

Deriving the temporal properties of future markers from aspect¹

Anne Mucha — University of Potsdam

Abstract. Languages vary in whether or not their future markers are compatible with non-future modal readings (Tonhauser, 2011b). The present paper proposes that this variation is determined by the aspectual architecture of a given language, more precisely *if* and *how* aspects can be stacked. Building on recent accounts of the temporal interpretation of modals (Matthewson, 2012, 2013; Kratzer, 2012; Chen et al., ta), the paper first sketches an analysis of the temporal readings of the English future marker *will* and then provides cross-linguistic comparison with a selected, typologically diverse set of languages (Medumba, Hausa, Gitksan, and Greek).

Keywords: Future, Aspect, Cross-linguistic variation

1. Introduction

Cross-linguistic research suggests that future markers differ in whether they can receive non-future readings (for discussion see Tonhauser 2011b). There seems to be one class of languages whose future markers entail future-shifting in all their occurrences. This class includes Paraguayan Guaraní (Tonhauser, 2011b), Gitksan (Matthewson, 2012, 2013) and Hausa (Mucha, 2012, 2013). Hence, the future morphemes in these languages are incompatible with non-future modal interpretations such as present-oriented epistemic necessity. This is illustrated for the Guaraní future marker *-ta* in (1), for the Gitksan future marker *dim* in (2) and for the Hausa future marker *zā* in (3).²

(1) Context: I try to soothe my friend whose child hasn't come home from school yet.

Oi-mé-**ta** iñ-angirû-ndive. (Paraguayan Guaraní, Tonhauser 2011b)
 A3-be-FUT B3-friend-with
 Intended: "He'll be with his friend."

(2) Context: You hear pattering on the roof.

yugw=imaa/ima'=hl **dim** wis (Gitksan, Matthewson 2013)
 IMPF-EPIS=CN FUT rain
 Intended: "It might be raining."

¹Many thanks to my consultants for their judgments and to the reviewers and participants of SuB20 for helpful comments. I am also grateful to Agata Renans who commented on this paper version and to Lisa Matthewson and Malte Zimmermann who reviewed my dissertation (Mucha, 2015) on which this paper is based. Any remaining mistakes are my own.

²The data from Hausa and Medumba stem from the author's own fieldwork, and the following glosses are used: PERF = perfect, PFV = perfective, IPFV = imperfective, PROG = progressive, PROSP = prospective, PRES = present, PST = past.

- (3) Context question: Why are Ibrahim and Bello not at home?

Zā sù wurin aikì yanzù (Hausa, Mucha 2013)
 FUT 3PL.PROSP PREP work now
 Intended: “They will/must be at work right now.”

Languages of the second class, including many Indo–European languages, differ from Guaraní, Gitksan and Hausa in that their future markers are compatible with non–future interpretations. This is illustrated for Greek, English³ and Medumba in (4), (5) and (6), respectively.

- (4) I Ariadne **tha** troi tora (Greek, Giannakidou and Mari 2014)
 the Ariadne FUT eat.ipfv.non–pst.3sg now
 “Ariadne must be eating now.”

- (5) Context: Your sister is visiting, but your daughter Alex is staying in her room. Your sister asks you why, but you can only guess:
 Alex **will** be busy. (English)

- (6) Context: You want to visit your friend Elodie. When you arrive at her house, you see that the lights are on, so you say:
 Elodie **á'** mbà cum ntu' ndá (Medumba, Mucha 2015)
 Elodie FUT be in piece house
 “Elodie will/must be in her room.”

The main claim of this paper is that the cross–linguistic variation observed in the temporal interpretation of future markers is due to differences in the aspectual architecture of the respective languages. This approach is crucially inspired by recent work on the interpretation of modals, in particular Matthewson (2012, 2013), Kratzer (2012) and Chen et al. (ta), and it works on the assumption that future interpretation in natural language involves the meaning components of quantification over possible worlds (modality) and (prospective) futur–shifting (see e.g. Copley 2002, 2009; Rullmann et al. 2008; Tonhauser 2011b). Specifically, I propose that the relevant parameters of variation are i) whether a language overtly realizes the modal or the time–shifting component of future meaning (or both) and ii) if and how aspects can be stacked in a particular language.

³I thank Joseph DeVeugh–Geiss for his judgments on English.

2. The case of English

2.1. Background assumptions

The existing literature on the English future forms is extensive, and I will not review it in detail here.⁴ Most importantly for present purposes, many accounts attribute some modal meaning component to the English future marker *will* (e.g. Enç 1996; Copley 2002, 2009; Klecha 2014); others argue that its meaning is purely temporal (e.g. Kissine 2008; Salkie 2010). As stated in the introduction, I will follow the first approach. I want to argue that the temporal behavior of *will* can be derived from the distribution of aspect if we accept the assumptions in (7).

- (7) a. The meaning of the future (*will* in English) is modal.
 b. In English, progressive and perfect aspect are projected in distinct aspect layers (Radford 1997; Hohaus 2013; Beck and von Stechow 2014). In AspP_1 , the progressive is in complementary distribution with a covert perfective. In AspP_2 the perfect is in complementary distribution with a covert prospective.
 c. The covert prospective must be licensed by a modal element; the default licenser for the covert prospective is *will*. Therefore, *will* always selects for AspP_2 .
 d. The perfective aspect requires the time of an event to be included in a contextual reference time⁵ (Klein, 1994; Kratzer, 1998). For stative predicates, it only requires temporal overlap. This idea is formalized in the lexical entries for perfective aspect in (7d-i) and (7d-ii), which result in different temporal specifications depending on the eventuality type of the VP predicate.⁶
- i. $\llbracket \text{PFV} \rrbracket^{g,c} = \lambda P_{\langle l, \langle s, t \rangle \rangle}. \lambda w. \lambda t. \exists e [\tau(e) \subseteq t \ \& \ P(e)(w)]$ if P is eventive
 - ii. $\llbracket \text{PFV} \rrbracket^{g,c} = \lambda P_{\langle l, \langle s, t \rangle \rangle}. \lambda t. \lambda w. \exists e [\tau(e) \text{ O } t \ \& \ P(e)(w)]$ if P is stative

The reason is that states do not have a well-defined end or beginning and therefore cannot be claimed to be temporally included in a (reference) time interval or to be temporally bounded. Altshuler and Schwarzschild (2013) formulate the idea of temporal unboundedness of stative predicates as in (7e):

- e. The Temporal Profile of Statives (Altshuler and Schwarzschild, 2013: p.45)
 For any tenseless stative clause ϕ , if ϕ is true at a moment m , then there is a moment

⁴Also, I will not consider the *be going to* future. For comparison and analysis see Copley (2002, 2009).

⁵I occasionally use the abbreviations RT, UT and ET for *reference time*, *utterance time* and *eventuality time*.

⁶This proposal is inspired by Condoravdi (2002)'s AT relation which is cited in (1).

- (1) $\text{AT}(t, w, P) =$
- a. $\exists e [\tau(e)(w) \subseteq t \ \& \ P(e)(w)]$ if P is eventive
 - b. $\exists e [\tau(e)(w) \text{ O } t \ \& \ P(e)(w)]$ if P is stative
 - c. $P(w)(t)$ if P is temporal

m' preceding m at which ϕ is true and there is a moment m' [sic] following m at which ϕ is true.

The present analysis suggests that variation in (7b) and (7c), rather than lexical variation in the meaning of future markers, is the source of the different temporal behavior of future markers across languages. The semantics of the remaining aspect morphemes as well as the (purely modal) semantics of *will* that I am assuming are given in (8).

- (8) a. $[[\text{IPFV/PROG}]]^{g,c} = \lambda P_{\langle l, \langle s, t \rangle \rangle} . \lambda t . \lambda w . \exists e [\tau(e) \supseteq t \ \& \ P(e)(w)]^7$ (Kratzer, 1998)
 b. $[[\emptyset\text{-PROSP}]]^{g,c} = \lambda P_{\langle i, \langle s, t \rangle \rangle} . \lambda t . \lambda w . \exists t' [t' > t \ \& \ P(t')(w)]^8$
 c. $[[\text{PERF}]]^{g,c} = \lambda P_{\langle i, \langle s, t \rangle \rangle} . \lambda t . \lambda w . \exists t' [t' < t \ \& \ P(t')(w)]$
 d. $[[\text{will}]]^{g,c} = \lambda P_{\langle i, \langle s, t \rangle \rangle} . \lambda t . \lambda w . \forall w' [w' \in \text{BEST}_{O(w),(t)} (\text{MB}(w)(t)) \rightarrow P(t)(w')]$

2.2. Analysis

The English future marker *will* is compatible with non-future epistemic interpretations. However, only state predicates (9a) and events with progressive aspect marking (9b) allow for these readings, in opposition to bare event predicates (9c).

- (9) Context: Your sister is coming to your house to visit. Your daughter Alex is staying in her room and your sister asks you why, but you can only guess:
 a. Alex will be busy. (state)
 b. Alex will be working. (event marked for progressive)
 c. # Alex will work. (unmarked event, only future reading)

It has also been observed that ongoing present readings cannot be obtained with simple present sentences in English; they require progressive aspect marking as illustrated in (10).

- (10) Context: Your sister asks you what your daughter is doing at the moment. You say:
 a. She is reading a book.

⁷I am setting aside any modal meaning components of the progressive. For detailed modal analyses of the progressive in English see Dowty (1977), Landman (1992), and Portner (1998).

⁸A reviewer pointed out to me that I might actually have to assume weak posteriority (\leq) rather than strong posteriority ($<$) for the English prospective in order for the analysis to go through, since otherwise it makes wrong predictions for sentences that contain temporal adverbials. I concede that the interaction of aspect and temporal adverbials does not receive much attention here and leave the question of whether the English prospective should be defined involving weak posteriority for future research.

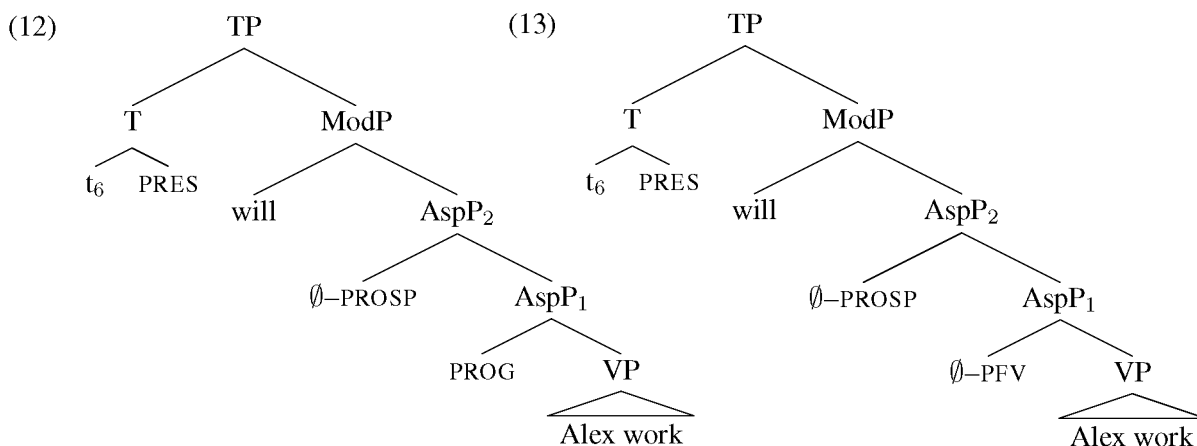
- b. # She reads a book.

This kind of observation has led some scholars to assume a covert perfective aspect in the grammar of English (see e.g. Arregui 2007; Wurmbrand 2014). The semantic perfective in (10b) would require the reference time of the sentence to include the run time of the reading event. This is not possible since in a present tense sentence the utterance time serves as reference time (cf. Reichenbach 1947), but the utterance time is instantaneous and cannot include a durative event like *reading a book*. This generalization, which is referred to as the *Bounded Event Constraint* by Smith (2008), accounts for the infelicity of (10b) under the assumption of a covert perfective aspect operator.⁹

Moreover, the contrast in (11) shows that also in future contexts, progressive marking is necessary if the context specifies that the reference time is punctual. This, I would like to argue, indicates that also future sentences like (11b) contain a covert perfective aspect.

- (11) Context question: Can I meet Alex tomorrow at 6 p.m. sharp?
 a. No, Alex will be working.
 b. # No, Alex will work.

The obligatory future meaning of *will* with eventive predicates as well as the contrast in (11) follow compositionally if we assume the structure in (12) for future progressives like (9b) and (13) for plain future sentences like (9c):



Assuming the semantics for perfective, prospective and *will* that were specified in (7d-i) and (8), we arrive at the truth conditions in (14) for the LF in (13).

⁹See also Smith et al. (2007) and Smith and Erbaugh (2005) for manifestations of this constraint in Navajo and Mandarin Chinese, as well as Bennett and Partee (1978) and Kamp and Reyle (1993) for similar ideas.

- (14) $\llbracket (9c)/(13) \rrbracket^{g,c}$ is only defined if $g(6)$ is t_c . If defined:
 $= \lambda w. \forall w' [w' \in \text{BEST}_{O_{(w)}(g(6))}(\text{MB}(w)(g(6))) \rightarrow \exists t' [t' > g(6) \ \& \ \exists e [\tau(e) \subseteq t' \ \& \ \text{work}(e)(w') \ \& \ \text{agent}(e)(w') = \text{Alex}]]]$

The truth conditions in (14) require that there be a future time that includes the running time of the event of Alex working, which is incompatible with a present construal. In the LF in (12), the only difference is that AspP_1 hosts a progressive aspect instead of a perfective, while AspP_2 is still specified for prospective. The truth conditions then come out as in (15).

- (15) $\llbracket (9b)/(12) \rrbracket^{g,c}$ is only defined if $g(6)$ is t_c . If defined:
 $= \lambda w. \forall w' [w' \in \text{BEST}_{O_{(w)}(g(6))}(\text{MB}(w)(g(6))) \rightarrow \exists t' [t' > g(6) \ \& \ \exists e [\tau(e) \supseteq t' \ \& \ \text{work}(e)(w') \ \& \ \text{agent}(e)(w') = \text{Alex}]]]$

The truth conditions specified in (15) only require that there be a time after the present RT (i.e. the utterance time t_c) which is included in the time of Alex working. Given that this time interval can be an instant that is located right after t_c , (15) is compatible with the ET including *both* the utterance time and the time introduced by the prospective aspect operator. Thus, the observed under-specification between present and future readings of sentences like (9b) is predicted.

If we accept the assumption made in (7c), the perfective/progressive contrast does not apply to stative predicates in the same way it does to events, since for states the relevant temporal relation between ET and RT is overlap rather than inclusion. Hence, it is predicted that stative predicates pattern with progressive events in allowing for present epistemic readings. For the sake of completeness, the truth conditions of the stative sentence in (9a) are provided in (16).

- (16) $\llbracket (9a) \rrbracket^{g,c}$ is only defined if $g(6)$ is t_c . If defined:
 $= \lambda w. \forall w' [w' \in \text{BEST}_{O_{(w)}(g(6))}(\text{MB}(w)(g(6))) \rightarrow \exists t' [t' > g(6) \ \& \ \exists e [\tau(e) \text{ O } t' \ \& \ \text{busy}(e)(w') \ \& \ \text{agent}(e)(w') = \text{Alex}]]]$

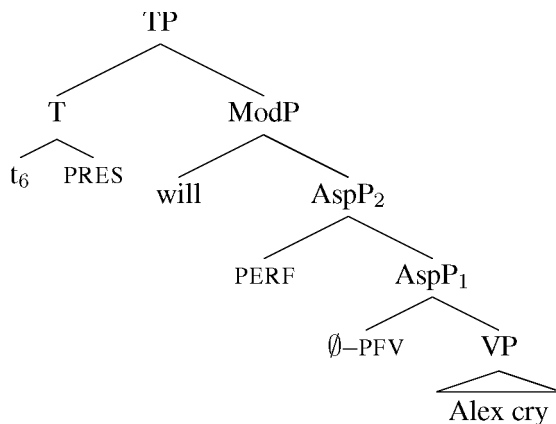
Again, the temporal component of these truth conditions only requires that the time where Alex is busy overlaps the time introduced by the prospective and if we assume with Altshuler and Schwarzschild (2013) that stative eventualities are inherently (temporally) unbounded, there will always be a part of the state of Alex being busy that temporally overlaps a time interval after the reference time $g(6)$ (which in the above case coincides with the utterance time).

Under this kind of approach, past-oriented modal interpretations in English arise if AspP_2 is specified for perfect rather than prospective and if AspP_1 has a covert perfective aspect, e.g. in the eventive sentence in (17) which gets the LF structure in (18) and the truth conditions in (19).

- (17) Context: Your sister is coming to your house to visit. When she sees your daughter, she remarks that her eyes look red and swollen and she wants to know what happened, you suppose:

Alex will have cried.

(18)



- (19) $\llbracket \text{TP} \rrbracket^{g,c}$ is only defined if $g(6)$ is t_c . If defined:
 $= \lambda w. \forall w' [w' \in \text{BEST}_{O(w)(g(6))}(\text{MB}(w)(g(6))) \rightarrow \exists t' [t' < g(6) \ \& \ \exists e [\tau(e) \subseteq t' \ \& \ \text{cry}(e)(w') \ \& \ \text{agent}(e)(w') = \text{Alex}]]]$

These truth conditions correctly predict that in all possible worlds in the modal base there is a time before the reference time that includes an event of Alex crying. As it stands, however, the proposed analysis does not predict the second reading of (18), namely the “past in the future” interpretation ($UT < ET < RT$, cf. Reichenbach 1947: p.290) where the RT is in the future, and the perfect aspect induces a past shift of the ET relative to this future RT. This reading will be a problem for any account that assumes a Reichenbachian distinction between ET, RT and UT, and also assumes that futur–shifting is aspectual, since the future and the perfect would impose contradictory requirements on the relation between ET and RT. One possible way of solving this is to adopt the proposal of Sauerland (2002) that present tense in English is semantically vacuous. This would remove the presupposition from the truth conditions above, thus allowing that the context shifts the RT to the future.¹⁰

¹⁰Sauerland’s proposal of vacuous present tense is not uncontroversial (for a counterargument see Thomas 2015). However, what Sauerland (2002) argues against is the present tense in English carrying a non–past presupposition, a proposal he attributes to Abusch (1997). Even if we assumed a lexical entry of the English present tense which involves a non–past presupposition, the future perfect reading could be derived, since a future RT would be possible. Hence, either of the present tense semantics in (1) would work for the account presented here.

(1) Present tense in English

- a. $\llbracket \text{PRES} \rrbracket^{g,c} = \lambda t. t$ (no presupposition)
 b. $\llbracket \text{PRES} \rrbracket^{g,c} = \lambda t : \neg(t < t_c). t$ (non–past presupposition)

Let me summarize the core properties of future interpretation in English. I propose that *will* is a modal future marker that always co-occurs with i) a covert prospective or an overt perfect operator and ii) a covert perfective or an overt progressive operator. The future–shifting component that is associated with *will* comes from the covert prospective. However, if the covert prospective co-occurs with a stative predicate or an event predicate marked for progressive, this results in truth conditions that are compatible with a present epistemic interpretation. Being covert and compositionally optional (i.e. of a modifier type $\langle\langle i, \langle s, t \rangle \rangle, \langle i, \langle s, t \rangle \rangle\rangle$), the covert prospective has to be licensed. In English, the licensing condition is modality. Hence, the covert prospective also occurs with other modal elements such as *can*, *must* etc. (see Kratzer 2012).

3. Cross-linguistic variation

What I hope to have shown in the last section is that an aspect-based analysis of the temporal readings of English *will* is viable. This section provides a sketch of how the proposed analysis accounts for future interpretation in selected other languages. The proposal for English builds on the analysis of future interpretation in Medumba developed in Mucha (2015), since future in Medumba patterns with future in English in many important respects. Hence, Medumba is the language to be considered first.

3.1. The parallel case: Medumba

Future in Medumba¹¹ is most commonly marked by the preverbal morpheme *á'*. Moreover, in simple question–answer pairs such as (20), *á'* seems to be necessary for future interpretation.

(20) Context question: What will Nana and Serge do tomorrow?

a. Bu *á'* ná ŋkwún (nəmndjũ)
 they FUT cook beans tomorrow
 “They will cook beans tomorrow.”

b. # Bu ná ŋkwún (nəmndjũ)
 they cook beans tomorrow
 Intended: “They will cook beans tomorrow.”

However, future interpretation is licensed without the *á'*–marker in a number of environments which seem to share the property of nonveridicality.¹² For reasons of space this is illustrated only for questions (21), negation (22), and the scope of modals (23), but it also holds for imperatives and antecedents of conditionals (see Mucha 2015).

¹¹Medumba is a Grassfields Bantu language mainly spoken in Western Cameroon in and around the city of Banganté.

¹²For a discussion of nonveridicality in prospective environments see Giannakidou (2014).

(21) Context: This year Mary is always cooking rice.

Wú kwádə mbə á ná kə ŋgo mu'?'
 you think that she cook what year other
 “What do you think she will cook next year?”

(22) Context: Marie has had a very hard time lately. She worked a lot and did not sleep very much. How will she be doing when I visit her tomorrow?

Marie kə mbə məbwô
 Marie NEG be good
 “Marie will not be well.”

(23) Context (adapted from Tonhauser 2011a): A farmer is looking at the clouds; he says:

mu'djə mbəŋ ndú
 maybe rain fall
 “It might rain.”

Not only is the future marker *á'* not necessary for future interpretation in all cases, *á'* does also not entail future interpretation, as example (6) in the introduction demonstrates for a sentence with a stative predicate. The contrast in (24) shows that Medumba also patterns with English in that present-oriented interpretation with *á'* is possible with eventive predicates only if these are marked for imperfective/progressive aspect (24a), but not in the aspectually unmarked case (24b).

(24) Context: Roger is coming home from work and is surprised that he does not find his children playing in front of the house. Then he realizes that his spouse is already preparing dinner, so he can guess what the kids are doing:

- a. Bú **á'** kə widə má yúb
 they FUT IPFV help mother their
 “They will be helping their mother.”
- b. # Bú **á'** widə má yúb
 they FUT help mother their
 Intended: “They will be helping their mother.”
 Speaker comment: “This sounds like an order.”

Medumba is a graded tense language, i.e. it has temporal morphemes that are specified for remoteness. While future interpretation marked by (plain) *á'* is unspecified for remoteness, *á'* can be combined with additional morphemes, e.g. *cág* in (25a) and *zí* in (25b), to make more fine-grained temporal distinctions.¹³

¹³See Mucha (2015) for evidence for the remoteness specifications of *á' cág* and *á' zí* as well as for the under-specification of plain *á'*. For reasons of space, the present paper also does not discuss the ambiguity of the temporal markers *cág* and *zí* proposed in Mucha (2015).

- (25) a. Louise **á'** **cág** nén ntən
 Louise FUT go market
 “Louise will go to the market (tomorrow).”
- b. Louise **á'** **zí** nén ntən
 Louise FUT go market
 “Louise will go to the market (in the distant future).”

Finally, Medumba has graded past morphemes as well, which are analyzed as past–shifting operators in Mucha (2015). However, these graded past morphemes cannot combine with the future marker *á'* to express past–oriented modality (in the sense of Condoravdi 2002), which requires an embedding structure. In other words, Medumba does not allow for the equivalent of *will* + perfect (cf. (17)) in English. This is illustrated with the near past morpheme *fə* in (26).

- (26) Context: Marie participated in a race yesterday. Today she looks very happy, so you suspect:
- a. * Marie **á'** **fə** cá
 Marie FUT NEAR win
 Intended: “Marie will/must have won.”
- b. a **á'** mbə zə Marie **fə** cá
 it FUT be that Marie NEAR win
 “Marie must have won.”
 lit. “It will be that Marie has won.”

From the data presented above I would like to conclude the following: Future–shifting in Medumba is realized either by overt graded future shifters such as *cág* and *zí* or by a covert future shifter whose meaning parallels that of the English covert prospective proposed in (8b) in section 2. Like in English, this covert future shifter has to be licensed, but in Medumba the licensing condition is nonveridicality rather than modality.¹⁴ The default licenser for the covert future shifter in Medumba is *á'*, its meaning parallels that of English *will*. In contrast to *will*, *á'* always selects for a future–shifting element and cannot combine with a past–shifter. Just like English *will*, however, *á'* is compatible with present–oriented epistemic readings if it co–occurs with the (covert) indefinite future shifter and a stative or imperfective predicate.

¹⁴Note that, in contrast to the Medumba cases, questions and negation do not generally license future interpretation in English, while modals do, as illustrated in (1). (Note that the English consultant who provided these judgments reports that the example in (1a) improves with a specific intonation that possibly indicates contrasting.)

- (1) Future licensing in English
- a. ?? What do you think Mary cooks tomorrow?
 b. # Mary does not feel well tomorrow.
 c. Tina might win tomorrow.

3.2. Overtly restricted co–occurrence in Hausa

Recall from the introduction (example (3)) that Hausa¹⁵ differs from languages such as English and Medumba in that its future marker *zā* is incompatible with present–oriented epistemic interpretations. In Hausa, TAM forms are usually marked directly on a weak subject pronoun (wsp), but the future marker *zā* diverges from this pattern in that it precedes the wsp. Interestingly, *zā* invariably co–occurs with a low tone on the wsp (27a) which is referred to as a “neutral” or subjunctive marker in the pertinent reference grammars (Newman, 2000; Jaggar, 2001). *Zā* cannot combine with imperfective (27b) or perfective marking (27c).

- (27) a. **Zā tà** wàsā gòbe.
 ZĀ 3SG.F-PROSP play tomorrow
 “She will play tomorrow.”
- b. * **Zā ta-nā** wàsā gòbe.
 ZĀ 3SG.F-IPFV play tomorrow
 Intended: “She will be playing tomorrow.”
- c. * **Zā tā** yì wàsā gòbe.
 ZĀ 3SG.F.PFV do play tomorrow
 Intended: “She will have played tomorrow.”

In Mucha (2013), I propose that Hausa is a genuinely tenseless language which marks aspect overtly and obligatorily. Following ideas of Schuh (2003), the neutral/subjunctive form is reanalyzed as a prospective aspect, which must be licensed by a modal operator (like the prospective in English). *Zā* is a modal operator that is lexically specified to license the prospective in the absence of other modals. The crucial difference between Hausa on the one hand, and English and Medumba on the other, is that Hausa does not allow for aspect stacking. As a consequence of this, the Hausa prospective aspect never combines with an imperfective but always directly modifies (i.e. forward–shifts) the ET of a sentence relative to its RT. Epistemic readings as a secondary effect of the combination of prospective and stative/imperfective meaning are therefore not possible in Hausa. Finally, since *zā* always combines with the prospective, it entails future–shifting in all its occurrences.

3.3. Overt realization of prospective aspect in Gitksan

Gitksan (Tsimshianic), like Hausa, has an overt prospective aspect marker, the morpheme *dim*. Matthewson (2012, 2013) shows that *dim* overtly contributes the future orientation of modals in

¹⁵Hausa is a Chadic language mainly spoken in Northern Nigeria.

Gitksan. Modals that are lexically specified for circumstantial flavor¹⁶ always co-occur with *dim*, which invariably makes them future-oriented. Epistemic modals, by contrast, can occur without the prospective marker, but in this case only allow for non-future orientation. With *dim* their interpretation is invariably future-oriented. The contrast is illustrated in (28) from Matthewson (2013) (contexts omitted).

- (28) a. yugw=imaa/ima'=hl wis
 IMPF=EPIS=CN rain
 “It might have rained.” / “It might be raining.” / ≠ “It might rain (in the future).”
- b. yugw=imaa/ima'=hl **dim** wis
 IMPF=EPIS=CN FUT rain
 ≠ “It might have rained.” / ≠ “It might be raining.” / “It might rain (in the future).”

With respect to the analysis of the future that I have been arguing for, we might expect future in Gitksan to be realized in a similar way as it is in Hausa, i.e. the modal and the temporal components of future interpretation are both overtly encoded. However, according to Matthewson (2012, 2013), *dim* is both necessary and sufficient for future interpretation, as shown in (29).

- (29) * (**dim**) limx=t James t'aahlakw (Matthewson, 2013)
 FUT sing=DM James tomorrow
 “James will sing tomorrow.”

Transferring this to the discussion on English, Hausa and Medumba above, it seems that in Gitksan the prospective does not have to be licensed by a modal or a nonveridical operator. This might not even be surprising in a language that overtly realizes future orientation, although it contrasts with the observation that in Hausa the overt prospective must be licensed. Moreover, taking the data from Gitksan at face value suggests that future interpretation does not (or not necessarily) involve modality after all. There is a caveat, however. According to Matthewson (2013), *dim* is not only used for plain predictive future sentences, but also for expressing other kinds of modality, e.g. deontic necessity as in (30).

- (30) Context: I tell you that Bob stole a book from the store.
dim ap guuxws mak-d-i-s Bob (Matthewson, 2013)
 FUT EMPH back give-T-TRA-PN Bob
 “He has to give it back.”

¹⁶According to Matthewson (2013), modals in Gitksan are lexically specified for their conversational background. Quantificational force is specified for circumstantial, but not for epistemic modals.

Matthewson (2013) mentions two possible explanations for this range of interpretations of sentences with (plain) *dim*. Either examples like (30) are in fact plain future statements and the modal interpretations arise via inferences, or there is a covert modal element occurring in plain *dim*-sentences. If we adopted the latter assumption, Gitksan would be the complementary case of English and Medumba in that the temporal component of the future is realized overtly while the modal one is covert.

Recall also that I propose to account for the possibility of present-oriented epistemic interpretations of future markers by reference to the aspectual architecture of a given language. More concretely, the proposal is that in English, Medumba and Hausa future marking always comes with a modal and a temporal component, but that the temporal component is covert in English and Medumba. The fact that only the Hausa future does not allow for present epistemic interpretations is attributed to the fact that Hausa does not allow for aspect stacking so that the prospective can never co-occur with an imperfective marker. The formal analysis of Gitksan modal sentences with *dim* provided in Matthewson (2012) suggests that it not only matters *if* a language marks grammatical aspect and if aspect can be stacked, but also *how* aspects can be stacked. Matthewson (2012) reports that, like English and Medumba, Gitksan allows for overt co-occurrence of prospective and imperfective aspect. Therefore, both aspects are formalized as quantifiers over times with an $\langle\langle i, \langle s, t \rangle \rangle, \langle i, \langle s, t \rangle \rangle\rangle$ modifier type (like the meaning that I proposed for the future shifters of English and Medumba). Existential quantification over the event variable is encoded in a bleached aspect head (31a). The lexical entries of the prospective marker *dim* and the imperfective morpheme *yukw*, cited from Matthewson (2012: p.438), are given in (31b) and (31c).

- (31) a. $\llbracket \text{ASP} \rrbracket = \lambda P_{\langle ev, st \rangle} \lambda t \lambda w. \exists e [P(e)(w) \ \& \ \tau(e) = t]$
 b. $\llbracket \text{dim} \rrbracket = \lambda P \in D_{\langle i, st \rangle} \lambda t \lambda w. \exists t' [t < t' \ \& \ P(t')(w) = 1]$
 c. $\llbracket \text{yukw} \rrbracket = \lambda P \in D_{\langle i, st \rangle} \lambda t \lambda w. \exists t' [t' \supseteq t \ \& \ P(t')(w) = 1]$

Given what I proposed earlier, I would expect that the combination of prospective and imperfective in Gitksan is compatible with a present epistemic interpretation, which does not seem to be the case, as illustrated in example (28b) above. However, the truth conditions that Matthewson (2012) gives for a prospective imperfective sentence (with epistemic modality) suggest that in Gitksan it is the prospective aspect that attaches to the VP (more precisely to $\llbracket \text{ASP} \rrbracket(\llbracket \text{VP} \rrbracket)$). Hence the prospective aspect shifts the ET to the future of the time introduced by the imperfective, which includes the RT. The truth conditions of (28b) are cited in (32).

- (32) $\llbracket [\text{ima}('a)_{\text{MB}} \text{yukw dim asp wis}] \rrbracket = \lambda t \lambda w \exists w' [w' \in \text{MB}(w, t) \ \& \ \exists t' [t' \supseteq t \ \& \ \exists t'' [t' < t''] \ \& \ \exists e [\text{it rains}(w')(e) \ \& \ \tau(e) = t'']]]]$
 (Matthewson, 2012: p.438)

By contrast with the truth conditions in (32), my proposal for Medumba and English implies that imperfective and (covert) perfective always apply to the VP, and that the prospective has to be

stacked on top, with the effect that the prospective never directly modifies the ET. Therefore, if my interpretation of Matthewson (2012) is correct, the compositional order of prospective and imperfective aspect could explain the difference between Gitksan on the one hand, and English and Medumba on the other hand, even if all of these languages allow for aspect stacking.

3.4. Overt free co-occurrence in Greek

Another language I want to consider, albeit only briefly, is Greek. Modern Greek (and Italian) as described by Giannakidou and Mari (2013a, b, 2014, ta) are among the languages that allow for non-future interpretations with future marking (like English and Medumba). According to Giannakidou and Mari (ta), in Greek the predictive interpretation with the future marker arises in combination with a perfective non-past (PNP) form. This is illustrated in (33).

- (33) O Janis **tha** ftasi avrio. (Giannakidou and Mari, ta)
 the John FUT arrive.PNP.3sg tomorrow
 “John will arrive tomorrow.”

Giannakidou (2009) defines the meaning of non-past as denoting an open interval which licenses a future interpretation, but does not force it. The formalization is given in (34).

- (34) $[[\text{nonpast}]] = \lambda P \lambda t P((t, \infty))$ (Giannakidou, 2009)

Giannakidou and Mari also argue that the time variable of the Greek non-past must be interpreted as a bound variable. It must be licensed by a nonveridical particle (see Giannakidou and Mari 2013a: p.257) and one possible licenser is the future particle *tha*. *Tha* licenses the defective non-past by supplying the UT as a RT, i.e. as a left boundary to the open interval denoted by the non-past.

Giannakidou and Mari also report that the Greek future systematically receives epistemic present interpretations when combined with stative predicates (35a) or with imperfective non-past (35b).

- (35) a. I Ariadne **tha** ine arrosti (Giannakidou and Mari, 2014)
 the Ariadne FUT be.3sg sick
 “Ariadne must be sick.”
 b. I Ariadne **tha** troi tora
 the Ariadne FUT eat.ipfv.non-pst.3sg now
 “Ariadne must be eating now.”

In order to get past-oriented epistemic readings, the Greek future particle *tha* can be combined with the perfective past (PP) form, illustrated in (36) (from Giannakidou and Mari 2013a: p.258).

- (36) I Ariadne **tha** kimithike (orin apo dyo ores).
 the Ariadne FUT sleep.PP.3sg before two hours
 “Ariadne must have fallen asleep two hours ago.”

Hence, Greek fits into the cross-linguistic picture as follows: As Giannakidou and Mari (2014) make explicit, Greek patterns with Gitksan in making the compositionality of future interpretation and prospectivity obvious. Predictive future readings arise in Greek only if the future modal *tha* is combined with perfective non-past, which has the meaning in (34). This perfective non-past, under their analysis, behaves like the Hausa prospective in that it is defective and must be licensed by a modal/nonveridical particle like *tha*. The future modal *tha* differs from the future modals of Hausa, Medumba, and English under my analysis in that it does not obligatorily co-occur with a future-shifter, but the future shifter under *tha* is in complementary distribution with an imperfective non-past and a perfective past.

A concluding conjecture: If the line of reasoning proposed here is on the right track, it can also account for attested variation *within* the class of languages that allow for non-future epistemic interpretations with future modals. As stated by Giannakidou and Mari (2014) and confirmed by English native speakers I consulted, purely epistemic readings with English *will* are much harder to obtain than with its counterparts in Greek and Italian, and *will* seems to have some kind of future flavor in all its uses.¹⁷ Under the present account, this can be related to the assumption that English *will* is always prospective and the present epistemic reading is a secondary effect in the sense that it does not contradict the derived truth conditions, as shown in section 2. In Greek, by contrast, there is no future-shifting at all in a sentence like (35b), which makes a present reading much more natural.

4. Summary

Languages differ with respect to the degree to which future marking is compatible with present readings (see Tonhauser 2011b). This paper proposes to account for this by referring to cross-linguistic differences in the aspectual architecture of languages, assuming that future interpretation generally involves two meaning components: modality and (prospective) future-shifting. Languages may overtly realize the modal component (e.g. English), the temporal component (e.g. Gitksan), or both (e.g. Hausa). If an overt future modal always occurs with a semantic future shifter which is in complementary distribution with other aspects, present readings are excluded. This is the case in Hausa. If a future modal always occurs with a future shifter, but this future shifter can be stacked on top of imperfective aspect, present readings are predicted to be possible

¹⁷Besides my colleague Joseph De Veugh-Geiss, I am grateful for judgments from and discussion with participants of the SIASSI 2015 and of SuB 20. Systematic testing of this generalization is desirable, but left for future research.

but restricted or slightly marked. This is what I propose for English and Medumba (with the difference that English *will* can also be combined with a perfect instead of a prospective). If a future modal freely combines with any temporal/aspectual operator, but if these cannot be stacked, we expect that present interpretations are available and natural with a combination of the future modal and imperfective aspect, but excluded with a combination of the future modal and the prospective or its equivalent. Judging from the data presented by Giannakidou and Mari, this might be the case in Greek. Table 1 provides an overview of the proposed typology developed in this paper.

	English	Medumba	Hausa	Greek	Gitksan
FUT – modal	<i>will</i>	<i>á'</i>	<i>zā</i>	<i>tha</i>	covert (?)
Co – occurrence	PERF/ \emptyset –PROSP + PROG/ \emptyset –PFV	\emptyset –PROSP + IPFV/ \emptyset –PFV	PROSP –	PNP/ PST/ INP –	IPFV/ PFV + PROSP
FUT – shifting	covert	covert	PROSP	PNP	<i>dim</i>
Readings	fut, pst, (pres)	fut, (pres)	fut	fut, pst, pres	fut
Licensing	modal	nonveridical	modal	nonveridical (?)	–

Table 1: Cross-linguistic variation in future marking

References

- Abusch, D. (1997). Sequence of tense and temporal de re. *Linguistics and Philosophy* 20, 1–50.
- Altshuler, D. and R. Schwarzschild (2013). Moment of change, cessation implicatures and simultaneous readings. In E. Chemla, V. Homer, and G. Winterstein (Eds.), *Proceedings of Sinn und Bedeutung* 17, pp. 45–62.
- Arregui, A. (2007). When aspect matters: the case of *would*–conditionals. *Natural Language Semantics* 15, 221–264.
- Beck, S. and A. von Stechow (2014). Events, times and worlds – an LF architecture. Ms., University of Tübingen.
- Bennett, M. and B. Partee (1978). *Toward the logic of tense and aspect in English*. Blackwell.
- Chen, S., V. Hohaus, M. Louie, L. Matthewson, H. Rullmann, O. Simchen, C. T. Turner, and J. Vander Klok (t.a.). Past possibility cross-linguistically. In A. Arregui, M. L. Rivero, and A. Salanova (Eds.), *Modality across Syntactic Categories*. Oxford: Oxford University Press.
- Condoravdi, C. (2002). Temporal interpretation of modals: Modals for the present and for the past. In D. Beaver, S. Kaufmann, B. Clark, and L. Casillas (Eds.), *The construction of meaning*, pp. 59–88. Stanford: CSLI Publications.
- Copley, B. (2002). *The Semantics of the Future*. Ph. D. thesis, MIT, Cambridge, MA.
- Copley, B. (2009). *The Semantics of the Future*. New York: Routledge.
- Dowty, D. (1977). Towards a semantic analysis of verb aspect and the English imperfective progressive. *Linguistics and Philosophy* 1, 45–77.
- Enç, M. (1996). Tense and Modality. In S. Lappin (Ed.), *The Handbook of Contemporary Semantic Theory*. London: Blackwell.

- Giannakidou, A. (2009). The dependency of the subjunctive revisited: Temporal semantics and polarity. *Lingua* 119, 1883–1908.
- Giannakidou, A. (2014). The prospective as nonveridical: polarity items, speaker commitment, and projected truth. In D. Gilberts and J. Hoeksema (Eds.), *The Black Book. Feestschrift for Frans Zwarts*, pp. 101–124.
- Giannakidou, A. and A. Mari (2013a). The future of Greek and Italian: An epistemic analysis. In E. Chemla, V. Homer, and G. Winterstein (Eds.), *Proceedings of Sinn und Bedeutung 17*, pp. 255–270.
- Giannakidou, A. and A. Mari (2013b). A two dimensional analysis of the future: modal adverbs and speakers bias. In M. Aloni, M. Franke, and F. Roelofsen (Eds.), *Proceedings of the 19th Amsterdam Colloquium*, pp. 115–122.
- Giannakidou, A. and A. Mari (2014). The future in Greek and Italian: Metaphysical and epistemic dimensions. Ms. University of Chicago and Institut Jean Nicod, CNRS. Accessed from <http://ling.auf.net/lingbuzz/002326>, January 4, 2016.
- Giannakidou, A. and A. Mari (t.a.). Epistemic future and epistemic MUST: nonveridicality, evidence, and partial knowledge. In J. Blaszczak, A. Giannakidou, D. Klimek-Jankowska, and K. Mygdalski (Eds.), *Mood, Aspect and Modality: What is a linguistic Category?* Chicago University Press. Accessed from <http://home.uchicago.edu/giannaki/papers.html>, January 6, 2016.
- Hohaus, V. (2013). Tensed modality cross-linguistically. Talk given at *Tempus Tuesday*, University of Tübingen, July 9, 2013.
- Jaggar, P. J. (2001). *Hausa*. Amsterdam: John Benjamins.
- Kamp, H. and U. Reyle (1993). *From Discourse to Logic*. Dordrecht: Kluwer.
- Kissine, M. (2008). Why *Will* is not a modal. *Natural Language Semantics* 16, 129–155.
- Klecha, P. (2014). Diagnosing Modality in Predictive Expressions. *Journal of Semantics* 31, 443–455.
- Klein, W. (1994). *Time in Language*. London: Routledge.
- Kratzer, A. (1998). More Structural Analogies Between Pronouns and Tenses. In D. Strolovitch and A. Lawson (Eds.), *Proceedings of Semantics and Linguistic Theory (SALT) 8*, pp. 92–110.
- Kratzer, A. (2012). What “can” can mean. Lecture notes LOT winter school, Tilburg.
- Landman, F. (1992). The progressive. *Natural Language Semantics* 1, 1–32.
- Matthewson, L. (2012). On the (non-)future orientation of modals. In A. G. Aguilar, A. Chernilovskaya, and R. Nouwen (Eds.), *Proceedings of Sinn und Bedeutung 16*, pp. 431–446.
- Matthewson, L. (2013). Gitksan modals. *International Journal of American Linguistics* 79, 349–394.
- Mucha, A. (2012). Temporal reference in a genuinely tenseless language: The case of Hausa. In A. Chereches (Ed.), *Proceedings of Semantics and Linguistic Theory (SALT) 22*, pp. 188–207.
- Mucha, A. (2013). Temporal interpretation in Hausa. *Linguistics and Philosophy* 36, 371–415.
- Mucha, A. (2015). *Temporal interpretation and cross-linguistic variation*. Ph. D. thesis, University of Potsdam.
- Newman, P. (2000). *The Hausa language*. New Haven: Yale University Press.

- Portner, P. (1998). The progressive in modal semantics. *Language* 74, 760–787.
- Radford, A. (1997). *Syntactic theory and the structure of English*. Cambridge: Cambridge University Press.
- Reichenbach, H. (1947). *Elements of Symbolic Logic*. New York: Macmillan.
- Rullmann, H., L. Matthewson, and H. Davis (2008). Modals as distributive indefinites. *Natural Language Semantics* 16, 317–357.
- Salkie, R. (2010). Will: tense or modal or both? *English Language and Linguistics* 14, 187–215.
- Sauerland, U. (2002). The present tense is vacuous. *Snippets* 6, 12–13.
- Schuh, R. G. (2003). The functional unity of the Hausa and West Chadic Subjunctive. *UCLA working papers* 9, 17–42.
- Smith, C. S. (2008). Time with and without tense. In J. Guéron and J. Lecarme (Eds.), *Time and Modality: Studies in Natural Language and Linguistic Theory*, pp. 227–249. Dordrecht: Springer.
- Smith, C. S. and M. S. Erbaugh (2005). Temporal interpretation in Mandarin Chinese. *Linguistics* 43, 713–756.
- Smith, C. S., E. Perkins, and T. Fernald (2007). Time in Navajo: Direct and indirect interpretation. *International Journal of American Linguistics* 73, 40–71.
- Thomas, G. (2015). The present tense is not vacuous. *Journal of Semantics* 32, 685–747.
- Tonhauser, J. (2011a). Temporal reference in Paraguayan Guaraní, a tenseless language. *Linguistics and Philosophy* 34, 257–303.
- Tonhauser, J. (2011b). The Paraguayan Guaraní future marker *-ta*: formal semantics and cross-linguistic comparison. In M. Rathert and R. Musan (Eds.), *Tense Across Languages*, pp. 207–231. Tübingen: Niemeyer.
- Wurmbrand, S. (2014). Tense and aspect in English infinitives. *Linguistic Inquiry* 45, 403–447.