institute of Technology, pp. 35-40).

(84) a. Context: Epe is sewing a new puletasi (= the traditional Samoan two-piece dress) for her sister. She still had some work left to do when I visited her earlier today. She told me to come back tomorrow:

b. \**Sau taeao, s̄a uma ai le ofu lea.*

come tomorrow, TAM(pfv) complete PRN the dress DEM.sg.

Intended: ‘Come tomorrow, the dress will be finished.’

We therefore suggest to analyze *nals̄a* as a perfective aspect with a presupposition: We posit that this operator not only relates the running time of the event to the reference time, but additionally introduces a presupposition on its time argument (see also Hohaus, forthcoming). The evaluation time is required to be past relative to some other time. (In the matrix case, this is the utterance time.) In the lexical entry in (85), temporal meaning is thus fused with the aspectual meaning. For the Samoan imperfective, the data are compatible with a standard lexical entry, in (86).

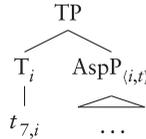
(85)  $\llbracket nals̄a \rrbracket = \lambda t'. \lambda p_{(v,t)}. \lambda t_i : t < t'. \exists e [\tau(e) \subseteq t \ \& \ p(e)]$  if  $p$  denotes a set of events

$\llbracket nals̄a \rrbracket = \lambda t'. \lambda p_{(v,t)}. \lambda t_i : t < t'. \exists s [\tau(s) \circ t \ \& \ p(s)]$  if  $p$  denotes a set of states

(86)  $\llbracket 'o \ lo'o \rrbracket = \lambda p_{(v,t)}. \lambda t_i. \exists e [\tau(e) \supset t \ \& \ p(e)]$

At Logical Form, just like in Hausa, the aspectual particles create a predicate of times, which then combines with a morphologically null free temporal variable in  $T$ , as sketched in (87).

(87)



Applied to the matrix case, the interpretation of the examples in (79-b) and (81-c) proceeds as in (88) and (89) below. In the case of imperfective ‘*o lo'o*’, the context must provide an appropriate (past, future or present) reference time via the variable assignment function. In the case of the perfective, however, appropriate value assignments are restricted by the presupposition of the aspectual operator to times that precede the utterance time, which, syntactically, is the first argument of the aspectual head here.

(79-b) *'O lo'o ita Sina.*

TAM(ipfv) angry Sina

‘Sina {is being/ was/ will be} angry.’

(88) matrix imperfective in Samoan:

a. LF structure:

$\llbracket \text{TP} [T \ t_{7,i}] [\text{AspP}_{(i,t)} [\text{Asp } 'o \ lo'o] [\text{vP}_{(v,t)} \text{ the boy angry}_{w@}]] \rrbracket$

b. truth conditions:

$\llbracket (79\text{-b}) \rrbracket^g = 1$  iff  $\exists s [\tau(s) \supset g(7, i) \ \& \ s$  is the state of S being angry in  $w_{@}$ ]

(81-c) *Sa ita le tama.*

TAM(past.pfv) angry the boy

‘The boy was angry.’

(89) matrix past perfective in Samoan:

a. LF structure:

$\llbracket \text{TP} [T \ t_{7,i}] [\text{AspP}_{(i,t)} [\text{Asp } s̄a \ t* ] [\text{vP}_{(v,t)} \text{ the boy angry}_{w@}]] \rrbracket$

b. truth and definedness conditions:

- $\llbracket (81\text{-c}) \rrbracket^g = 1$  iff  $\exists s [\tau(s) \circ g(7, i) \ \& \ s \text{ is the state of the boy being angry in } w_{@}]$   
 $\llbracket (81\text{-c}) \rrbracket^g$  is defined iff  $g(7, i) < t^*$

When it comes to the interpretation of a perfective-marked stative in a matrix clause like (81), Samoan thus crucially differs from Hausa. Recall that the perfective in Hausa with a stative predicate is interpreted as temporally overlapping with the utterance time. In Samoan, stative predicates marked for perfective must however be interpreted with a past evaluation time. A further example is in (90).

- (90) *Sa tauaso, a ua vaai!*  
 TAM(past.pfv) blind, but TAM(inch.) see  
 ‘[Ruth] was blind, but now she sees!’  
 (Mosel & Hovdhaugen, 1992, p. 340, no. (7.61))

Without any additional machinery, this setup predicts embedded imperfectives in Samoan to yield simultaneous readings and embedded perfectives to yield backward-shifted readings, irrespective of the *Aktionsart* of the predicate. Modulated by the attitude predicate, the running time of the embedded eventuality will be required to overlap with or contain the running time of the matrix event. This is indeed the pattern we find in complement clauses.

3.2.2 *The Temporal Interpretation of Complement Clauses in Samoan* For complement clauses (as well as relative clauses, see Hohaus, *forthcomin*, for details), only the shifted reading is available for perfective-under-perfective. Simultaneous readings require the imperfective in the embedded clause. Two relevant examples along with appropriate contexts are below. In (91), the context sets up a simultaneous reading but the embedded past perfective is not acceptable. As one of the consultant’s comments suggests, the resulting reading is the backward-shifted one. If the simultaneous reading were actually available for the embedded past perfective, we would expect it to show up most clearly with perception verbs like *iloa* (‘to notice’), which strongly bias towards a simultaneous interpretation (Dickey, 2001; Hollebrandse, 2000). The embedded past perfective in (93-c) is however only acceptable in the context in (92-b), which forces a shifted reading. Crucially, it is however not acceptable in (92-a). The embedded imperfective in (93-b) on the other hand is unacceptable in the shifted context, but acceptable in (92-a), which allows only for a simultaneous reading.

- (91) a. Context: You have not seen your friends Malia and Sina in a long time because they live in New Zealand now. Last week, however, you met Malia who is in Samoa visiting her family. She tells you: “Sina is expecting a baby!” You tell your sister later that day:  
 b. #*Sa ta’u mai e Malia sa tō Sina.*  
 TAM(past.pfv) tell DIR. ERG. Mary TAM(past.pfv) pregnant(colloq.) Sina  
 Intended: ‘Mary told me that Sina was pregnant.’  
 Consultant’s comment: “Sina already gave birth, she has a baby already.”  
 c. *Sa ta’u mai e Malia ‘o lo’o tō Sina.*  
 TAM(past.pfv) tell DIR. ERG. Mary TAM(ipfv) pregnant(colloq.) Sina  
 ‘Mary told me that Sina was pregnant.’

- (92) a. Description of picture context: (SIM)  
 Today is October 8, 2015. Three days ago, Tigilau looked at his calendar and saw a note saying that Sina was staying in Apia that day.
- b. Description of picture context: (SHIFT)  
 Today is October 8, 2015. Yesterday, Tigilau looked at his calendar and saw that Sina was in Apia on October 5, 2015.
- (93) *Na iloa e Tigilau...*  
 TAM(past.pfv) noticed ERG. Tigilau  
 ‘Tigilau noticed...’
- a. *sā nofo Sina i Apia.* # (92-a), ✓ (92-b)  
 TAM(past.pfv) stay Sina in Apia  
 ‘that Sina had been in Apia.’  
 Comment: “Sina has gone back already.”
- b. *‘o lo‘o nofo Sina i Apia.* ✓ (92-a), # (92-b)  
 TAM(ipfv) stay Sina in Apia  
 ‘that Sina was in Apia.’

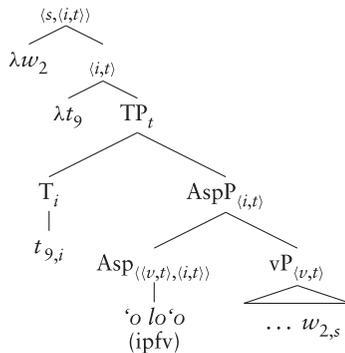
Table 3 summarizes the possible interpretations of complement clauses in Samoan.

**Table 3** The temporal interpretation of complement clauses in Samoan

	past PFV-under-past PFV	IPFV-under-past PFV
simultaneous	#	✓
backward-shifted	✓	#

We derive this pattern by abstraction over the time argument of the aspectual operator in the complement, assuming that attitude verbs embed tensed propositions (type  $\langle s, \langle i, t \rangle \rangle$ ). For the simultaneous reading with the embedded imperfective, the Logical Form and the interpretation are sketched in (94).<sup>28</sup>

- (94) imperfective-under-perfective in Samoan:  
 a. LF for the embedded clause:



28 We simplify away from the problem of presupposition projection through quantifiers here (see, e.g., Tiemann (2014) for recent discussion).

b. interpretation of the embedded clause:

$[\lambda w. \lambda t. \exists s [\tau(s) \supset t \ \& \ s \text{ is the state of S being in Apia in } w]]$

c. truth and definedness conditions:

$[[ (93\text{-b}) ]^g = 1 \text{ iff } \exists e [\tau(e) \subseteq g(7, i) \ \& \ \forall w [w \in \text{NOTICE}(T, e, w_{@}) \rightarrow \exists s [\tau(s) \supset \text{NOW}_T(\tau(e), w) \ \& \ s \text{ is the state of S being in Apia in } w]]]]$   
 $[[ (93\text{-b}) ]^g \text{ is defined iff } g(7, i) < t^*$

A simplified version of the above truth conditions is offered in (95). Modulated by the matrix verb, the matrix event time  $\tau(e)$  ends up being the reference time for the embedded event, yielding the simultaneous reading.

(95) a. simplified lexical entry for perception verb:

$[[ \textit{iloa} \text{ ('notice')} ]_{(\text{simplified})} ] = \lambda w_s. \lambda e_{(v)}. \lambda P_{(s, (i, t))}. \lambda x_e.$   
*e is an event of x observing in w that P(w)(τ(e))*

b. simplified truth and definedness conditions:

$[[ (93\text{-b}) ]^g = 1 \text{ iff } \exists e [\tau(e) \subseteq g(7, i) \ \& \ e \text{ is an event of T observing in } w_{@} \text{ that } \exists s [\tau(s) \supset \tau(e) \ \& \ s \text{ is the state of S being in Apia in } w_{@}]]]$   
 $[[ (93\text{-b}) ]^g \text{ is defined iff } g(7, i) < t^*$

This interpretation is the expected one without any further assumptions (see also section 1.3 above). Note though that this qualification is important: given the interpretative possibility of tenseless complement clauses in Table 3, Samoan also does not appear to make use of any additional manipulation of the temporal proform in the embedded clause (such as *res*-movement) to derive a shifted interpretation for the embedded imperfective.

Shifted readings with the embedded past perfective require that binding target the presupposition introduced by the aspectual operator, (96-a), with the result in (96-c). The temporal proform in the lower T remains free. We thereby derive the requirement that the contextually provided evaluation time  $t_9$  for the embedded sentence must precede the running time of the matrix event.

(96) perfective-under-perfective in Samoan:

a. LF for the embedded clause:

$[\_{(s, (i, t))} \lambda w_2 [\lambda t_1 [\_{TP} [\_{T} t_{9, i}] [\_{AspP(i, t)} [\_{Asp} \bar{s} a t_{1, i}] [\_{VP} \dots w_{2, s}]]]]]]]$

b. interpretation of the embedded clause:

$[\lambda w. \lambda t : g(9, i) < t. \exists s [\tau(s) \circ g(9, i) \ \& \ s \text{ is the state of S being in Apia in } w_{@}]]]$

c. simplified truth and definedness conditions:

$[[ (93\text{-b}) ] = 1 \text{ iff } \exists e [\tau(e) \subseteq g(7, i) \ \& \ e \text{ is an event of T observing in } w_{@} \text{ that } \exists s [\tau(s) \circ g(9, i) \ \& \ s \text{ is the state of S being in Apia in } w_{@}]]]$   
 $[[ (93\text{-b}) ] \text{ is defined iff } g(7, i) < t^* \ \& \ g(9, i) < \tau(e)$

Note that Past-under Past Deletion cannot be applied to the Logical Form in (96-a), despite the temporal meaning component of the perfective: The lower aspect cannot undergo a deletion operation for compositional reasons. If the lower past perfective were entirely deleted from the LF structure, its aspectual meaning would be deleted along with the temporal presupposition, resulting in a type mismatch. Languages with hybrid aspectual operators like the Samoan past perfective are under this view predicted to not participate in the SoT ambiguity.

### 3.3 *Interim Summary: The Temporal Interpretation of Complement Clauses in Tenseless Languages*

While the view from Japanese and English that we started out with in section 1.2 suggests that differences in the temporal readings of complement clauses boils down to parametric variation in the availability of Past-under-Past Deletion, the view from Hausa and Samoan presented in this section further highlights that (15) is not the only source of variation in the temporal interpretation of complement clauses across languages.

(15) The Sequence of Tense Parameter [ $\pm$  SoT]:

A language {does/ does not} allow for Past-under-Past Deletion.

Even in the absence of temporal operators to which the deletion operator could apply, languages may exhibit the simultaneous/shifted ambiguity in complement clauses, as is the case for stative perfective-marked predicates embedded under a perfective in Hausa. Hausa has a purely aspectual perfective operator that is compatible with future and present interpretations (the latter only with stative predicates, see section 3.1). Assuming that the reference time is syntactically represented as a temporal proform, we derive the simultaneous reading in complements with binding of that pronoun, and the shifted reading with free (past) reference of the pronoun facilitated by *res*-movement. The temporal interpretation of complement clauses in the language thus falls outside the scope of (15). Rather, the Hausa data can be analyzed in parallel to tenseless clauses in Washo with recourse to some auxiliary mechanism.

As is the case for tensed languages, the availability of the two readings is subject to variation even among tenseless languages. In Samoan, a past perfective embedded under a past perfective only allows for a backward-shifted interpretation. We suggest that the variation observed in the available interpretations of perfective-marked complement clauses is the result of variation in the functional lexicon of the two languages, more specifically variation in the lexical semantics of the perfective. Under the analysis presented in the previous section, the Samoan perfective is not purely aspectual, but involves an anteriority presupposition. Thus, Samoan in this one case fuses temporal and aspectual meaning (and is therefore not a genuinely tenseless language in the same way as Hausa). We have argued that this quirk of the grammar is the reason that Samoan does not allow for simultaneous readings of embedded past perfectives. Past-under-Past Deletion cannot target the anteriority presupposition. Contrasting Hausa and Samoan, however, also supports our generalization from section 2 that languages differ in the interpretative possibilities for temporal proforms in embedded environments, more specifically in the availability of *res*-movement. We repeat this generalization below.

(62) Res-Movement Variation:

Languages vary in the degree of availability of *res*-movement.

Samoan lacks the backward-shifted readings with embedded imperfectives that such a movement operation would allow us to derive. Explaining the interpretative possibilities of embedded perfectives in Hausa, however, requires such an operation. Thus, not all tenseless languages are alike.

The view from optional-tense and tenseless languages thus reveals several important dimensions of variation that play a role in the temporal interpretation of attitude complements. We discuss the bigger picture that results in the next section.

## 4 THE BIGGER PICTURE

Our investigations started out from a contrast observed in obligatory-tense languages, where past-marked complement clauses embedded under past-marked attitude verbs are ambiguous between a backward-shifted and a simultaneous reading in +SoT languages like English, or license only a backward-shifted reading in –SoT languages like Japanese. To this parametric view on the composition of temporal meaning in embedded environments, we added data from four understudied and typologically unrelated languages that lack obligatory tense marking: Washo (language isolate), Medumba (Niger-Congo), Hausa (Afro-Asiatic), and Samoan (Austronesian). Under an analysis that translates the absence of morphological tense marking as the absence of temporal operators at Logical Form (and relies on temporal variables only), temporally bare complement clauses are predicted to only allow for simultaneous readings—at least without further machinery. We repeat the relevant LF configuration from (18) below.

(18) Tenseless complement clause at LF (= simultaneous reading):

$$[ \dots (\text{attitude verb}) [_{(s,(i,t))} \lambda w_1 \lambda t_7 [ \text{TP} [ \text{T } t_{7,i} ] [_{(i,t)} \dots (\text{verb}) w_{1,s} \dots ] ] ] ] ] ]$$

This is not what we find, however, with our results summarized in Table 4. While the simultaneous reading is available for tenseless complement clauses in all four languages (the top right cell in our table), tenseless complement clauses may also allow for a backward-shifted reading (the bottom right cell in the table).

**Table 4** Availability of SIM and SHIFT in the four languages

		Past-under-Past	bare-under-Past bare-under-bare
simultaneous reading	Washo	✓	✓
	Medumba	✗	✓
	Hausa	n/a	✓
	Samoan	(✗)	✓
backward-shifted reading	Washo	✓	✓
	Medumba	✓	??
	Hausa	n/a	✓
	Samoan	(✓)	✗

In more detail: Washo, a language with optional past tense marking, allows simultaneous and backward-shifted readings with past-marked complements (but also with bare complements), if the matrix clause contains a past tense. In Medumba, by contrast, past-under-past can only be used to express backward-shifted readings, while bare complements are strongly preferred for expressing simultaneous readings. In Hausa, temporally bare, perfective-marked complement clauses are ambiguous between the simultaneous and the backward-shifted reading. And lastly, in Samoan, an aspect-prominent language that however encodes a past meaning in its perfective aspect form, simultaneous readings of a past perfective embedded under a past perfective are disallowed and require the imperfective aspect in the complement. The imperfective, however, is only compatible with the simultaneous reading, a backward-shifted interpretation is not available.

We thus find no variation in the two cases that we might call compositionally transparent in that the interpretation is true to the surface morphology. In the first case, if a language

has a past tense, it also allows for the backward-shifted reading of past-marked complement clauses. In the second case, bare complement clauses always allow for simultaneous readings. Variation arises when it comes to the interpretations that require additional compositional machinery, namely the simultaneous interpretation of past-under-past (which requires Past-under-Past Deletion, whose availability is governed by  $[\pm \text{SoT}]$  in (15)), and the backward-shifted interpretation of bare complement clauses (governed by the availability of *res*-movement). With respect to the availability of Past-under-Past Deletion across languages, we can conclude that  $[\pm \text{SoT}]$  in (15) is active in optional-tense languages, just like it is in obligatory-tense languages. The differential parameter setting accounts for some of the variation observed between Washo and Medumba. We have however identified in this paper another point of cross-linguistic variation, in (62): languages vary in the degree to which an additional compositional mechanism is available for shifting the interpretation of an embedded temporal pronoun, e.g., *res*-movement.

- (15) The Sequence of Tense Parameter  $[\pm \text{SoT}]$ :  
 A language {does/ does not} allow for Past-under-Past Deletion.
- (62) Res-Movement Variation:  
 Languages vary in the degree of availability of *res*-movement.

This second point of variation is at issue for any language that has finite tenseless clauses, thereby cross-cutting the divide between optional tense and completely tenseless languages. Washo and Hausa allow for a relatively free application of such a mechanism to derive backward-shifted readings of morphologically tenseless clauses. In Medumba, the availability of such a mechanism appears more restricted, while Samoan does not appear to resort to such a mechanism at all in the temporal interpretation of complement clauses.<sup>29</sup> Recall that in Medumba, embedded past marking is incompatible with a simultaneous reading. The backward-shifted reading of bare complements, however, is marginally acceptable in this language. This suggests that whatever mechanism derives this reading (*res*-movement in the analysis proposed here) is in principle available in this language, but restricted. While Hausa, being a genuinely tenseless language, brings nothing to the table when it comes to past-under-past embeddings, the fact that tenseless clauses freely allow for both backward-shifted and simultaneous readings suggests that an additional mechanism is freely available in this language, given that only the simultaneous reading follows directly from semantic composition. We conjectured in section 3.1 that this might not be surprising since the grammatical system of Hausa does not provide a compositionally transparent way of deriving the backward-shifted reading. This, however, is in sharp contrast with the observations we made for Washo. In Washo, backward-shifted readings are available with bare complement clauses although past-marking of the complement is a viable alternative that derives this reading in a compositionally transparent way. Conversely, the simultaneous reading can be expressed with past-under-past, although leaving the complement unmarked is an alternative. This leads us to conclude that both an SoT deletion rule and an additional mechanism for the interpretation of the embedded temporal pronoun are available in

29 Cable (2015) provides an analysis of (graded) tense in complement clauses in Gikūyū that relies on the idea that embedded pronominal tenses *must* be interpreted *de re*. While Cable proposes a universal preference for temporal *de re*, in our view Gikūyū would complete the cross-linguistic picture by exemplifying languages where *res*-movement of temporal pronouns is not just unrestricted, but actually preferred or even obligatory.

Washo. More generally, the overall picture suggests that the source of the variation we observe is the degree to which languages resort to post-compositional mechanisms and/or redundant morphological marking of temporal relations.

Judging by their availability in our language sample, Past-under-Past Deletion appears to have a different status in the grammar than *res*-movement. Variation in tense deletion appears to be categorical, as the parameter in (15) suggests. The variability we observe when it comes to *res*-movement excludes such a categorical treatment, but is reminiscent of gradient variation observed in other areas of the grammar of natural languages. For instance, Stiebels (2007) proposes that cross-linguistic variation in the availability of control shift is based on covert coercion mechanisms that different languages are more or less likely to avoid. Likewise, it has been noted that there are cross-linguistic differences in scope preferences and in the availability of inverse-scope readings (= the availability of Quantifier Raising across languages; see, e.g., Beck, forthcoming, Radó & Bott 2018, and references therein), and that there is variability in island strength across languages (= the availability of extraction from islands; see, e.g., Featherston 2005; Kush *et al.* 2018; Polinsky *et al.* 2013; Sprouse *et al.* 2016).

In connection with the categorical *vs.* gradable nature of these parameters, it is interesting to note that not all –SoT languages with obligatory tense marking behave like Japanese, but that some have been reported to show “mixed behavior” when it comes to SoT ambiguities in complement clauses. Russian, for instance, behaves like a –SoT language in that simultaneous readings of complement clauses are canonically expressed with embedded non-past (see, e.g., Grønn & von Stechow 2010; Kubota *et al.* 2009). As discussed by Altschuler (2008) and Grønn & von Stechow (2010), however, past-under-past complement clauses can receive simultaneous interpretations under certain conditions as well, depending on their aspectual properties and the surrounding discourse context. Similar observations have been made for Hebrew. Ogihara & Sharvit (2012) and Sharvit (2018) report that the preferred way to express a simultaneous reading of attitude complements is present-under-past, and that speakers vary in their judgments on simultaneous readings of past-under-past complement clauses. This fact leads those authors to propose that Hebrew lacks an SoT deletion rule but that simultaneous readings can be derived from a *de re* LF, which is restricted due to a preference for bound pronouns (Ogihara & Sharvit, 2012, p. 662). Thus it would appear that Hebrew would be a language similar to Medumba, where *res*-movement is in principle available, but restricted generally in the language. On such a view the SoT parameter remains categorical, but the availability of *res*-movement can be more or less restricted across languages, in line with what we have proposed here. Moreover, the broader cross-linguistic comparison suggests that languages vary in whether or not *res*-movement can derive simultaneous readings of past-marked complement clauses. This seems to be possible in Hebrew, but not in Washo, Medumba, or Japanese. As noted in section 2.3, this variation can be captured by the Tense-Copy Parameter proposed in Ogihara & Sharvit (2012).

## 5 SUMMARY AND CONCLUSIONS

This paper provides new empirical data on the temporal interpretation of complement clauses from a cross-linguistic perspective, with special focus on sequence-of-tense (SoT) phenomena and the availability of backward-shifted and simultaneous readings. While existing research on cross-linguistic variation in this area is restricted to languages with

obligatory tense marking, we demonstrate that variation in the existence of simultaneous readings extends to languages with optional tense marking as well as morphologically tenseless languages.

More specifically, in the optional (graded) tense language Medumba, past-under-past embeddings only give rise to shifted readings, while optional embedded past tense in Washo is compatible with shifted, but also with simultaneous readings, provided that the matrix clause also contains a past marker. In the morphologically tenseless language Hausa, perfective-marked statives in complement clauses are compatible with both shifted and simultaneous readings, while the same configuration in Samoan allows for shifted readings only. The central empirical observations presented in the paper are summarized in Table 5.

**Table 5** New data on the temporal interpretation of complement clauses

Hausa	perfective-under-perfective	SIM and SHIFT
Samoan		SHIFT only
Medumba	past-under-past	SHIFT only
Washo		SIM and SHIFT

To analyze these observations, we proposed that the variation we find in the availability of simultaneous readings for complement clauses with (optional) past-tense marking in Medumba and Washo is straightforwardly accounted for under a structural SoT analysis, which assumes that the relevant parameter is whether a language has an SoT deletion rule in its grammar. Meanwhile, for Hausa and Samoan, a difference in the exact semantics of the aspectual operators leads to the same empirical contrast that we find in tensed languages. Being tenseless languages, they clearly fall outside the scope of a potential SoT deletion mechanism. Simultaneous readings in Hausa are simply derived by binding the embedded temporal proform. Samoan also derives simultaneous readings by binding of the embedded temporal proform, but in combination with the imperfective aspect. The perfective aspect marker encodes additional temporal meaning (i.e., a past presupposition) which derives a backward-shifted interpretation, but this temporal meaning cannot be accessed in the structure, and can thus not be deleted to derive a simultaneous interpretation. To account for the backward-shifted reading of bare complement clauses in Washo and Hausa, we adopted an analysis from the literature that assumes *res*-movement of the embedded reference time pronoun which is then interpreted as a free temporal variable. However, based on the data from Medumba and Samoan as well as proposals made in the literature (e.g., Ogihara & Sharvit 2012), we proposed that languages vary in the availability of such an additional mechanism, but crucially this point of variation is gradable, not categorical.

To summarize, our investigations suggest that three factors govern the variation we observe in the interpretation of stative complement clauses: (i) variation in the functional lexicon (the temporal presupposition of the perfective in Samoan *vs.* the purely aspectual perfective in Hausa), (ii) a parametric, structural choice with respect to some sort of SoT-Rule (for example in Washo *vs.* Medumba), and (iii) the availability of a further mechanism affecting the interpretation of an embedded temporal pronoun (e.g., *res*-movement). Importantly, we have shown that there is variation within the set of optional-tense languages, and within the set of tenseless languages with respect to the availability of readings in complement clauses. Going back to a question we asked at the beginning of the paper, we find that variation in the broad type of tense systems alone (i.e., obligatory tense,

optional tense, tenseless) is not a driving force behind the available readings for complement clauses. Rather, languages vary in how they employ additional mechanisms for manipulating temporal interpretation such as (15) and (62), independent of their overall tense system.

The primary goal of this study was to broaden the typology of SoT effects in complement clauses by presenting data from and proposing analyses for understudied languages without obligatory tense marking. Our hope is that future research in this direction will complement and refine the potential sources of variation that we have proposed in this paper.

**List of Abbreviations used in Glosses:** 1, 2, 3 = First, second, third person, ATTR = attributive, colloq. = colloquial, COMP = complementizer, DIR. = directional particle, DEM. = demonstrative, DEP = dependent mood, ERG. = ergative case marker, F = feminine, INCH. = inchoative aspect, IND = independent mood, IPFV, IPFV = imperfective aspect, LOC = locative, NC = negative concord, NEAR = temporal remoteness marker for near past, NEG = negation, NMLZ = nominalizer, NOM. = nominative case marker, NPAST = non-past verbal morphology, OBJ = object, past, PAST = past tense morphology, PL = plural, PFV, PFV = perfective aspect, PREP. = preposition, PRES = present tense morphology, PRT = particle, PRN, PRO = pronoun, PROSP = prospective aspect, REC.PAST = recent past marker, REL = relative clause marker, REM = temporal remoteness marker for remote past, REFL = reflexive, SG = singular, SR = switch reference, STATIC = prefix on weather predicates, TAM = tense-aspect marker, TOP. = topicalization marker.

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