Cycles in Syntax, Morphology, and Phonology

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Abstract

This paper is a brief investigation into determining what is necessary to investigate whether domains between modules come from the same source or not. Opposing views have been put forward, which will briefly be discussed. In order to come closer to an answer, it is important to investigate different modules in a single language, as well as conducting cross-linguistic work. This paper discusses various ways this can be investigated.

1. Introduction

Domains have been around in various forms in the different modules of grammar. For example, in the syntax domains have been defined in terms of bounding nodes, barriers, or most recently, phases. In the morphology domains are defined by assuming #/+ boundaries, levels, strata, or, just as in syntax, through phases. Even though linguistic theory has made extensive use of some form of a domain to account for the presence or absence of cyclic rule applications, it remains an open question whether domains in the different modules come from the same source.

There is a growing body of work that connects syntactic phases to morphological and phonological domains. This type of work looks extensively at mismatches between either the syntax and the phonology or the syntax and the morphology, leading to different conclusions (Marvin 2003, Adger 2007, Ishihara 2007, Cheng and Downing 2007, 2016, Pak 2008, Newell 2008, Kahnemuyipour 2009, Embick 2010, D'Alessandro and Scheer 2015, Sande et al. 2020, Harðarson 2022). One strand of research argues that it is better to have a single device in the grammar that delimits domains, while the other strand of research argues that there are too many mismatches between the different modules to maintain this.

It thus seems that a satisfying answer to the questions of whether and how domains across modules are related is difficult to find. Crucially, in

most cases the syntax-phonology interface is discussed separately from the syntax-morphology interface, and independent operations that are used in the syntactic literature to mask domains have generally not been considered when looking at domain mismatches. There is some research that does work on the syntax, morphological and phonological side in a single language, but not for the same phenomenon Bobaljik and Wurmbrand (2013), Harðarson (2022). However, recently is there work on the same phenomenon in a single language across syntax, morphology, and phonology: Bogomolets (2020), Fenger (2020), Georgieva et al. (2021), Georgieva and Borise (2022), Fenger and Weisser (2022).

The aim of this paper is to evaluate what is needed to investigate whether domains across modules are the same. Section 2 reviews the two types of research that have been done before. Then in section 3, the focus will be on what can be done to come closer to the question of whether domains are related, and it presents two preliminary case studies.

2. The State of the Art: Cycling through Previous Work

2.1. Starting from the Top

The first family of analyses that investigates if domains in the syntax have a direct effect on the phonology takes syntax as a starting point (cf. Selkirk 2011, Downing 2013, Cheng and Downing 2016, Bonet et al. 2019) . That is, they follow certain syntactic works who have argued for certain heads being the least controversial to be domain delimitors: v, C and D. The reasoning is that if these are domain-delimitors in the syntax, and the phonology is read off of the syntactic structure, one should find evidence of these three domains in the phonology as well . However, such a perfect mapping does not seem to be found when looking at various patterns, and the general conclusion is that there are too many mismatches to be accounted for by this type of direct inheritance of syntactic domains into the phonology.

To illustrate, consider penultimate vowel lengthening (PVL) in various Bantu languages (Kanerva 1990, Kenstowicz and Kisseberth 1990, Cheng and Downing 2007: a.o.). This phonological process is one in which there is lengthening of the penultimate vowel in a specific domain. This domain seems to be roughly similar to the syntax, but not completely. The illustrations below are from Chicheŵa. In a simple mono-clausal sentence there is a single

instance of PVL (1). When there are adverbials present, each of these are treated as a different domain from the clause, and as such there can be more instances of VL (2).

(1) físi   a-na-dyá   ḿ-k⟨áa⟩ngo
     hyena 1.SUBJ-TAM-eat CL3-lion

     'The hyena ate the lion'   (Downing and Mtenje 2011: p.1968)

(2) Ti-ná-pírikitsa m-b⟨áa⟩lá [ku-chókéra mu-m-s⟨ii⟩ka   ] [
     we-TAM-chase CL9-thief INF-leave   LOC-CL3-market

     ku-ítá   ku-tchál⟨íi⟩tchi]
     INF-arrive LOC-church

     'We chased the thief from the market to the church'   (Downing and Mtenje 2011: p.1972)

The intuition, based on this type of data, is that the syntax plays a role in determining the domains for vowel lengthening, since adverbials are parsed separately from the main clause. However, the 'basic' delimitors, *v*, C, and D are not visible in the phonology. Thus, there is in fact a syntactic-phonology mismatch when looking at (1). The bracketed structure for (1) is given below, where there are two DPS, a vP and a CP. If syntax is what matters for the application of PVL, one should expect it on all three of the elements, contrary to fact. Only the last DP, lion, has a lengthened vowel.

(3) [$_{CP}$ [$_{DP}$ físi   ] [$_{vP}$ a-na-dyá   [$_{DP}$ ḿ-k⟨áa⟩ngo]]]
              hyena   1.SUBJ-TAM-eat   CL3-lion

Although the process of PVL is sensitive to syntax, there is no perfect inheritance from syntax to phonology, since there is one instance of PVL but four syntactic domains. Because of these mismatches, researchers concluded that syntax is not directly mapped onto phonology.

Before coming to this conclusion, however, several issues need to be considered. Specifically, independent operations that can mask domains (Pak 2008, Harðarson 2022) in the syntax. One example of such an operation is movement inside DPs. That is, in Chicheŵa the word order in the DP is generally noun initial with modifiers to the right of the head noun (Mchombo 2004). To account for this word order pattern, N-to-D movement has been proposed (Downing and Mtenje 2011, Dehé and Samek-Lodovici 2009).

Coupled with a theory of spell-out where it has been argued that the only the complement of the phase head gets sent to the interfaces (Chomsky 2008), Harðarson (2022) accounts for the fact that there is no penultimate vowel lengthening in (1) for the DPs. If there is movement of the noun, it moves to the edge of the DP and therefore is not part of the spell-out cycle of the DP. On the next cycle, the DP is part of the domain together with the verb, and therefore there is only a single instance of PVL.

It is therefore crucial to consider independent operations that can mask syntactic domains, before considering whether or not the phonology is sensitive to the syntax directly, or an intermediate step is needed. Of course, one should not account for the data above by assuming N-to-D movement without actual evidence for this movement operation.

2.2. Starting from the Bottom

The other group of approaches takes under-application of phonological processes as a starting point. (Marvin 2003, Newell 2008, Newell and Piggott 2014, D'Alessandro and Scheer 2015, Creemers et al. 2018, Sande et al. 2020: a.o.). The guiding idea behind these approaches is that it is not desirable to have different operations that divides up pieces of grammar in different modules. Since there is some understanding of what this device is in the syntax, i.e., currently phases, it means that phases play a role everywhere in grammar, also in case of phonological mismatches.

An example of such a phonological mismatch is given for stress in Turkish. Turkish is considered an agglutinating language, and verbs generally expresses tense, mood and aspect morphology as suffixes. Moreover, stress assignment is generally an indicator of wordhood, and falls at the edge of a 'word' (Kornfilt 1997). Thus, stress can fall on any verbal morpheme, (4), even when there is an additional suffix before it, such as the causative, (5).

(4) a. kal-'**du**   b. koş-'**tur**   c. kal-'**ıyor**
        stay-PST   run-CAUS   stay-PROG
        'stayed'   'make run'   's/he is staying'

(5) a. bit-**ir**-'**iyor**   b. koş-**tur**-'**du**
        finish-CAUS-PROG   run-CAUS-PST
        's/he is finishing'   '*x* made *y* run'

However, not every combination leads to stress on the final morpheme. Stress does not fall on the past when there is an aspectual morpheme, (6).

(6) a. gid-'**ıyor-du**
         stay-PROG-PST
         'was staying'

     b. gid-'**ecek**-i-**di**-m
         stay-FUT-COP-PST-1SG
         'I will have gone '

Even though the past is the second morpheme from the stem in both (5b) and (6), the morpheme that the past attaches to matters. Specifically it means that (6) constitutes a mismatch, in that it seems that the past is suffixed to the verb stem, but stress seems to fall in the middle of the verb word.[1] Newell (2008) analyzes this mismatch as follows. She argues that the phonology is interpreted from the syntax, and that phases play a role in delimiting when stress is assigned. Her analysis is presented in (7): she assumes that the copula is the phase head v, and that the aspectual morpheme is below this phase head. The tense morpheme is above the phase head.

(7) $[[[[\text{gid-} \sqrt{\ }] \boxed{\text{'ecek}}_{asp}] \text{-i} \boxed{v}] \text{-di-m} \quad _T]$
     go   FUT   COP   PST-1.SG

She argues thus that, in line with Chomsky (2001) that v is a phase head, and this head triggers spell-out of its complement, i.e., the heads below it which include the verb stem and the aspectual marker. Stress is assigned at this point as well. This analysis is different from several phonological analyses that treat markers such as the aspectual marker as special, in that they have a diacritic marking them for stress, and has the advantage that the stress assignment aligns with what is considered to be a phase in many syntactic works, namely v.

However, there is no independent research showing that the syntactic structure that is proposed based on the phonological phenomena is in fact the correct structure. For example, it is generally not common that viewpoint aspect is below the domain defining head v. Second, one counterargument that is being made against criticism of these type of approaches is that syntactic correlates of phase heads like v, n, a are not available, as they occur inside of

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[1] One indication that the past is part of the same phonological word is based on vowel harmony: when there is a single vowel harmony domain, there is a single phonological word.

words, and as such they should have a different status than syntactic phase heads. Even though this might be true for cases where for example stress-shifting and stress-neutral affixes have been reanalyzed from level-1/level-2 affixes to below or above the phase head (Marvin 2003, Lowenstamm 2015, Creemers et al. 2018), this argument does not go through for a case like Turkish, since this is directly reflecting the syntactic clausal structure.[2]

Moreover, even though in the analysis by Newell it is assumed that syntactic and phonological phases align, similar types of research of other phonology-morphology mismatches have been arguing that other heads can be a phase head, since syntactic analyses haven't settled on which heads are phases (Sande et al. 2020). This could be true, but in order to investigate this, independent syntactic evidence is needed.

To summarize, although it is possible to analyze most phonological mismatches as coming from the syntax, the syntactic analyses proposed for these mismatches seem to not be independently corroborated, and lack advantages over the existing morpho-phonological analyses.

3. What to Do Next

The above sections very briefly illustrated the two lines of research, and what steps have been made to investigate domains. However, it also showed that there is a gap in what should be researched in order to look at mismatches more carefully. The next steps are laid out in this section.

First of all, independent operations that can mask domains are not taken into account. For example, in the syntactic and morphological literature on boundaries the following have played a role for variable domains: variation in (syntactic) movement is said to have played a role in domains extending (den Dikken 2007, Gallego and Uriagereka 2007), the question if domains are cross-linguistically the same (Bošković 2014), and if all (morpho-)phonological properties are sensitive to syntax or not. This means that, depending on the phenomenon and the language in question, the question of whether the interfaces require an different mapping procedure might look different. That is, it is important to compare minimal pairs by taking into account these different

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[2]Fenger (2020) has a similar analysis to that of Newell, but argues that the phase head can be aspect above *v*, following Harwood (2014).

variables, which might lead to syntax-phonology or syntax-morphology mismatches.

The second property that should be considered is what diagnostics are used to count as a domain, and whether this can vary with the independent operations cross-linguistically. For example, Harwood (2014) shows that it is important to look if different tests cluster together, and that a richer aspectual structure shows in more detail where boundaries in English are.

Relatedly, and most importantly, in order to determine whether or not syntactic domains play a role in the phonology, it is important to do in-depth research in a single language for a single phenomenon across all modules. Generally, when the interfaces are investigated, only a single module (or two) are researched, leaving open whether or not the other modules align or not.

In the remainer of this paper I show preliminary results for two case studies that differ minimally. Namely, I consider verbal morphology in Japanese and Sinhala. These languages are both head final, agglutinating languages, and therefore have a rich testing ground for domains in the verbal domain. They overlap to a large extent, but a single syntactic operation (syntactic head movement to T) in one language, but not in the other, leads to different results in the domains and the mismatches.

3.1. Japanese

Japanese has been discussed extensively in the syntactic literature, and several works have argued for a *vP* phase. Interestingly, this boundary is also visible by looking at word-internal pitch accent (Fenger 2020). Syntactically, Tense in Japanese seems to be excluded from various syntactic processes. For example, fronting of the verb (+object), as a form of VP fronting, excludes Tense; and Tense cannot be elided (Funakoshi 2020).

(8) a. [$_{TP}$ aogaeru-o **tabe-ta**-sae] Kaonashi-ga t_{TP}
         Aogaeru-ACC eat-PST-even No.Face-NOM

         'No Face even ate Aogaeru'

     b. [$_{VP}$ aogaeru-o **tabe**-sae] Kaonashi-ga t_{VP} si-**ta**
         Aogaeru-ACC eat-even No.Face-NOM   do-PST

         'No Face even ate Aogaeru'   based on Funakoshi (2020)

Crucially, Aspect has generally been excluded from these debates, but

interestingly it patterns with the root for VP fronting and ellipsis (to the exclusion of Tense) (Fenger 2020).

(9) ?[$_{\text{ASPP}}$ aogaeru-o   **tabe-te**-sae   ] Kaonashi-ga   t$_{\text{ASPP}}$ i-**ta**
       Aogaeru-ACC eat-ASP-even   No.Face-NOM   be-PST
       'No Face was even eating Aogaeru'   (Fenger 2020)

Interestingly, (Harwood 2014) argues that there is a split between (progressive) aspect and tense for English. This thus means that Japanese behaves syntactically similar to English with regard to domains.

Turning to morphology and phonology, a similar split between the root, voice, aspect on the one hand, and tense is visible in auxiliary patterns and pitch accent (Fenger 2020). That is, T and Asp can never occur on the same verb, and an auxiliary is needed to host the tense morpheme. Wordhood tests, including conjunction, and putting material 'inside' words, reveal the same pattern. The difference between a causative form, and a form with aspect shows this difference: The tense morpheme is included in the pitch pattern in (10), but is excluded when the progressive is present. The (a.) examples provide the phonological breakdown, (b.) the morphological breakdown.

(10)   a. (L H H H H L) (11)   a. ((L H H L) L)
           he. da. ta. ra. se. ru   he. da. ta. te.   ru

       b. [hedatar   -sase -ru   ]   b. [hedatar   te   ] -ru
           be.distant -CAUS -PRES   be.distant -PROG   -PRES

   'To make it distant'   'It is being distant '

The exception to this pattern is (10): in these cases the root and the tense morpheme can form a single morphological and phonological unit. However, as shown above, syntactically Tense and the root are not part of the same domain. Put differently, there is in this case a mismatch between syntax and the morphology: the syntax shows two domains but the morphology only a single domain. However, in most other cases the syntax and the morphology align. there are always two domains in the syntax, which can include aspectual information, but never tense. There is a mismatch in the verbal domain when looking at verbal tenses, i.e. when the aspectual morpheme is missing. Thus, there is a morpho-syntax mismatch in very restricted environments and the morphological cycle can sometimes be bigger than the syntactic cycle. This

can be represented as follows (12-13), where there are always two domains in the syntax (a.), and it can include aspect. However, when the heads are being mapped to phonological domains, there is a procedure in place that can delete the boundary in case there is no overt aspectual material present (see Fenger (2020) for details, following Embick (2010)).

(12) Multiple domains in syntax, single domain in morphology
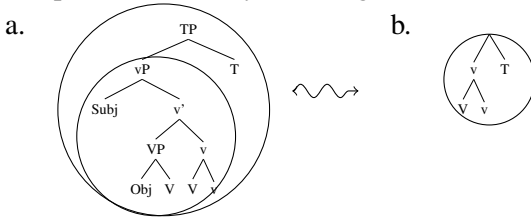
(13) Multiple domains in syntax, mulitple in morphology
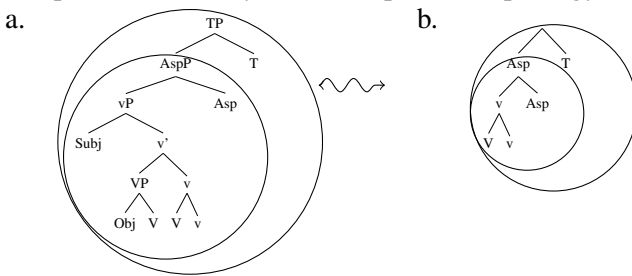
Thus, there is a mismatch in the morphology only, in a very restricted environment. This would not have been clear when only looking at a single TMA morpheme, i.e., simple tenses in the syntax, morphology, and phonology. Nor would it have been clear when only looking at only one module.

3.2. Sinhala

Sinhala (Indo-Aryan) is minimally different from Japanese in that it syntactically shows differences between simple tenses and complex tenses.[3] That is, even though on the surface both Japanese and Sinhala form a simple tense form (without aspect) synthetically, in Sinhala, unlike Japanese, these forms are a single unit in the syntax as well. Crucially, there is evidence that syntactically V+T also form a single domain in the language.

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[3]I report here a small part of a larger project (Fenger and Weisser 2022, 2023).

Morpho-phonologically there is a distinction between umlaut triggers in the verbal domain. Sinhala has a rich inventory of verbal affixes, and among them are those that trigger fronting of the vowel on the stem. For example, affixes such as the causative (/wa/), the non-past (/nə/), or the indicative (/waa/) do not trigger fronting of the vowel, (14). However, the past (GEM/u) or the perfect (/laa/) do trigger fronting of the stem, (15-16).[4]

(14)   adə-wə-nə-wa   (15)   æd-d-a   (16)   ædə-la
       pull-CAUS-NP-IND   pull-PST-IND   pull-PERF
       'causes to pull'   'pulled' (Past)   'pulled' (Perf)

Other umlaut triggers are the passive, the progressive, and the informal imperative. Among the umlaut-triggering morphemes there is a split. Even though they can all trigger fronting of the vowel when the trigger is adjacent to the target, they differ when morphemes intervene. Certain triggers, such as the past and the passive, can trigger vowel fronting across the causative, whereas triggers such as the perfect, the progressive, and the informal imperative can not. This is shown for the past in (17), and the perfect in (18).

(17)   æd-də-u-wa   (18)   adə-wə-la
       pull-CAUS-PST-IND   pull-CAUS-PERF
       'made X pull'   'have made X pull'

The behaviour of these different morphemes could be analyzed by assuming different domains for the different triggers. Since the past and the passive always trigger fronting, they seem to end up in the same morpho-phonological domain as the verb stem. Other morphemes, such as the perfect, seem to be variable: they are generally outside of the domain of the stem, but when adjacent they 'count' as if they are in the same domain. The question is whether these domains are only word-internal, or if they come from the syntax.

It turns out that the same split, for the same group of morphemes, can be observed for the choice of clausal negation. To see this, first consider the following sentence with an embedded and matrix clause that both are negated:

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[4]There are various phonological processes that mask the underlying form. Short vowels, such as in the causative, are often reduced to schwa, and long vowels, such as in the indicative, are shortened. For clarity only the surface forms of the morphemes are given in the examples.

(19) [oyaa bat **no**-ka-nə-wa nisaa], oyaa-ʈə sindu-ak ki-u-e
  2SG rice NEG-eat-NP-IND because 2SG-DAT song-DET say-PST-F
  nææ.
  NEG

 'Because you don't eat rice, I didn't sing you a song.' (Slomanson 2008)

The embedded sentence has a prefixal negation /no-/; the matrix clause has a negation particle /nææ/. This thus means that there is a split for the choice of negation depending on being in an lower or higher domain. Crucially the simple tense form in the matrix clause cannot be negated with the prefix, (20a). However, the perfect can be, (20b).

(20) a. *Mamə **no**-giy-a.   b. Mamə **no**-anɖə-la
   1SG NEG-go.PST-IND   1SG NEG-cry-PERF
   'I didn't go'   'I haven't cried'

Other morphemes that can take the prefix-negation in a matrix clause are the progressive and the informal imperative. This means that those morphemes that can only trigger umlaut when adjacent to the verb stem, correlate with taking clausal negation for embedded domains. The other umlaut triggers, which are always part of the same domain as the verb stem, are those that cannot take prefixal negation. This means that for the same group of morphemes both the syntax and the morpho-phonology make reference to the same domains.

One way to analyze this, is to say that for simple tenses there is movement of the verb to T. Since it moves to this position, it also carries along the phase head, and as such it extends the domain of the internal phase (den Dikken 2007: a.o.). Since there is only a single domain in this case, the only negation available is the matrix negation. Under the assumption that single morpho-syntactic domains are mapped onto single morpho-phonological domains, the umlaut trigger that is the passive or the past will always be in the same domain as the verb stem. This correspondence between domains is shown in (21).

(21)   Single domains
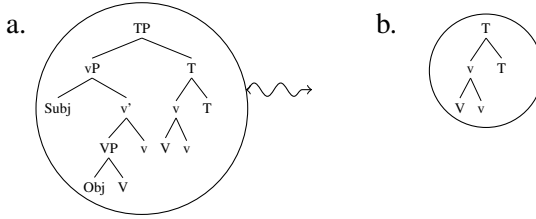
This is then different from simple tenses in Japanese, where there is no extension in the syntax. The overt aspectual cases are the same in both languages. In this case there is no head movement to a higher position above the phase, and thus there is no domain extension of the vP phase. This means that syntactically there are two clause-internal domains, and the negation can be expressed with /no-/. The Perfect also remains outside of this first domain, under the assumption that material is interpreted at the interfaces cyclically.[5]

This means that in Sinhala there is more often than in Japanese a direct correspondence between the syntax and the morpho-phonology. The difference between the two languages stems from an independent syntactic mechanism that is present in one but not the other language.

3.3. Implications

Both Japanese and Sinhala have simple tense forms in the morphology, which are derived differently. Since syntactic domains can vary, possibly through the presence or absence of verb movement, differences in the morphology and phonology are expected. Thus, these two languages differ across one syntactic operation, leading to differences in the other modules as well. Moreover, both languages have the same type of syntax-morphology mismatch, for different features (simple tenses or the perfect). These mismatches are restricted, and can be derived through morphological extension.

Crucially, only looking at one form might give the impression that there is just random variation between the two languages, but turns out to be systematic when considering all modules, and independent points of language variation.

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[5]For space reasons the pattern where the perfect can trigger umlaut is not discussed, but see Fenger and Weisser (2022). In essence this requires the same type of analysis as the simple tenses in Japanese.

4. Conclusion

This paper is a brief investigation into determining what is necessary to investigate whether domains between modules come from the same source or not. Before coming to the conclusion that there is no direct mapping between the modules, it is necessary to investigate various independent processes in the languages that can mask the output of one or the other module, such as head movement in the syntax. Crucially, in order to investigate domains, it is important to take a cross-modular and cross-linguistic approach.

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