

## Size matters: auxiliary formation in the morpho-syntax and morpho-phonology \*

Paula Fenger

University of Connecticut

### 1. Introduction

Variation exist in how many inflectional features can be expressed on verbs. A language like English, (1), expresses tense and aspect contrasts through suffixes on the verb, for example *-ed* for past, (1a), and *-ing* for progressive, (1b). However, a periphrastic construction with an auxiliary is needed to host the past when both features need to be expressed, (1d), and it is not grammatical to express both morphemes on the verb simultaneously, (1c). On the other hand, a language like Turkish seems to allow stacking of tense and aspect suffixes, as is the case in (2c) for exactly the same feature combination as in English.

- |     |    |   |    |   |    |  |    |                             |
|-----|----|---|----|---|----|--|----|-----------------------------|
| (1) | a. | stay- <b>ed</b>                         | b. | stay- <b>ing</b>                            | c. | *stay- <b>ing-ed</b>                                   | d. | <b>was</b> stay- <b>ing</b> |
| (2) | a. | kal-' <b>di</b><br>stay-PST<br>'stayed' | b. | kal- <b>ıy'or</b><br>stay-PROG<br>'staying' | c. | kal- <b>ıy'or-dü</b><br>stay-PROG-PST<br>'was staying' |    |                             |

Recently it has been proposed that auxiliary formation arises as an intervention process where multiple features residing on separate heads compete for being spelled out as part of the same word as the verbal stem (Ackema 1995, Embick 2000, Bjorkman 2011, Pietraszko 2017). In case of English (1d), PROG intervenes for the attachment of PST in English. This explains why this example is traditionally understood as two words, i.e., there are two syntactic and phonological units, as opposed to all the other examples in (1)-(2). If that is true for English, then the question arises if a language like Turkish is a different type of language, lacking this process, since PROG does not seem to block PST to be attached onto the verb. However, this cannot be the full story, since Turkish does allow for auxiliaries, even with PROG, (3). If we were to extend an intervention approach to Turkish, we still need to explain why sometimes the same features can be spelled out as auxiliaries.

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- (3) bit-ir-**iyor** ol-**malı** i-**di**  
finish-CAUS-PROG AUX-NEC AUX-PST  
's/he had to be finishing' (adapted from Kornfilt 1997)

It is possible to say that Turkish has different features competing than English, i.e., PROG is only an intervener for the necessity marker, but not for the PST, and the necessity marker is an intervener for the PST. This is in principle possible, but might be a problem from the perspective of learnability. For a language learner it would mean they have to store each combination of suffixes that leads to an auxiliary separately. In this paper I show, by looking at complete inventories of languages with large inventories of Tense Mood and Aspect (TMA) affixes, specifically Turkish and Japanese, that there is an asymmetry in which features need auxiliaries and which can attach onto the verb. That is, morphemes expressing features in the voice and aspect domain can attach onto the verb in the syntax, whereas morphemes expressing features in the tense and mood domain cannot. I argue that this is because complex head formation is domain sensitive, and I propose that the extended projection of VP is a barrier for complex head formation. I cast this in a contextual phases approach (Bobaljik and Wurmbrand 2005, Wurmbrand 2013, Bošković 2014) to account for the cross-linguistic variation in where the domain edge falls.

Moreover, looking closely at phonological and syntactic tests, it turns out that (2c), *kaliyordü*, is in fact more similar to *was staying* and not to *stayinged*. Accounting for this seeming difference is done at PF. This then means that a language learner does not need to posit different rules for PROG in Turkish, and does not need to learn each combination separately. The proposal is illustrated mostly by looking at Turkish, and Sect. 5 briefly discusses Japanese and several predictions regarding word-hood.

## 2. Two contradictory types of auxiliaries?

Turkish has a large inventory of Tense, Mood and Aspect (TMA) morphology, listed in (4) (based on Kornfilt 1997, Cinque 2001, Zanon 2014).<sup>1</sup> Note that the same phonological form of the suffix occurs with different TMA features. For example, the modality marker *-abil* can have an ability reading when it is attached low, before aspectual morphemes; but has a possibility reading when it is attached high, after aspectual morphemes. Moreover, these double morphemes can also co-occur. This means that, based on morpheme order and (im)possible interpretations, that some morphemes can have multiple positions in the clause.<sup>2</sup> Note also that all the suffixes are listed with their underlying form, and change depending on phonological processes.

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<sup>1</sup>I assume, with Zanon (2014) that the past tense marker is a mood marker. The same generalization arises if it in fact were a tense marker.

<sup>2</sup>I remain agnostic at this point if this means that there is rampant homophony, or if the morphemes themselves are underspecified and can be inserted in multiple positions

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- |  |  |
|--|--|
| <p>(4) <u>Voice</u></p> <p>a. passive: <i>Il</i></p> <p>b. causative: <i>DUr</i></p>   | <p>(7) <u>High modality</u></p> <p>a. necessity.: <i>mAll</i></p> <p>b. possibility: <i>abil</i></p>   |
| <p>(5) <u>Low modality</u></p> <p>a. obligation: <i>mAll</i></p> <p>b. ability: <i>abil</i></p>  | <p>(8) <u>Tense</u></p> <p>a. future: <i>AcAK</i></p> <p>b. anterior: <i>DI</i></p>  |
| <p>(6) <u>Aspect</u></p> <p>a. habitual: <i>Ar</i></p> <p>b. perfect: <i>miş</i></p> <p>c. progressive: <i>Iyor</i></p> <p>d. Prospective: <i>AcAK</i></p> | <p>(9) <u>Mood</u></p> <p>a. evaluative: <i>sA</i></p> <p>b. evidential: <i>miş</i></p> <p>c. past: <i>DI</i></p> <p>d. irrealis <i>sA</i></p> |

Each of these morphemes by themselves can occur on a verb and form a single phonological unit. Two examples are given, (10). Generally, in a phonological word, stress falls on the last syllable (Kabak and Vogel 2001, Güneş 2009), which is also the case for the examples.

- (10) a. Hasan çay-in-ı iç-i'yor [PROG]<sub>x0</sub>  
 hasan tea-3.SG-ACC drink-PROG  
 'Hasan is drinking his tea'
- b. Hasan ödev-in-i bitir-e'cek [FUT]<sub>x0</sub>  
 hasan assignment-3.SG-ACC finish-FUT  
 'Hasan will finish his assignment' (Kornfilt 1997)
- (11) a. Ayşe gel-'di [PST]<sub>x0</sub>  
 A. come-PST
- b. Ayşe gel-'se [COND]<sub>x0</sub>  
 A. come-COND

There are restrictions on which feature combinations cannot co-occur on the verb together. In those cases an auxiliary is used. These auxiliaries do not contribute any meaning and are dummy elements. There are two allomorphs for the dummy auxiliary, *ol* and *i*, (Kornfilt 1997, Sağ 2013); their distribution is determined by the specific TMA feature.<sup>3</sup> For example, in the case of [PROG] and [FUT], stacking of the suffixes with stress on the last syllable is not possible, and *ol* is used to host [FUT], and stress falls on the main verb. The same holds for different feature combinations, (13), where *i* is used to host the conditional.

<sup>3</sup>For the purpose of this paper I only look at instances where the auxiliary is used to host an inflectional feature, and I do not look at copula constructions or cases where the auxiliaries seem to contribute any meaning (Kornfilt 1996, Göksel 2001).

- (12) a. \*yaz-**iyor-aca'ğ-ım** \*[PROG, FUT]<sub>x0</sub>  
 write-PROG-FUT-1.SG  
 ‘I will be (in the process of) writing’
- b. yaz-**i'yor ol-acağ-ım** [PROG]<sub>x0</sub>, [FUT]<sub>x0</sub>  
 write-PROG AUX-FUT-1.SG  
 ‘I will be (in the process of) writing’ (Kornfilt 1997)
- (13) a. \*kal-**dı-sa-'nız** \*[PST, COND]<sub>x0</sub>  
 stay-PST-COND-2.PL
- b. kal-**'dı i-se-niz** [PST]<sub>x0</sub>, [COND]<sub>x0</sub>  
 stay-PST AUX-COND-2.PL  
 ‘If you have stayed’

The presence of the auxiliary is always due to a combination of multiple features that cannot co-occur as morphemes attached to the verb stem. It is not the case that certain features are never allowed to be expressed as part of the verb, since each morpheme by itself can occur on the verb. Moreover, auxiliaries are not inserted as a restriction on a certain amount of suffixes on the verb. Adding another morpheme such as the passive or the causative in examples (12b) or (13b) still gives rise to an auxiliary. Thus, the use of dummy auxiliaries is due to the expression of certain feature combinations.

This pattern is in line with recent findings on dummy auxiliary formation, which has been modeled as the blocking of movement (Embick 2000), a type of intervention approach (Ackema 1995, Bjorkman 2011, Pietraszko 2017), or as a markedness effect (Kiparsky 2004). However, there is a broader generalization to be made when looking at all instances of TMA combinations and the use of a dummy auxiliary. That is, there is an asymmetry in which features can and cannot combine, and, moreover, this asymmetry seems to correlate with other unrelated phenomena in the language.

Looking at the combinations of TMA features that are licit on the verb stem, the following picture emerges. From all the suffixes we saw in (4)-(9), all combinations of Tense, (8), high (alethic) modality, (7), and Mood, (9), features lead to the insertion of an auxiliary. Put differently, morphemes spelling out these features can never occur in a single syntactic word. Second, all combinations of Aspect with a higher head (Tense, Mood, high modality) also cannot co-occur in a single syntactic word. The only elements that can occur on the main verb are low modality, voice and some aspectual combinations. This thus points to the fact that elements that are, descriptively speaking, more inflectional, cannot co-occur, whereas derivational morphemes can, together with a single inflectional morpheme. I propose that this split is caused by a phasal edge, in that forming complex heads in the syntax is sensitive to the VP-phase. Before moving to the proposal in detail, let us discuss some apparent counterexamples, which, when we examine them more closely, actually lend further support to the overall approach in this paper.

## 2.1 Refining the generalization: looking at phonological and syntactic cues

Up until this point I have presented data with the underlying assumption that what the unit that is picked out as a word in the syntax is the same unit that has been picked out in the phonology. That is, based on the stress facts in Turkish and the use of an auxiliary, the generalization could be made that combinations of higher inflectional material always leads to the insertion of a dummy auxiliary. An example is given in (14a) for the combination of PROG and PST. However, recall from the introduction that this combination can also be expressed as follows, (2c), repeated as (14b), where there is a single phonological domain for vowel harmony for the PST marker with the previous morpheme, indicating that for the purposes of vowel harmony the two must be part of the same domain. Observe that the stress pattern in both cases is the same, it falls on PROG, and there is also no meaning difference.

- (14) a. kal-**iy'**or i-**di**  
stay-PROG AUX-PST  
'was staying'
- b. kal-**iy'**or-**dü**  
stay-PROG-PST  
'was staying'

The behaviour of stress and vowel harmony looks like a contradiction: auxiliaries are needed in certain combinations of two TMA features, creating two syntactic words, but a single phonological domain can be created for vowel harmony. The generalization presented in the previous section is in fact correct, but there are PF operations that can mask this generalization. That is, by looking at the syntactic behaviour of the examples in (14) above, the results are identical; the only difference is a phonological one. This then means that the generalization in section 2 is about syntactic word-hood, and that at PF bigger phonological words can be created.

First of all, the auxiliary has multiple phonological forms (i) it can be a full vowel, (14a), (ii) deleted when it occurs between two consonants, (14b), and, (iii) can be a glide when it occurs between a consonant and a vowel. The alternation between (i) and (iii) is found in (15). Again the only difference is the vowel harmony pattern.

- (15) a. kal-'**di**-y-sa-nız  
stay-PST-AUX-COND-2.PL  
'If you have stayed'
- b. kal-'**di** i-se-nız  
stay-PST AUX-COND-2.PL  
'If you have stayed'

I propose that the underlying form of the auxiliary is a glide, and can be deleted when between two consonants, and becomes a full vowel when it is at the edge of a word boundary.

- (16) a.  $y \rightarrow i / \# \_ \_$   
b.  $y \rightarrow \emptyset / C \_ C$   
c.  $y$

Now let us look at syntactic tests to show that the examples in (14) are identical. To do so, we look at coordination tests (Kornfilt 1996, Newell 2008, Zanon 2014). When two verbs with an aspectual marker are conjoined, the second one can carry a tense marker, and the first one does not. However, the tense from the second conjunct scopes over the verb of the

first conjunct, which we can see from the interpretation of the two verbs. The example below alternates between the phonologically null auxiliary *-tim*, and the full vowel form, *-itim*.

- (17) [gel-'miʃ ve git-'miʃ] (i)-ti-m  
come-PERF and go-PERF -PST-1.SG  
'I had come and gone' (Kornfilt 1996)

Thus, the form of the auxiliary is phonologically conditioned, but syntactically the examples behave the same with respect to coordination. Thus, the mismatch regarding vowel harmony, stress, and the auxiliary must come from PF and not the syntax. This then means that these examples are relevant when determining the correct generalization regarding which features occur inside a single syntactic head and which ones do not. Namely, stress and the conjunction test pick out the same domain boundary, and are therefore relevant for the generalization, whereas vowel harmony should be treated differently.

### 3. Analysis, Part I: Creating multiple words

The generalization that needs to be accounted for is the following:

- (18) Tense / high modality / Mood features can never be expressed morphologically as part of the same syntactic word

I propose that the realization of certain feature values as auxiliary verbs is determined in the syntax, and that it is an effect created by phases. Complex head formation is a process that occurs in the syntax. However, it is not completely unbounded. In fact, it is contained within phases (Chomsky 2000, 2001, et. seq.). Additionally the cross-linguistic variation in the maximum size a complex head can achieve in terms of the morpho-syntactic features it spells out is due to phases themselves being contextual (Bobaljik and Wurmbrand 2005, Wurmbrand 2013, Bošković 2014, Wurmbrand 2017) — that is, their size can vary cross-linguistically.

Let us discuss what determines the variation in phase sizes. For this paper it is important to understand what the extended thematic domain of V consists of and how it can differ per language; the definition of phases in this paper is that of Wurmbrand (2017).

- (19) a. The highest projection of a cyclic domain constitutes a phase  
b. The cyclic domains of a clause are  
(i) The extended thematic domain of V;  
(ii) The combined T and C domains and

Based on several considerations, categories can be part of the extended thematic domain of V, the first phase, or can be part of the higher phase. It has been shown that categories that have been traditionally categorized as tense and aspect in some languages, under closer scrutiny behave more like the other grammatical category (Kang 2014, Todorović 2016, a.o.). For example, perfect aspect in English has been shown to have syntactic and semantic

properties of tense rather than a type of aspect, whereas progressive does behave as expected like a type of aspect (Bach 1967, Iatridou et al. 2003, Pancheva 2003, Harwood 2015).

This means that the extended domain of V can vary cross-linguistically and can contain aspectual categories (Borer 1994, Kiparsky 1998). I propose that complex head formation is sensitive to this exact domain boundary, i.e. how large complex heads can be is dependent on what counts as the inner phase in a particular language. When a head of the lower phase is present, the heads of the higher phase cannot combine with the verb stem, and are left stranded (i.e., they can become part of auxiliaries, see also next section). Moreover, it is predicted that several syntactic and phonological phenomena should pick out the exact same edge as is the case for other phenomena that seem sensitive to phases, such as ellipsis or VP fronting (Harwood 2015).

Turning to Turkish, it has been shown that the domain for ellipsis can include all aspectual morphemes, and is thus slightly larger than the domain of English (Ince 2009, Bošković 2014). Moreover, the auxiliary split also occur after aspectual morphemes, and thus the extended domain of V includes aspectual morphemes. This means that syntactic complex head formation in Turkish stops after aspect. This is summarized for a combination of PROG and FUT in Table (20).

(20) Syntactic Derivation of *yaz-i'yor olacağım*

i. Clause structure	[ <i>TP</i> [ <i>AspP</i> [ <i>VP</i> V ] PROG ] FUT AGR ]
ii. Complex head formation	[V PROG] [FUT AGR]

Thus combining a morpheme from a lower and a higher phase leads to two syntactic heads, which then accounts for the split between higher and lower affixes, specific derivations will be given in the following section. However, as we have seen, affixes of the higher phase can never be combined, as repeated in example (21). Note that stress only occurs on the main verb, and not of the auxiliaries carry stress. For the higher phase I propose that syntactic complex head formation is not possible anymore. This is reminiscent of the pattern found for word order phenomena in Biberauer et al. (2014). This explains that after the verbal phase, each morpheme needs to be in its own syntactic word, i.e., is a separate auxiliary.

- (21) bit-ir-**iyor**            ol-**malı**    i-**di**  
 finish-CAUS-PROG AUX-NEC AUX-PST  
 ‘s/he had to be finishing’ (adapted from Kornfilt 1997)

The following section shows how the proposed analysis derives the facts.

#### 4. Analysis, part II: Spelling out words

I have proposed that phases restrict syntactic complex head formation, which can account for when TMA features are expressed as morphemes on the verb, or as part of an auxiliary. Further evidence that there is syntactic head formation comes from the mismatches between stress and vowel harmony. These mismatches help determine that we need word formation

in the syntax and at PF. The two usually align, but there can be limited mismatches. This section shows how to spell out (i) a single syntactic and phonological word, (ii) two syntactic words, and (iii) two syntactic words that can become a single phonological word.

#### 4.1 Spelling out a single word

Recall that each TMA suffix by itself can occur on the verb, even suffixes from a higher phase, an example is given in (22). Phonologically there is a single domain for stress, which falls on the last syllable.

- (22) kal-'**di**/'**sa**  
stay-PST/-COND  
' (if) s/he stayed'

Here the notion of contextual phase becomes important. That is, when heads of different phases are present, it is not possible to create a complex head containing both heads. However, I assume there is no Asp head in the syntax in cases of (22), and thus when T is merged the domain is not closed off: syntactic head formation from V to T is possible.<sup>4</sup> Merging the next head will close off the phase.

At this point complex head formation takes place, forming a single complex head, containing V+T/M. Since the complex head is built inside a single phase, interactions between these heads is possible. I assume that vocabulary insertion proceeds cyclically from the bottom up (Bobaljik 2000). Stress and Vowel harmony apply at the same level, namely at the highest complex head (adapted from Güneş 2009, Kabak and Vogel 2001).

- (23) Stress on every last syllable of every highest  $X^0$

- (24) Apply vowel harmony at every highest  $X^0$

At this point, the desired result is obtained. The stress is at the end of a verb, vowel harmony treats it as a single domain<sup>5</sup>

#### 4.2 Spelling out multiple words

In the case when there are two syntactic words, i.e. V+aux construction, as in (25), there are suffixes from two phases. In this case FUT is part of the higher phase and hosted by an auxiliary, the morpheme expressing PROG carries stress.

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<sup>4</sup>alternatively, one could assume that Asp is there, but unmarked and as such is deficient and does not close off the domain; or that *di* is an aspect marker, since it does alternate in the readings it can receive. However the latter analysis does not hold up for the other mood elements

<sup>5</sup>At this point I am not concerning myself with the purely phonological properties that drive and constrain vowel harmony, such as the qualities of the vowels involved. Important for the story is the sensitivity to morphological boundaries and the fact that if there is a single domain for vowel harmony, it must be the case that there is a single complex head.



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- (25) **yaz-i'yor ol-acāğ-ım** [PROG]<sub>x<sup>0</sup></sub>, [FUT]<sub>x<sup>0</sup></sub>
- write-PROG AUX-FUT-1.SG
- ‘ I will be (in the process of) writing ’

As shown in the previous section, once FUT is merged, the lower phase is closed off and complex head formation from PROG to FUT is impossible, stranding FUT. This means we end up with two complex heads, one where there is a stranded inflectional feature. I assume that auxiliary insertion is used as a repair (Calabrese 2011, Bjorkman 2011) against this constraint. The summary of the derivation up until this point is given in Tab. (27).

- (26) a. Infl Constraint: \*[INFL]<sub>x<sup>0</sup></sub>  
 b. Auxiliary insertion: [AUX INFL]<sub>x<sup>0</sup></sub>

- (27) Derivation of *yaz-i'yor olacağım* — version 1

i. Clause structure	[TP [AspP [VP V ] PROG ] FUT AGR ]
ii. Complex head formation	[ [V] PROG ] <sub>x<sup>0</sup></sub> [FUT]
iii. Infl Constraint	*[INFL] <sub>x<sup>0</sup></sub>
iv. Aux Insertion	[[V ] PROG ] <sub>x<sup>0</sup></sub> [AUX FUT AGR] <sub>x<sup>0</sup></sub>

At this point phonological material is inserted, and as before, this occurs cyclically starting from the most embedded element, leading to the translation of (v) into (vi), Tab. (29).

- (28) a. V → yaz c. Asp<sub>prog</sub> → iyor  
 b. (i) AUX → y / \_M<sup>0</sup> d. T<sub>FUT</sub> → AcAK  
 (ii) AUX → ol e. AGR → ım

- (29) Derivation of *yaz-i'yor olacağım* — version 2

i. Clause structure	[TP [AspP [VP V ] PROG ] FUT AGR ]
ii. Complex head formation	[ [V] PROG ] <sub>x<sup>0</sup></sub> [FUT]
iii. Infl Constraint	*[INFL] <sub>x<sup>0</sup></sub>
iv. Aux Insertion	[[V ] PROG ] <sub>x<sup>0</sup></sub> [AUX FUT AGR] <sub>x<sup>0</sup></sub>
v. Vocabulary Insertion	[yaz - Iyor ] <sub>x<sup>0</sup></sub> [ol- AcAK -ım ] <sub>x<sup>0</sup></sub>

At this point we have derived the fact that complex head formation is blocked by phases, creating two syntactic heads. What is left are the phonological processes such as stress assignment and vowel harmony. The rules are the same as above, with one addition. That is, as before, both stress and vowel harmony apply at each highest X<sup>0</sup>, leading to two stress and two vowel harmony domains. However, in fast speech, there is no stress on the auxiliary. This is similar to compounds, where the left hand member of a compound is not stressed, but the right hand member receives main stress. I assume the same rule for compound tenses.

- (30) Stress on every left member of phrasal compound

The full derivation is now given in Tab. (31). The correct result is obtained, where there is stress on the main verb, and there are two vowel harmony domains, because there are two syntactic words that are created due to a phase boundary in syntax.

(31) Derivation of *yaz-i'yor olacađım* — version 3 (final)

i.	Clause structure	[ <i>TP</i> [ <i>AspP</i> [ <i>VP</i> <i>V</i> ] <i>PROG</i> ] <i>FUT</i> <i>AGR</i> ]
ii.	Complex head formation	[ [ <i>V</i> ] <i>PROG</i> ] <sub>x<sup>0</sup></sub> [ <i>FUT</i> ]
iii.	Infl Constraint	*[ <i>INFL</i> ] <sub>x<sup>0</sup></sub>
iv.	Aux Insertion	[ [ <i>V</i> ] <i>PROG</i> ] <sub>x<sup>0</sup></sub> [ <i>AUX</i> <i>FUT</i> <i>AGR</i> ] <sub>x<sup>0</sup></sub>
v.	Vocabulary Insertion	[ <i>yaz</i> - <i>iyor</i> ] <sub>x<sup>0</sup></sub> [ <i>ol-</i> <i>AcAK</i> - <i>ım</i> ] <sub>x<sup>0</sup></sub>
vi.	Stress	[ <i>yazi</i> ' <i>yor</i> ] <sub>x<sup>0</sup></sub> [ <i>olAcAK</i> ' <i>ım</i> ] <sub>x<sup>0</sup></sub>
vii.	Phrasal Stress	[ <i>yazi</i> ' <i>yor</i> ] <sub>x<sup>0</sup></sub> [ <i>olAcAKım</i> ] <sub>x<sup>0</sup></sub>
viii.	Vowel harmony	[ <i>yazi</i> ' <i>yor</i> ] <sub>x<sup>0</sup></sub> [ <i>olacađım</i> ] <sub>x<sup>0</sup></sub>

4.3 Re-creating a single word

What we are left with are the patterns where stress and vowel harmony falls apart. I show that these exceptions follow from the system presented here, under the assumption that syntactic word boundaries can sometimes be erased at PF. The relevant examples are repeated in (32)-(33), where there is an alternation between the full vowel of the auxiliary and a glide/zero, and a single or two vowel harmony domains. All examples behave syntactically identical: for operations such as coordination the same pattern arises. Moreover, the stress pattern is also the same, where stress only falls on the edge of the main verb, and not on the auxiliary.

- (32) a. *kal-'dı i-se-niz*  
 stay-PST AUX-COND-2.PL  
 ‘If you have stayed’
- b. *kal-'dı-y-sa-nız*  
 stay-PST-AUX-COND-2.PL  
 ‘If you have stayed’
- (33) a. *kal-i'yor i-di*  
 stay-PROG AUX-PST  
 ‘was staying’
- b. *kal-i'yor-dü*  
 stay-PROG-PST  
 ‘was staying’

Since the syntactic coordination tests are the same for both examples, the variation must come from a difference at PF. That is, in both cases creating a complex head is limited by a phase and that an auxiliary is inserted to save the stranded feature. The solution proposed here, inspired by Kornfilt (1996), is that there is a rebracketing operation (Embick and Noyer 2001) that applies after stress assignment and before vowel harmony. This then means that not only the syntax is identical for the cases with and without the auxiliary, the phonological processes also not differ, but only hold at different steps in the derivation. That is, the rebracketing is an operation over phonological units: vocabulary insertion has applied and the syntactic features are not present anymore. Thus, mismatches are expected to a certain extent. The syntax requires there to be an auxiliary, but these requirements can be masked at PF at the point where no syntactic features are present anymore.

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The phonological derivation is given in Tab. (34) for the alternation in (32). The syntactic steps of the derivation are omitted, but are as before, where two complex heads are created in the syntax. The vocabulary insertion and stress rules are the same in both derivations: stress only on the main verb. Step (viii) is where the derivation differs: the rebracketing operation creates a single phonological unit of two adjacent complex heads. When this rebracketing operation does not apply, there are two syntactic units and thus two domains for stress and two domains for vowel harmony. However, when rebracketing does apply, after stress assignment, there is only a single unit over which vowel harmony can apply, creating a syntax-phonology mismatch. Recall that the underlying form of the auxiliary is /y/ and it can be pronounced as /i/ when it is word-initial, and is deleted when it occurs between two consonants. The latter is the case in example (33), creating a pattern that looks highly agglutinating, but is in fact only so at PF and not syntactically.

(34) Derivation *kal'dı i-se-niz* vs. *kal'dıysanız*

		A.	kal-'dɪ	i-se-niz	B.	kal-'dɪ-y-sa-nız
v.	VI		[kal-Tɪ] <sub>x</sub> <sup>0</sup>	[y-sA-nɪz] <sub>x</sub> <sup>0</sup>		[kal-Tɪ] <sub>x</sub> <sup>0</sup> [y-sA-nɪz] <sub>x</sub> <sup>0</sup>
vi.	Stress		[kal'Tɪ] <sub>x</sub> <sup>0</sup>	[ysA'nɪz] <sub>x</sub> <sup>0</sup>		[kal'Tɪ] <sub>x</sub> <sup>0</sup> [ysA'nɪz] <sub>x</sub> <sup>0</sup>
vii.	PS		[kal'Tɪ] <sub>x</sub> <sup>0</sup>	[ysAnɪz] <sub>x</sub> <sup>0</sup>		[kal'Tɪ] <sub>x</sub> <sup>0</sup> [ysAnɪz] <sub>x</sub> <sup>0</sup>
viii.	RB		[kal'Tɪ] <sub>x</sub> <sup>0</sup>	[isAnɪz] <sub>x</sub> <sup>0</sup>		[kal'TɪysAnɪz] <sub>x</sub> <sup>0</sup>
ix.	VH		[kal'dɪ] <sub>x</sub> <sup>0</sup>	[iseniz] <sub>x</sub> <sup>0</sup>		[kal'dıysanız] <sub>x</sub> <sup>0</sup>

Summarizing, the proposal in this paper derives single verbs and auxiliaries, as well as limited mismatches between syntax and phonology. Moreover, a difference in the size of syntactic words is predicted. This will be more explored in the following section.

### 5. Language variation

The proposal presented based on the Turkish data makes predictions about the size of syntactic words. That is, I propose that complex head formation is blocked by phases. These phases can differ per language (cf. contextual phase hood [Wurmbrand 2013](#), [Bošković 2014](#), [Todorović 2016](#)), based on the nature of the specific TMA material. However, even if the phases differ, and thus the size of words, this should correlate with other phenomena in the language, such as ellipsis. Let's focus on Japanese, which has been, just as Turkish, described as an highly agglutinating language ([McCawley 1968](#), [Inoue 1969](#), [Sugioka 1984](#), a.o). (35) shows exactly this; there is also a single domain for pitch accent, which is a phonological test for word-hood ([Kubozono 2011](#), [Kawahara 2015](#)). Generally, the pitch shifts, the more suffixes are stacked onto the verb. However, C-elements do not participate, (36). Importantly, it is not about the number of suffixes, but it is about the type of suffix.

- (35) a. [L H H H H H H H H L]     b. [hatarak-ase-rare-taga-ru]  
 ha. ta. ra. ka. se. ra. re. ta. ga. ru.     work-CAUS-PASS-WANT-PRES  
 'Want to be forced to work'  
 ([Sugioka 1984](#))

- (36) a. [L H H H L] L L  
 a. ra. ta. me. ru. yo. ne.
- b. [aratamer -ru] -yo -ne  
 renew -PRES -PART -PART  
 (Yamada 2018)

Interestingly, the pitch also does not shift in combinations of aspect and tense, (37), the /i/ is optional. Note the similarity to the Turkish stress facts, where stress does not appear at the last morpheme, but seems to occur in the middle of the verb. The same applies here: generally pitch spreads throughout the whole verb, but here it ends in the middle.

- (37) a. [L H H L] L L  
 he. da. ta. te. (i). ru
- b. [hedatar te]- (i) -ru  
 be.distant -ASP AUX -PRES  
 ‘It is (being) distant’

Multiple syntactic tests can show that there are in fact two complex heads present. One test is an intervening element. Particles or *only* can occur in between words, but never inside, (38). However, they can occur exactly at the boundary of the pitch accent domain, (39).

- (38) Yoshiki \*{ne} -ga {ne} Yuta \*{ne} -o {ne} mi \*{ne} -ta {ne}  
 Yoshiki PART -NOM PART Yuta PART -ACC PART see PART -PST PART  
 ‘Yoshiki saw Yuta’

- (39) ?Saito-sensei-ga pan-o [mesiaga -te] **ne** [i -ta]  
 Saito-hon-NOM bread-ACC eat -ASP PART AUX -PST  
 ‘Saito was eating bread’

Thus, syntactically and phonologically the same domain is picked out. Again, this is strikingly similar to Turkish. Moreover, the split between C-elements and ‘derivational’ elements as in (35) seem to follow a similar phasal-split.

## 6. Conclusion

This paper contributed to the status of word-formation in the syntax and the post-syntax. I have argued that syntactic complex head formation is sensitive to phases, by looking at verb and auxiliary constructions in Turkish and Japanese. This syntactic component is universal in that it is predicted that there is a unit picked out by syntax and phonology. However, there is language variation depending on what counts as a phase in a particular language, based on the nature of TMA elements. Moreover, it is predicted that syntactic head formation patterns with other phenomena that are sensitive to phases. Finally, I have shown that there are post-syntactic operations that can mask the output of syntax in limited ways.

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Paula Fenger

[paula.fenger@uconn.edu](mailto:paula.fenger@uconn.edu)