

A novel argument for PF operations: STAMP morphs in Gã

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Abstract. A key question facing piece-based syntactic morphological frameworks is whether morphophonological structure may be read directly from syntactic structure, as in Spanning, or if postsyntactic operations mediate this relationship, as in Distributed Morphology. Additionally, it is necessary to determine whether linear order is relevant for determining locality. This paper brings new data from STAMP portmanteaux in Gã (Kwa, Ghana) to bear on this question. I demonstrate that STAMP portmanteaux are composed of terminal nodes which do not form a syntactic constituent, and thus are incompatible with syntax-only morphological frameworks like Spanning. PF operations which are sensitive to linear locality, like Fusion in DM, are necessary to generate the portmanteaux. Instrumental adjuncts are additionally demonstrated to block portmanteaux formation, confirming that linear locality is crucial for calculating portmanteaux. Gã STAMP portmanteaux thus provide empirical support for PF operations that are sensitive to linear locality.

Keywords. morphology; morphosyntax; portmanteaux; Gã; Spanning; Distributed Morphology

1. Introduction. Piece-based, syntactic morphological frameworks must propose a mechanism which maps phonological content to syntactic features, such as Vocabulary Insertion in Distributed Morphology (Halle & Marantz 1994). A number of models have been proposed which differ from one another with respect to the degree of complexity that should be allotted to the interface between syntax and phonology. To investigate this issue, this paper is framed as a comparison between the Spanning (Svenonius 2012, 2016; Merchant 2015) and Distributed Morphology (DM) (Halle & Marantz 1994; Embick & Noyer 2007) approaches, which ostensibly take opposite stances. DM assumes a number of operations at PF which manipulate morphosyntactic structure, some of which are sensitive to linear locality. In contrast, Spanning proposes limited to no PF operations. In Spanning, morphophonology is read directly from the syntax.

These frameworks differ from one another with respect to their treatment of portmanteaux morphemes. Portmanteaux, defined as “morphs which belong simultaneously to two (or theoretically, more) morphemes, and have simultaneously the meaning of both” (Ostrove 2018:1248), have received much attention in the morphological literature (Ostrove 2018, Svenonius 2012, Embick 2015, i.a.). Portmanteaux are modeled as a single lexical entry which expones multiple syntactic terminals with a single phonological form. Portmanteaux are precisely the type of mismatch between syntax and phonology that at morphological theory must explain: how is it the case that multiple syntactic terminals come to be exponed with a single phonological form? Syntax-only approaches like Spanning proposes that portmanteaux may be read directly from the syntax (Svenonius 2012), while morphological approaches like DM generates these mismatches using PF operations like Fusion (Embick & Noyer 2007).

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In this paper, I present data from STAMP (Subject-Tense-Aspect-Mood-Polarity) portmanteaux in Gã (Kwa, Ghana, iso:gaa). In STAMP portmanteaux, pronominal features and Tense-Aspect-Mood-Polarity features are expressed on a single morpheme (Anderson 2011). Gã STAMP portmanteaux are particularly relevant because the syntactic nodes in question do not seem to form a syntactic constituent, posing a challenge to theories which read morphological structure directly from syntactic structure. I demonstrate that the Gã data requires a morphological framework which includes operations at PF that are sensitive to the linear order of morphemes by comparing analyses in two frameworks, Spanning (Svenonius 2012) and Distributed Morphology (Halle & Marantz 1993)

Section 2 will briefly provide background on Spanning and DM, with a focus on how these frameworks treat portmanteaux. In Section 3, I introduce STAMP morphs in Gã. Section 4 presents Spanning and DM analyses of the data. I demonstrate that a DM approach does generate STAMP portmanteaux, and that current syntax-only formulations of Spanning do not. Section 4 brings new data from instrumental adjuncts in support of the importance of linear locality for morphological operations. Section 5 concludes.

2. Morphological frameworks and portmanteaux. This section provides a brief overview the key differences between Spanning and DM, with a focus on their approaches to portmanteaux. Spanning and DM are compatible morphological frameworks; as such, the framework which I refer to as “DM” is the version of DM which contrasts with Spanning. Both Spanning and DM are realizational, piece-based frameworks which assume the same basic grammatical architecture, the y-model. Assuming syntax-all-the-way-down and late insertion, Spanning and classic DM agree that the purpose of morphology is to map syntactic structure to phonological content

2.1. SPANNING. Svenonius (2012) proposes the Spanning framework as a response to classic DM (as in Halle & Marantz 1994). Spanning is intended to be a “radically conservative” approach to morphology (Bye & Svenonius 2012: 2). This theoretical move is motivated by Svenonius’s (2012) observation that the PF operations proposed in DM are extremely powerful and may be superfluous, adding unnecessary complexity to the syntax/phonology interface. The Spanning framework argues that the interface between syntax and phonology is maximally simple. The only point of contact between syntactic structure and phonological form is the lexical item, and cases of apparent incongruence between syntactic and phonological structures are attributed to syntactic operations, phonological processes, or the insertion process itself.

To handle cases in which there is not a one-to-one correspondence between nodes and morphemes without proposing PF operations which manipulate the syntax, Spanning must propose a lexical insertion process which looks different from that in DM. Insertion is divided into two steps, L-match and Insert. L-match associates the syntactic features on a syntactic node or nodes with the syntactic features associated with a lexical item. Insert assembles the lexical items into a form that is legible to the phonology. L-match can target multiple terminal nodes simultaneously if these nodes stand in a particular hierarchical relationship; that is, if the nodes form a Span. The formal definition of a span is presented in (1).

(1) Definition of a Span (Merchant 2015: 20)

Let T be an ordered n -tuple of terminal nodes $\langle t_1, \dots, t_n \rangle$ such that for all $t \in T$, $t = t_i$, or t is an element of the extended projection of t_i .

- a. For all $k = 1 \dots n$, t_k is a span (every node is a trivial span).
- b. For any $n > 0$, if t_k is a span, then $\langle t_k, \dots, t_{k+n} \rangle$ is a span.

In other words, a span is defined as a contiguous set of nodes in a head-complement relationship (Svenonius 2012). Portmanteaux are predicted by the Spanning framework. Lexical insertion targets multiple terminal nodes, so it follows that features on multiple syntactic nodes may be expressed by a single morpheme. Spanning also makes clear predictions about the typology of portmanteau morphemes in the world's languages. If Spanning is on the right track, then it is predicted that portmanteau morphemes will always correspond to spans. That is, the nodes which are incorporated into a portmanteau will be in a head-complement relationship. Adjuncts and specifiers are not visible for the purposes of calculating a Span, and so an intervening adjunct or specifier will not block two nodes from forming a span, and spans will not include adjuncts or specifiers.

2.2. DISTRIBUTED MORPHOLOGY. In DM, Vocabulary Insertion (VI) targets terminal nodes. Mis-matches between nodes and morphemes, including portmanteaux, are derived using PF operations which mediate between syntactic spell-out and phonology. These operations are ordered such that some apply before the syntactic structure is linearized, and others apply after. As a result, some operations are sensitive to linear locality relationships.

One operation which has been proposed in order to account for portmanteaux is Fusion. Fusion is a PF operation which combines multiple local terminal nodes into a single position of exponence (Embick 2015). Fusion applies after linearization and prior to VI. Locality is thus defined in terms of linear adjacency, rather than syntactic constituency. A Fusion rule is schematized in (2). This rule states that whenever a node X bearing features [α] is concatenated with a node Y bearing features [β], nodes X and Y may be collapsed into a single node bearing features [α, β].

$$(2) \quad X[\alpha]^Y[\beta] \rightarrow [\alpha, \beta]$$

The output of Fusion is the input to VI. That is, in the case of (2), VI will associate phonological content with the feature bundle [α, β], rather than targeting nodes X and Y individually. Fusion thus enables portmanteaux morphemes to be created from two linearly local nodes.

Spanning and DM make different predictions with respect to the types of portmanteaux that we expect to see in the world's languages. Spanning predicts that portmanteaux will consist of heads which form a syntactic constituent; specifically, those in a head-complement relationship. Specifiers and adjuncts will not be included in portmanteaux. DM predicts that portmanteaux will consist of heads which are linearly local, regardless of their hierarchical relationship. Specifiers and adjuncts may be included in portmanteaux. The following section introduces portmanteaux from Gã which will be used to test this prediction.

3. STAMP Morphs in Gã. Gã is a Kwa language that is spoken in Accra, Ghana.¹ Its basic word order is subject-verb-object. Subject agreement is not morphologically realized on the verb. Overt subjects are obligatory; either as a full DP (3a) or as a pronoun (3b). It is clear that subject markers, like the third person singular *e* in (3a), are pronouns and not agreement morphemes. The subject marker surfaces in complementary distribution with overt lexical objects like *lofloo* 'the bird' in (3b).

¹ Unless otherwise cited, data in this proposal comes from elicitation sessions with a native speaker of Gã. Thank you, again, to Tracy.

- (3) a. e naa loflo b. loflo-o naa le
 3SG see.HAB bird bird-DEF see.HAB 3SG.ACC
 ‘He/She/It sees the bird.’ ‘The bird sees him/her/it.’

Additionally, subject markers may bind an anaphor (4).

- (4) e dzu e-he
 3SG.NOM wash 3SG-rflx
 ‘She washed herself.’

The distribution of the subject marker and its ability to bind an anaphor would be surprising for an agreement marker, but follows if the subject marker is a pronominal.

Gã distinguishes morphologically between nominative and accusative pronouns. Nominative seems to be the default case, as it is present in nominative (5a) and genitive (5b) contexts.

- (5) a. í ná gbèé-i éṅɔ
 1SG see dog-PL two
 ‘I saw two dogs.’
 b. í kɛ í ɲanɛmẽ-ĩ tee dzàáno
 1SG with 1SG friend-PL go.PFV market
 ‘I went to a market with my friends.’

The default pronominal paradigm is presented in Table 1.

| | Singular | Plural |
|---|----------|--------|
| 1 | í | wɔ |
| 2 | o | ɲɛ |
| 3 | e | ame |

Table 1. Default Pronominal Paradigm

Gã additionally exhibits what Anderson (2011) refers to as “STAMP morphology”, also known as “tensed pronouns”, “TAM-encoding pronouns”, or “fused subject/TAM auxiliaries” (Anderson 2006, 2011). Characteristic of languages of the Macro-Sudan Belt, STAMP morphs are portmanteaux morphs which “encode the referent properties of subjects in addition to various TAM and polarity categories” (Anderson 2011:1). STAMP morphs express the phi-features of a pronominal subject together with TAM and polarity categories.

In Gã, STAMP morphs surface in the progressive aspect in the context of singular pronouns. In its default form, progressive aspect is marked by a homorganic nasal prefix on the verb, as in (6).

- (6) ɲɛ n-na wɔ
 2PL PROG-see 1PL.ACC
 ‘You are seeing us.’

In the progressive, second- and third-person singular subject pronouns are lengthened and bear low tone. The first person subject pronoun is realized as *mí*, as in (7). In all of these cases, the progressive prefix is not present on the verb; these morphemes are thus clearly STAMP morphs. Progressive aspect features are realized on the subject pronoun, rather than the verb.

- (7) mí na bo
 1SG.PROG see 2SG.ACC
 ‘I am seeing you.’

The set of pronominal forms in the progressive aspect is provided in Table 2.

| | Singular | Plural |
|---|----------|--------|
| 1 | míí | wɔ n- |
| 2 | oo | ɲɛ n- |
| 3 | ee | ame n- |

Table 2. Progressive Pronominal Paradigm

Gã additionally exhibits STAMP morphs in the irrealis mood. The default irrealis marking is the morpheme *bá* (8).

- (8) o báá na mi
 2SG IRR see 1SG.ACC
 ‘You will see me.’

However, in the context of a first person singular pronoun, irrealis mood and first person singular features are both expressed by the morpheme *má* (9).

- (9) má na bo
 1SG.IRR see 2SG.ACC
 ‘I will see you.’

The set of irrealis pronominals and mood marking is presented in Table 3.

| | Singular | Plural |
|---|----------|---------|
| 1 | má | wɔ báá |
| 2 | o báá | ɲɛ báá |
| 3 | e báá | ame báá |

Table 3. Irrealis Pronominal Paradigm

STAMP morphs are puzzling given that Nevins (2011) proposes that a defining characteristic of pronouns which distinguishes them from agreement is that the pronoun does not vary according to features of the verbal projection such as aspect. This is because pronouns are determiners, and thus they express only nominal features and are not sensitive to verbal features.

Syntactically, I assume that the pronominal is a node D which bears phi-features, and that a node in the verbal extended projection bears inflectional features. A theory of morphology must explain how it is that these features originating on different nodes come to be expressed by a single portmanteaux morpheme.

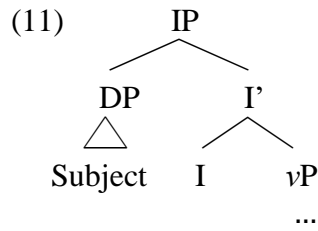
3. Analyses. This section attempts analyses of the Gã STAMP portmanteaux using the Spanning (3.1) and DM (3.2) frameworks. For space, the analysis focuses on first person singular progressive STAMP portmanteaux. Recall that in the context of a first person singular subject and progressive aspect, phi-features and aspect features are both realized on a single morpheme *míí* (10a). In other persons and numbers, the pronoun is realized in its default form and progressive aspect is expressed on the morpheme *n-* (10b).

- (10) a. míí na bo
 1SG.PROG see 2SG.ACC
 ‘I am seeing you.’
 b. ɲɛ n-na wɔ
 2PL PROG-see 1PL.ACC
 ‘You are seeing us.’

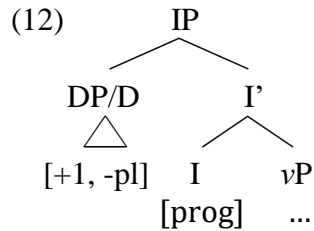
I demonstrate that syntax-only formulations of Spanning cannot generate the STAMP pattern. A DM framework which includes PF operations such as Fusion that are sensitive to linear locality does generate the STAMP pattern.

3.1. A SPANNING APPROACH. The Spanning morphological framework (Svenonius 2012, Merchant 2015) seems particularly well suited to account for the Gã data, as it allows multiple nodes to be exponed by a single morpheme. Specifically, in a Spanning approach, multiple nodes may be targeted for insertion as long as they form a span. A span is defined as a contiguous region of a sequence of heads in a head-complement relationship. Crucially, the span is determined based solely on the hierarchical syntactic structure. Unlike in Distributed Morphology, linear order plays no role, and there are not operations like Fusion or Fission which could modify the set of terminal nodes prior to insertion.

For simplicity, I assume that the basic syntactic structure of Gã is as schematized in (11). However, the details of the clausal syntax are not crucial to the present analysis. What is crucial is that inflectional features such as aspect occupy the head of an inflectional projection within the extended verbal projection, and that the subject occupies the specifier position of that projection. In other words, the subject pronominal DP/D and the head bearing aspectual features are in a specifier-head relationship. This basic structure is consistent with current approaches to Gã syntax (Korsah 2015, 2017; Allotey 2020). A detailed syntactic derivation is beyond the scope of this study, and is left to future research.



In the context of a first person singular pronoun and progressive aspect, the syntactic structure at spell-out is as in (12).



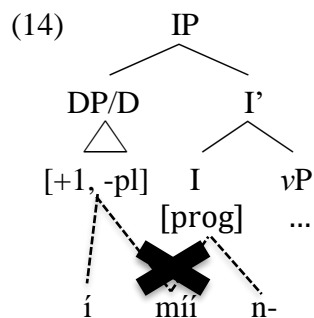
Additionally, I propose the following set of lexical items to account for the first person singular progressive morphemes. (13a) is the default first person singular morpheme, (13b) is the default progressive marking, and (13c) is the portmanteaux morpheme spelling out first person singular progressive features.

- (13)
- a. [+1, -PL] ↔ /i/
 - b. [PROG] ↔ /n-/
 - c. [+1, -PL, PROG] ↔ /míí/

In Spanning, the L-Match step of lexical insertion matches the features on lexical items to the morphosyntactic features in a span. Each eligible lexical item is inserted, and morpheme choice is determined at Insert. In order for a Spanning analysis to derive Gã STAMP

portmanteaux, L-match would need to associate the default first person singular lexical item (13a) with the first person singular features on D, the default progressive lexical item (13b) with progressive features on I, and the portmanteaux lexical item (13c) with a span comprised of D and I.

However, this derivation does not converge. D and I are in a spec-head relationship. A span is defined as a head-complement sequence. D and I thus do not meet the structural criteria for a span, and are not an eligible target for L-match. This is illustrated in (14), where dashed lines represent the association of a feature bundle with a lexical item.



Because D and I do not form a span, current syntax-only formulations of Spanning cannot generate STAMP morphs in Gã. Rather, such frameworks predict that the default morpheme will always surface.

A main goal of Spanning is to propose a way for complex morphological structures to be interpreted directly from the syntactic structure without complicating the morphological component of grammar by proposing additional PF operations like Fusion or head movement (Svenonius 2016, 2019). The Gã data is an interesting test case for this theory because there is a mismatch between morphological structure and syntactic structure, as two nodes are realized on a single morpheme, but the nodes, D and I, do not form a syntactic constituent. Because the nodes are not members of the same Extended Projection, they do not meet the structural criteria to be a Span. Thus, spanning does not account for the data. The Gã data thus cannot be explained if morphological structure is determined by syntactic structure alone, so an alternative analysis must be explored. In Section 3.2, I propose a solution to this problem in Distributed Morphology, and demonstrate that the data can be explained using a Fusion operation which is sensitive to the linear adjacency of nodes.

3.2. A DISTRIBUTED MORPHOLOGY APPROACH. The inability of the Spanning framework to account for the Gã data suggests that it is not possible to capture STAMP portmanteaux by reading morphological structure directly from the syntactic structure. One solution to this problem is to propose PF operations to mediate between morphosyntax and phonology. Specifically, I propose that the operation Fusion is necessary to capture this data (Embick & Noyer 2007).

Like the Spanning analysis in Section 3.1, the DM analysis assumes the basic syntactic structure in (11). The subject DP/D and inflectional features are in a specifier-head relationship. In a DM framework, following spell-out, the syntactic structure in (12) is subject to a number of operations at PF (Embick & Noyer 2007). Following Embick (2010), I assume that these operations are ordered such that a linearization operation such as concatenation linearizes the hierarchical structure prior to Fusion, and Vocabulary Insertion follows Fusion.

When the syntactic structure in (12) is concatenated, the result is the linear string in (15). In the case of the first person singular progressive, a node D bearing features [+1, -PL] is concatenated with a node I bearing the feature [PROG] (15). These nodes are now linearly local to one another.

(15) D[+1, -PL]^I[PROG]

Fusion is a PF operation which collapses two or more local terminal nodes into a single terminal node prior to VI, creating a single feature bundle which includes features from multiple nodes (Embick 2015: 215). Fusion is sensitive to linear locality relationships. Given that singular pronouns in Gã participate in STAMP portmanteaux in the progressive context, I propose the Fusion rule in (16). When a node D bearing the feature [-PL] is concatenated with a node I bearing the feature [PROG], these nodes Fuse to form a single feature bundle [__, -PL, PROG].

(16) Fusion Operation: Progressive Aspect
 D[__, -PL]^I[PROG] → [__, -PL, PROG]

Importantly, the result of this operation is that the features on D and I now form a single bundle which is an eligible target for Vocabulary Insertion. In the first person singular case, the Fusion operation yields the feature bundle in (17).

(17) D[+1, -PL]^I[PROG] → [+1, -PL, PROG]

For the DM analysis, I assume the set of Vocabulary Items proposed in (13) for the Spanning analysis. These are repeated in (18). The input to VI is the output of Fusion in (17), a feature bundle containing first person singular phi-features and progressive inflectional features [+1, -PL, PROG]. Per (18c), the portmanteau morpheme matches all of these features and is inserted.

(18) a. [+1, -PL] ↔ /i/
 b. [PROG] ↔ /n-/
 c. [+1, -PL, PROG] ↔ /mí/

Because concatenation is the relevant locality domain to which Fusion applies, a single morpheme may realize all of these features even though their nodes do not form a syntactic constituent. Spanning was unable to obtain this result because spans are calculated based on hierarchical structure.

A Distributed Morphology framework, in which the morphological component of grammar includes a Fusion operation which is based on the linear adjacency of morphemes, can thus account for STAMP portmanteau morphemes in Gã. In the following section, I provide further empirical support for the importance of linearity in calculating portmanteaux.

4. Further support for linearity: Instrumentals. Because Fusion applies after concatenation and is thus sensitive to linear order, while spans are calculated from hierarchical structure, DM and Spanning make a further conflicting prediction. DM predicts that an adjunct intervening between two components of a portmanteau will block Fusion, and thus cause the two nodes to be realized independently instead of by a portmanteau. Spans are blind to adjuncts, and thus an adjunct intervening between two component pieces of a span will not affect whether or not two nodes surface as a span. Instrumental adjuncts in Gã enable us to test this prediction.

In Gã, an instrumental adjunct may intervene between the pronoun and the verbal complex (19).

- (19) e kɛ blo tʃumo ʃíàà
 3SG with broom clean house
 ‘He already cleaned a house.’

When the instrumental surfaces between the subject pronoun and the inflectional marker, as in (20-21), it intervenes linearly between them. However, because the instrumental is an adjunct, it would not intervene structurally. A consequence of the Spanning framework, in which spans are head-complement sequences, is that an intervening adjunct will not affect the calculation of a portmanteau. Spanning thus predicts that STAMP morphs will co-occur with instrumental adjuncts. The Gã instrumental demonstrates that this prediction is not borne out. In (20) we see that the pronoun and aspect marker surface in their default form when the instrumental *kɛ awalé* surfaces between the subject and the verb. (21) demonstrates that the same pattern occurs with irrealis STAMP morphs. It is unclear how this pattern could be generated in Spanning.

- (20) í kɛ awalé n-ho amada-í
 1SG with spoon PROG-cook plantain-PL
 ‘I am cooking plantains with a spoon.’
- (21) í kɛ awalé bàá ho amada-í
 1SG with spoon FUT cook plantain-PL
 ‘I will cook plantains with a spoon.’

This data can be accounted for in DM. When an instrumental adjunct is present, Fusion does not apply. This is not surprising if the context for Fusion operations like (17) is determined based on linear adjacency. The linear order of the subject, instrumental, and inflection are such that the subject precedes the instrumental, and inflection follows the instrumental; the relevant nodes are concatenated roughly as in (22).²

- (22) $D_{\text{Subj}} \hat{P}_{\text{Inst}} \hat{N}_{\text{Inst}} \hat{I}$

As is evident in (22), when a preverbal instrumental is present, the subject node D and inflectional node I are no longer concatenated. This structure does not meet the requirements for the application of Fusion. In other words, because the instrumental intervenes linearly between the subject and inflection, its presence bleeds the environment for Fusion. Because D and I are not Fused, Vocabulary Insertion will apply to each node separately. D and I are exponed by separate morphemes, which is consistent with the data in (20-21). Thus, a morphological framework which includes a Fusion operation that applies based on linear adjacency can account for the exceptional cases where Fusion does not apply just as well as the cases where Fusion does apply. The Gã data thus suggests that certain operations must be sensitive to linear order rather than hierarchical structure. Pronominal patterns cannot be generated under Spanning, in which spans are read from hierarchical structure. In addition, the data cannot be generated under current versions of linear-based Spanning like Stretching because these restrict Stretches to hierarchically related nodes. The best current morphological approach to account for the Gã data is Fusion, which allows a portmanteau to be generated from any two linearly adjacent nodes and predicts that any intervening material between the two nodes will block the portmanteau. Thus, the Gã case study supports a morphosyntactic framework which includes postsyntactic

² I have omitted null nodes, such as the extended nominal projection associated with the instrumental noun, for simplicity.

operations like Fusion which are sensitive to linear order. Morphological structure cannot be read directly from syntactic structure.

5. Conclusion. This paper has presented empirical support for postsyntactic operations which are sensitive to linearity, like the type proposed in Distributed Morphology. STAMP portmanteaux in Gã are comprised of terminal nodes which are in a specifier-head relationship, but are linearly local to each other. This data cannot be generated in current syntax-only formulations of Spanning, as the specifier-head configuration does not meet the structural criteria for a span. However, proposing postsyntactic operations which are sensitive to linear locality, such as Fusion in DM, does generate this data. Further support that linear locality is the relevant relationship for calculating Gã STAMP portmanteaux is that an instrumental adjunct interrupts the linear, but not hierarchical, relationship between the subject and the verbal complex. When this occurs, the portmanteaux does not surface. Taken together, these findings suggest that the importance of linear locality is crucial at PF, and that there are morphological operations mediating between syntax and phonology. It is unlikely that phonological structure may be read directly from the syntactic structure. Future work is necessary in order to extend the analysis to STAMP morphs in other languages.

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