What can tone tell us about successive-cyclic movement? Evidence from Asante Twi*

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1. Introduction

Since Chomsky's (1977) original proposal that long-distance movement proceeds in a series of a smaller, local steps, morphological evidence from a number of languages has emerged in support of it. In particular, the complementizer morphology of a number of languages seems to be sensitive to whether or not extraction has taken place in that clause. A classic example comes from complementizer alternations in Irish (McCloskey 1979, 2002). In (1a), the complementizer in each clause has the *go*-form, however complementizers surface as a^L if crossed by an Ā-movement dependency, e.g. relative clauses (1b) or long-distance wh-questions (1c).[1]

(1) *Complementizer alternation in Irish (McCloskey 1979, 2002)*:

a. Dúirt mé [$_{CP}$ **gu**-r shíl [$_{CP}$ mé **go** meadh sé ann
said I *go*-PAST thought I *go* would.be he there
'I said that I thought that he would be there.'

b. [$_{DP}$ an tainm [$_{CP}$ **a** hinndeadh dúinn [$_{CP}$ **a** bhí t ar an áit]]]
the name a^L was.told to.us a^L was on the place
'the name that we were told was on the place'

c. [$_{CP}$ cen t-ursceal **a** mheas me [$_{CP}$ **a** duirt se [$_{CP}$ **a** thuig se]]] ?
which novel a^L thought I a^L said he a^L understood he
'Which novel did I think he said he understood?'

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[1] The superscript ^{L} indiciates lenition on the following word. There is also a third complementizer form a^N that triggers nasalization on the following word. This is assumed to mark a dependency between a base-generated operator and a resumptive pronoun.

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Morphological alternations of this sort provide compelling evidence for the successive-cyclic nature of movement (see Boeckx 2008, Lahne 2008, Citko 2014, Georgi 2014, van Urk 2015 for recent overviews). In general, the evidence in support of CPs as intermediate landing sites seems to be robust (but cf. den Dikken 2009). However, given the current Minimalist view that both CP and *v*P constitute phases (Chomsky 2000, 2001), we would also expect to find comparable evidence for successive-cyclic movement in the *v*P domain. While varied evidence has been put forward in favour of this view (e.g. Fox 1999, Legate 2003, van Urk 2015), the status of *v*P as a phase remains a somewhat controversial issue (den Dikken 2006, Keine 2015, Dayal to appear).

In this paper, we discuss an interesting tonal alternation in Asante Twi (Niger-Congo: Ghana), where low-toned syllables of verbs are raised to high in typical Ā-environments, i.e. in wh-questions, focus clefts and relative clauses. We analyze this tonal change as a phonological reflex of successive-cyclic movement in the *v*P domain. This not only provides an interesting challenge for the syntax-phonology interface, but also lends empirical support to the status of *v*P as a phase.

2. Tonal alternations in Asante Twi

Asante Twi is a dialect of Akan, a Niger-Congo language from the Kwa branch, spoken by around 7.5 millon speakers in Ghana (Williamson & Blench 2000, Kropp Dakubu 2009). The basic word oder is SVO and it is a terraced-tone language, distinguishing between high and low tones as well as downstep between consecutive high tones (Schachter & Fromkin 1968, Paster 2010). The simple transitive clause in (2a) contains the underlying low-toned verb *pɛ* ('like') (low tones are unmarked). However, in a wh-question, this tone surfaces as high (2b).

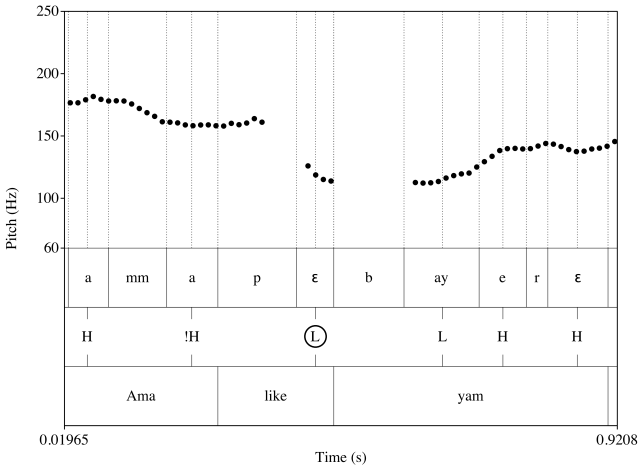
(2) a. Ám!má **pɛ** bayéré.
Ama like yam
'Ama likes yam.'

b. Déén$_1$ na Ám!má **pɛ́** t$_1$?
what FOC Ama like
'What does Ama like?'

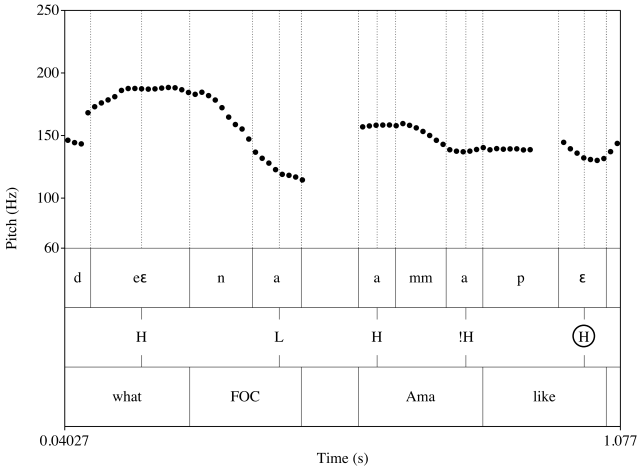
The tonal distinction between the verbs can be seen in the pitch tracks (3) and (4).[2] In (3), we can clearly see a drop in pitch at the verb *pɛ*, indicating a low tone. In the wh-movement case, we do not observe a comparable reduction in pitch, suggesting that the verb bears a high tone (4).

[2] The recordings are of the first author made with a *Zoom H5 Handy Recorder* microphone and analyzed in Praat 6.0.17 (Boersma & Weenink 2016).

(3) *Pitch track for (2a):*



(4) *Pitch track for (2b):*



Although it might be tempting to assume that this tonal change is specific to wh-questions, the following minimal pair shows that the alternation between low and high tones is not found with the underlying LH stem *seré* 'laugh at' in *in situ* wh-question such as (5a):[3]

(5) a. Baá **re-se**ré hwáń?
Baah PROG-laugh who
b. Hwáń$_1$ na Baá **ré-sé**ré nó$_1$?
who FOC Baah PROG-laugh 3SG
'Who is Baah laughing at?' (Marfo 2005, 81)

However, we can see that the low tones in *ré-sére* have become high in the *ex situ* construction (5b). In light of this contrast, we could entertain the alternative hypothesis that the low-high alternation on verbs is related to the presence of movement in that clause. Looking at long-distance dependencies supports this view.

2.1 Tonal alternations in long-distance dependencies

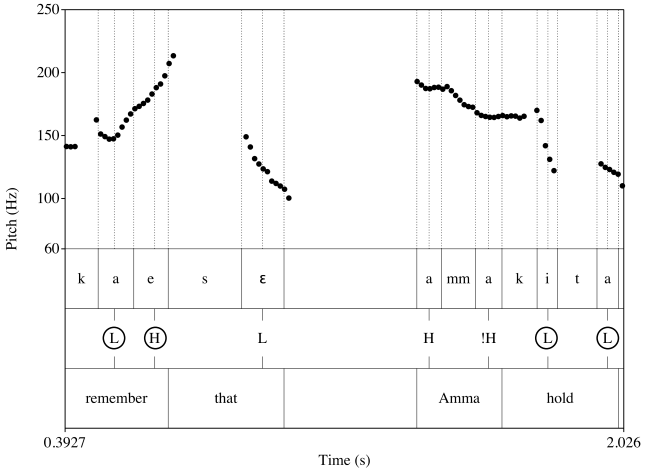
If the change from an underlying low tone to high one were linked to movement, then we would expect this process to be 'unbounded' and apply in every clause through which movement takes place. If we consider cases of long-distance wh-movement such as (6), we see that this expectation is in fact borne out:

(6) a. [$_{CP}$ Kofí **kaé** [$_{CP}$ sɛ Ámˈmá **kita** bayérɛ́]]
Kofi remember that Ama hold yam
'Kofi remembers that Ama is holding a yam.'
b. [$_{CP}$ Déɛ́n$_1$ na Kofí **káé** [$_{CP}$ sɛ Ámˈmá **kítá** t$_1$]] ?
what FOC Kofi remember that Ama hold
'What does Kofi remember that Ama is holding?'

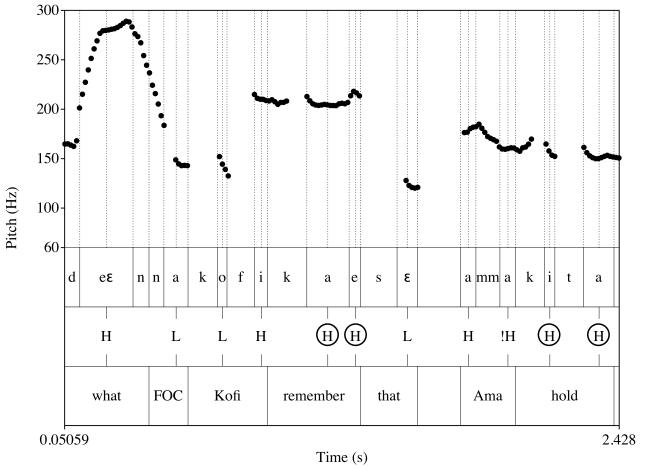
In (6a), we have the LH matrix verb *kaé* ('remember') and the embedded LL verb *kita* ('hold'). If the direct object is extracted from the matrix clause, we observe that the low tones of verbs in both matrix and embedded clauses are changed to high (6b). This can be clearly seen in the pitch tracks in (7) and (8), corresponding to (6a) and (6b) respectively:

[3] It is important to mention that (5) contains a resumptive pronoun *nó* in the 'extraction site'. The relevant generalization is that overt resumption is obligatory with animate wh-phrases (Saah 1988, 1994). While this may seem to imply a base generation approach, Korsah & Murphy (2016) show that these constructions test positive for a number of movement dependencies such as a variety of reconstruction effects. Thus, we assume that resumption configurations are also derived by (Ā-)movement. However, it is important to note that Akan is impervious to island constraints (Saah & Goodluck 1995), which leads Korsah & Murphy (2016) to assume that resumption (null or overt) can circumvent island effects in general (cf. Ross 1967).

(7) *Pitch track for (6a)*:



(8) *Pitch track for (6b)*:



Furthermore, this effect can span more than one level of embedding:[4]

[4] Note that the tone of the complementizer changes to low in (9). However, this does not appear to pattern systematically with movement since the complementizer is also low in (6a), where no movement takes place. Thus, it seems that there is a rule that lowers the tone on a complementizer if it is preceded by a high tone

(9) a. [$_{CP}$ Kofí **nim** [$_{CP}$ sɛ́ Ési á-**ka** [$_{CP}$ sɛ́ Ámˈmá **pɛ** bayéɾɛ́]]]
Kofi know that Esi PERF-say that Ama like yam
'Kofi knows that Esi has said that Ama likes yam.'

b. [$_{CP}$ Déɛ́n$_1$ na Kofí **nímɩ́** [$_{CP}$ sɛ Ési á-**ká** [$_{CP}$ sɛ Ámˈmá **pɛ́** t$_1$]]] ?
what FOC Kofi know that Esi PERF-say that Ama like
'What does Kofi know that Esi has said that Ama likes?'

2.2 Focus fronting

In addition, we find this effect in fronting or 'cleft' constructions involving focus (Boadi 1974, Saah 1988, Amfo 2010). Here, we also find a displaced constituent followed by the *na* focus marker. Here, we also see an LH stem that becomes HH, just like in (5).

(10) a. Kofí **bo**á-a Afíá
Kofi help-PAST Afia
'Kofi helped Afia.'

b. Kofí na ɔ-**bó**á-a Afíá
Kofi FOC 3SG-help-PAST Afia
'It is Kofi who helped Afia.' (Marfo 2005, 9)

Furthermore, it is apparent from these examples that not all low-toned affixes undergo the low-high alternation. We saw that the low-toned progressive prefix *re-* changes to high in movement contexts (5). However, (10) shows that the low-toned past tense suffix (which varies due to vowel harmony) and agreement morphemes do not. This distinction will be addressed in the analysis to follow. In general, it may be tempting to analyze these tonal alternations as some construction-specific quirk of the *na*-construction (Marfo 2005, Marfo & Bodomo 2005), however, we also find these patterns outside of the *na*-construction, namely with relative clauses.

2.3 Relative clauses

The example in (11a) shows the LH stem *waré* ('marry'). When this verb occurs inside a relative clause, however, it surfaces with two high tones (11b).[5]

(11) a. Kofí **waré**-e ɔbáá nó.
Kofi marry-PST woman DEF
'Kofi married the woman.'

(perhaps only applying across a clause boundary). When the low tones are raised to high in (6b), this rule is then fed.

[5] Some clarification is required about the glossing in (11b). First, we saw in (5) that object extraction of an animate noun leaves an obligatory resumptive *nó*. Ā-extraction of an animate subject results in a resumptive pronoun ɔ- which is clitcized to the verb (see Korsah to appear). Furthermore, the *nó* that is glossed as CD refers to the so-called 'clausal determiner' that occurs in relative clauses and clefts and is homophonous to both deteminers and object resumptives. Its correct theoretical analysis remains unclear (cf. Saah 2010).

b. [$_{DP}$ Ɔbáá$_1$ [$_{CP}$ áa ɔ$_1$-**wáré**-e Kofí nó]] fi Aburí.
woman REL 3SG-marry-PST Kofi CD be.from Aburi
'The woman who married Kofi is from Aburi.'
(Saah 2010, 92)

Furthermore, we also find the expected effects in long-distance relativization: all low tones in all verbs crossed by movement become high and the *sɛ́*-complementizers also show the high-low alternation (12).

(12) a. Me-**nim** [$_{CP}$ sɛ́ óbíárá **á-te** [$_{CP}$ sɛ́ Kofí **á-ka** [$_{CP}$ sɛ́
1sg-know that everybody PERF-hear that Kofi PERF-say that
ɔ-**dɔ** ɔbáá nó]]]
3SG-love woman DEF.
'I know that everybody has heard that Kofi has said that he loves the woman.'

b. Me-**hu-u** [$_{DP}$ ɔbáá nó$_i$ [$_{CP}$ áa óbíárá **á-té** [$_{CP}$ sɛ Kofí
1SG-see woman DEF REL everybody hear.PAST that Kofi
á-**ká** [$_{CP}$ sɛ ɔ-**dɔ́** nó$_i$ nó]]]]
PERF-say that 3SG-FUT-love 3SG CD
'I saw the woman whom everybody has heard that Kofi has said that he loves.'

These facts strongly suggest that we are dealing with a genuine reflex of Ā-movement, rather than some construction-specific rule.

2.4 Analysing movement-related tonal alternations

The literature on successive-cyclic movement contains a discussion of one particularly complex instance of a tonal reflex: downstep deletion in Kikuyu (Clements et al. 1983, Clements 1984a,b). For reasons of space, we will not recount the details here (but see e.g. Zaenen 1983, Haïk 1990, Lahne 2008, Georgi 2014, Murphy 2015 for discussion). The basic pattern is that lexical downsteps originating on the finite verb in a clause are argued to disappear when Ā-movement passes through that clause. However, this reflex turns out to be somewhat indirect since the presence or absence of downstep can only be determined by its interaction with other tonal processes. Consequently, some authors are skeptical about its validity (e.g. Boeckx 2008, 23 and Schippers 2012, 40). The reflex we find in Asante Twi, however, is much clearer and consists of a simple alternation between low and high tones on verbs.

For the complementizer alternations in Irish shown in (1), McCloskey (2002) proposes that the Spell-Out rules of a language must be sensitive to the features on a given C head (also see Georgi 2014). If movement has place out of a CP, then the C head presumably has the relevant features triggering this movement, for example an EPP or 'edge' feature. McCloskey then suggests the following Spell-Out rules for Irish to account for the fact that a different complementizer form appears in movement contexts:

(13) *Spell-Out rules for Irish complementizers (McCloskey 2002, 203):*

a. C ↔ *go*

b. $C_{[OP,\ EPP]} \leftrightarrow a^{L}$

We can adopt a similar approach for the systematic tonal alternations we observe in Asante Twi. However, in order to capture the 'overwriting' effect, we assume that the *v* head is realized as a floating high tone ($^{H\text{-}}$) only if it bears an edge feature (see Paster 2003, who argues that the perfective is realized as a floating low tone in the closely related language Gã). Following standard approaches to phase locality, we assume that if movement proceeds out a phase, then an edge feature is inserted on the head of that phase (e.g. Chomsky 2000, 2001, Richards 2011, Müller 2010, 2011). Consider example (6) repeated below.

(14) a. [$_{CP}$ Kofí **kaé** [$_{CP}$ sɛ Ám!má **kita** bayéɛ́]]
Kofi remember that Ama hold yam
'Kofi remembers that Ama is holding a yam.'

b. [$_{CP}$ Déɛ́n$_1$ na Kofí **káé** [$_{CP}$ sɛ Ám!má **kítá** t$_1$]] ?
what FOC Kofi remember that Ama hold
'What does Kofi remember that Ama is holding?'

The derivation of (14b) proceeds as follows: the wh-phrase first moves to the edge of vP_1 to be accessible for the next highest phase. As such, an edge feature is inserted on the v_1 head (15b), triggering movement to Spec-*v*P. This process is then repeated for the embedded C_1 head and the matrix v_2. Finally, the terminal movement step is triggered by the focus and wh-features on the matrix C_2 head, enforcing movement of the wh-phrase to matrix Spec-CP.

(15) a. [$_{vP}$ $v_{1[EF]}$ [$_{VP}$ V wh]]

b. [$_{vP}$ wh [$_{v'}$ $v_{1[EF]}$ [$_{VP}$ V ⟨wh⟩]]]

c. [$_{CP}$ wh [$_{C'}$ $C_{1[EF]}$ ... [$_{vP}$ ⟨wh⟩ [$_{v'}$ $v_{1[EF]}$ [$_{VP}$ ...]]]]]

d. [$_{vP}$ wh [$_{v'}$ $v_{2[EF]}$ [$_{VP}$ V [$_{CP}$ ⟨wh⟩ [$_{C'}$ $C_{1[EF]}$ ... [$_{vP}$ ⟨wh⟩ [$_{v'}$ $v_{1[EF]}$ [$_{VP}$ ...]]]]]]]]

e. [$_{CP}$ wh [$_{C'}$ $C_{2[WH,FOC]}$ ... [$_{vP}$ ⟨wh⟩ [$_{v'}$ $v_{2[EF]}$ [$_{VP}$ V [$_{CP}$ ⟨wh⟩ [$_{C'}$ $C_{1[EF]}$ ...
... [$_{vP}$ ⟨wh⟩ [$_{v'}$ $v_{1[EF]}$ [$_{VP}$ ...]]]]]]]]]]

The relevant phase heads now all bear an [EF] feature, which has been checked in syntax, but is still visible to the interfaces (Chomsky 1995). In a Late Insertion approach to morphology such as Distributed Morphology (Halle & Marantz 1993), the relevant Vocabulary Items are inserted into the terminals of the structure in (15e). We assume the following specifications for Vocabulary Items: the default form of the C head is *sɛ́* (16a), unless it bears a focus feature and is then realized as *na* (16b). The insertion rules for *v* are given in

(17). The default realization of *v* is assumed to be null (17a), unless it also bears an edge feature, in which case it is realized as a floating high tone (16b).

(16) *Vocabulary Items for C*

a. *sɛ́* ↔ [C]
b. *na* ↔ [C, FOC]

(17) *Vocabulary Items for v*

a. Ø ↔ [*v*]
b. $^{\text{H-}}$ ↔ [*v*] / ___ [EF]

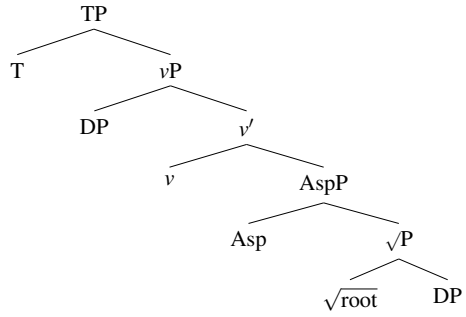
Once this floating tone is present in the structure, it triggers overwriting of the underlying tones in that word.[6]

(18) *Tonal overwriting of v+V* :

2.5 Deriving affix asymmetries

Recall that there was a discrepancy with regard to the verbal affixes undergoing the low-high alternation: whereas low-toned aspect morphemes such as *re-* surface as high in movement contexts, low-toned tense and agreement markers on the verb do not. This receives a natural explanation following standard assumptions about the architecture of the verbal domain in Twi. Kusmer (2011) and Kandybowicz (2015) provide compelling evidence for the structure in (19), where aspect is situated lower than *v*.

(19) *Clause structure of Asante Twi:*

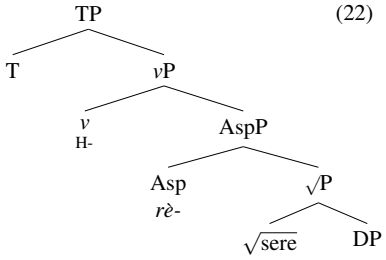


[6]There are various theoretical approaches to tonal overwriting that could be employed here. In Korsah & Murphy (2016), we adopt Trommer's (2011) approach to tonal overwriting, which involves the assumption that overwriting tones are actually tonal circumfixes that spread inwards, triggering delinking of the tones they surround. For reasons of space, we refrain from a detailed exposition here.

We saw in example (5) (repeated below) that the low-toned prefix *re-* is affected by tonal overwriting from *v*. Given the clause structure in (19), this follows from the bottom-up derivational nature of the post-syntactic component in attaching affixes. First, Asp is combined with the root (22a), and then *v* subsequently combines with this (22b), triggering overwriting of all low tones in both the prefix and the stem (22c).

(20) a. Baá **re-se**ré hwáń?
Baah PROG-laugh who
b. Hwáń$_1$ na Baá **ré-sé**ré nó$_1$?
who FOC Baah PROG-laugh 3SG
'Who is Baah laughing at?' (Marfo 2005, 81)

(21)



(22) a. Asp+$\sqrt{\text{sere}}$ ⇒ rè-sèrè
b. *v*+[rè-sèrè] ⇒ ^{H}-rè-sèrè
c. ^{H}-rè-sèrè ⇒ ré-séré

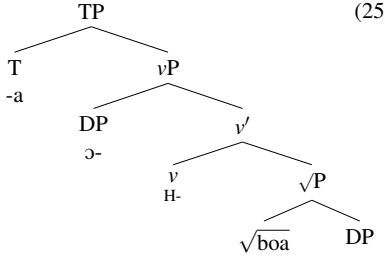
Example such as (10) (repeated below) showed that the low-toned tense suffix and resumptive clitic on the verb do not undergo the change to high.

(23) a. Kofí **bo**á-a Afíá
Kofi help-PAST Afaí
'Kofi helped Afia'

b. Kofí na ɔ-**bó**á-a Afíá
Kofi FOC 3SG-help-PAST Afia
'It is Kofi who helped Afia'

This is because they are both situated above *v* and therefore, tonal overwriting applies before the tense affix is attached to the stem. In the first step, *v* attaches to the stem (25a) and subsequently triggers overwriting of the low tone in *boá* (25b). Only after overwriting has applied, the resumptive clitic and tense suffix are attached and are therefore unaffected.

(24)



(25) a. *v*+$\sqrt{\text{boa}}$ ⇒ ^{H}-bòá
b. ^{H}-bòà ⇒ bóá
c. ɔ̀+bóá ⇒ ɔ̀-bóá
d. T+ɔ̀-bóá] ⇒ ɔ̀-bóá-à

Thus, the original generalization we had that aspect affixes are affected, whereas tense and agreement markers are not, actually translates into a height distinction. Affixes originating below *v* are affected by the tonal overwriting due to the cyclic nature of affix concatenation, whereas morphemes situated above *v* come too late to be affected by the overwriting processes induced by *v*.

3. Movement reflexes in adverbial clauses

Finally, it is worth noting that the tonal alternation that we assume to be movement-related has also been reported in other environments, such as adverbial clauses (26).

(26) a. Kofí re-bisá nó
Kofi PROG-ask him
'Kofi is asking him.'
b. [Kofí ré-bísá nó ná] Sɛ́bɛ́ á-da
Kofí PROG-ask him when Sebe PERF-sleep
'While Kofi was asking him, Sebe was asleep.' (Kügler 2015)

Example (26b) shows that the progressive prefix and low tone of LH *bisá* surface as high inside an adverbial clause, despite the apparent lack of movement in this clause. However, we believe that this fact provides support for an established assumption that adverbials involve movement of a covert operator (Geis 1970, Larson 1990, Haegeman 2007, Zentz 2014). This assumption was tradtionally motivated by interpretive distinctions such as (27).

(27) The professor wrote the letter after being asked.
a. [$_{PP}$ after [$_{CP}$ Op$_1$ [$_{TP}$ he said [$_{CP}$ he needed it] t$_1$]]]
High reading: 'The professor wrote the letter after being asked to.'
b. [$_{PP}$ after [$_{CP}$ Op$_1$ [$_{TP}$ he said [$_{CP}$ he needed it t$_1$]]]]
Low reading: 'The professor wrote the letter after the deadline.'

Interstingly, languages that mark extraction morphologically also display 'movement' reflexes inside adverbial clauses. For example, McCloskey (2001, 2002) shows that the movement-marking a^L complementizer in Irish also appears in adverbials (28) (also see Zentz 2014 for the same claim for the Bantu language Akɔɔse).

(28) *Movement reflex in adverbial clauses in Irish* (McCloskey 2001):
a. nuair a^L tháinig siad 'na bhaile
when COMP came they home
'when they came home'
b. mar a^L chloisimid a^L dh'imthigh ar Níobé t
when COMP hear.1PL COMP went on N.
'as we hear happened to Niobe'

Thus, the fact that we find putative movement reflexes in adverbial clauses is therefore not problematic and actually lends support to the null operator movement analysis.

4. Conclusion

In this paper, we have presented new data from Asante Twi showing that there are tonal alternations on verbs that are sensitive to the presence of Ā-movement in a given clause. We analyze this as a tonal reflex of successive-cyclic movement and argue that a *v* phase head bearing an edge feature is realized as a floating H tone, which then triggers overwriting in the verb. This observation adds to the growing body of empirical evidence for successive-cyclic movement, but is particularly relevant to recent discussions since it manifests a rare, purely tonal reflex of successive-cyclic movement and also provides evidence for the status of *v* as a phase head.

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