

A Defense of Bare Mapping from Syntax to Phonology

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1. Introduction

Hosseini (2014) outlines the idea of Bare Mapping proposed in Tokizaki (1999, 2008, 2012) and points out some problems with respect to the phrasing data in Selkirk (2000). Although his comments should be well taken seriously, I believe that those problems can be solved with no extra cost in the theory of syntax-phonology interface.

In this paper, I argue that his arguments against my analysis can be refuted by considering suitable syntactic analysis of the sentence. In section 2, I outline the basic idea of Bare Mapping proposed in Tokizaki (1999, 2008, 2012). In section 3, I show Hosseini's (2014) arguments against Bare Mapping. In section 4, I argue that Bare Mapping is a valid generalization of the syntax-phonology interface in spite of the seemingly problematic cases pointed by Hosseini (2014). Section 5 points out the differences between Bare Mapping and some OT based analyses such as Selkirk (2000) and concludes the discussion.*

2. Bare Mapping from syntax to phonology

I have proposed a mapping of phonological structure from syntactic phrase structure, which is stated as (1) (Tokizaki 1999, 2008: 19, 2012).

(1) Interpret boundaries of syntactic constituents [...] as prosodic boundaries / ... /.

For example, this rule maps the bare phrase structure in (2a) to a phonological representation in (2b) (cf. Chomsky 1995 for bare phrase structure).

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- (2) a. [[John] [[loves] [Mary]]]
b. // John /// loves // Mary ///

Prosodic boundaries in the phonological representation in (2b) can be deleted by Boundary Deletion (3).¹

- (3) Delete n boundaries between words. (n : a natural number)

Bare Mapping and Boundary Deletion (3) correctly predict possible phrasing patterns (4a), (4b) and (4c) for the example sentence in (2a).

- (4) a. / John // loves / Mary // ($n=1$) → (John) (loves) (Mary)
b. John / loves Mary / ($n=2$) → (John) (loves Mary)
c. John loves Mary ($n=3$) → (John loves Mary)
d. * John loves / Mary // → *(John loves) (Mary)
 $n=3$ $n=1$

The phrasing in (4d) is impossible or implausible because the number of boundaries to be deleted is not consistent in the sentence: three boundaries must be deleted between the subject and the verb while only one boundary can be deleted between the verb and the object. Tokizaki (2008: 81) formalizes the idea of consistency in the number of boundaries to be deleted as in (5), which I will call Consistent Boundary Deletion.

¹ This is the original formulation of Boundary Deletion (3) in Tokizaki (1999, 2008, 2012), which uses a number n . One might argue against a grammatical rule counting numbers. Then, we could reformulate Boundary Deletion as in (i).

- (i) Delete a boundary between words.

Boundary Deletion (i) applies iteratively. Then, the times it applies decide the level of prosodic phrases as I will argue in section 4.

- (5) In a sentence (or paragraph), the number of boundaries to be deleted (*n*) should be as consistent as possible.

Then, the phrasing in (4d) violates Consistent Boundary Deletion (5) while the phrasings in (4a), (4b) and (4c) observe it. Thus, Consistent Boundary Deletion (5) correctly predicts the acceptability of the phrasing patterns in (4a) to (4d).

3. Arguments against Bare Mapping

Hosseini (2014) shows the phrasing data in (6) cited from Selkirk (2000).²

- (6) a. (_{MaP} she lóaned her rólleblades to Róbin)
 b. (_{MaP} she lóaned her rólleblades) (_{MaP} to Róbin)
 c. * (_{MaP} she lóaned) (_{MaP} her rólleblades to Róbin)
 d. * (_{MaP} she lóaned) (_{MaP} her rólleblades) (_{MaP} to Róbin)

Hosseini argues that Bare Mapping cannot predict the phrasing patterns in (6). He assumes the phrase structure shown in (7) as argued in Selkirk (2000: 242).³

- (7) [_{VP} she [lóaned] [_{NP} her rólleblades] [_{PP} to Róbin]]

Then, Bare Mapping (1) maps the phrase structure (7) to the phonological representation in (8).

² Selkirk (2000) shows other example sentences than (6), which have the same phrasing patterns and acceptability as (6a) to (6d).

- (i) a. She pushed Sám's bóat into the wáter.
 b. She gáve Zóe a báckrub.
 c. She sént her sincere regréts to Luís.

³ The phrase structure in (7) does not represent boundaries at the edges of a word as (2) does. This does not affect the discussion. I will show all the boundaries in the sentence in (32) below.

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(8) / she // lóaned // her rólleblades // to Róbin ///

Hosseini shows the case when Boundary Deletion (3) applies to (8) with $n=1$ to give the phrasing pattern in (9).

(9) she / lóaned / her rólleblades / to Róbin // ($n=1$)

The representation in (9) is similar only to the phrasing in (6d), which is not acceptable. Hosseini argues that “Bare Mapping is simply unable to exclusively derive the actually existing forms in [6a] and [6b].” In the next section, I will argue that in fact Bare Mapping, Boundary Deletion and Constant Boundary Deletion can exclusively derive the possible phrasings.

Hosseini (2014) also argues that Bare Mapping does not take into account the size of prosodic phrases. Hosseini shows Selkirk’s (2000) prosodic markedness constraint `BINARYMAP` defined as (10).

(10) `BINARYMAP (BINMAP)`: A Major Phrase consists of just two Minor Phrases.

This constraint rules out the phrasing in (6d) where each Major Phrase (MaP) consists of one Minor Phrase (MiP), as shown in (11).⁴

(11) * (_{MaP} (_{MiP} she lóaned)) (_{MaP} (_{MiP} her rólleblades)) (_{MaP} (_{MiP} to Róbin))

In other words, Major Phrases in (6d) are too short. Hosseini argues that an OT-based approach by Selkirk (2000) can explain the possible size of prosodic phrases while Bare Mapping cannot.

⁴ The terms Major Phrase and Minor Phrase are almost equal to Intonational Phrase and Phonological Phrase. I will use these terms interchangeably.

However, Hosseini (2014) overlooks some points in the theory of Bare Mapping. In the next section, I reconsider the example (6) and argue that Bare Mapping can explain the phrasing patterns with no extra cost.

4. Arguments for Bare Mapping

4.1 Variability of Boundary Deletion

First, let us consider the phrasing in (6a) where the entire sentence is contained in a Major Phrase. Here, I need to emphasize that Bare Mapping has some flexibility in phrasing with the variable n in the deletion rule (3). As we have just seen, the phrase structure Selkirk (2000) and Hosseini (2014) assume (12a) (=7) is mapped to the representation in (12b) (=8) by Bare Mapping (1).

- (12) a. [_{VP} she [lóaned] [_{NP} her rólleblades] [_{PP} to Róbin]]
 b. / she // lóaned // her rólleblades // to Róbin ///

Hosseini shows only the case when Boundary Deletion (3) applies to (12b) with $n=1$. However, the number n in Boundary Deletion (3) is variable. If we set n as 2 instead of 1 in (3), we get the phrasing in (6a) where the entire sentence is in a Major Phrase, as shown in (13).

- (13) she lóaned her rólleblades to Róbin / ($n=2$)

One of the advantages of Bare Mapping is this flexibility in mapping, which may correspond to speech rate (cf. Tokizaki 2008: Ch. 4). Also, it should be noted that Boundary Deletion (3) itself does not mention the constant number of boundaries to be deleted in positions in a sentence. Constant Boundary Deletion (5) rules out a phrasing where numbers of deleted boundaries are inconsistent.

4.2 Reconsidering syntactic structure

Second, we can also get the phrasing in (6b) if we reconsider the syntax of the sentence, which has a direct object and a Goal PP. Hosseini (2014) assumes the syntactic structure (12a) following Selkirk (2000). Here, Selkirk and Hosseini seem to assume that VP immediately dominates V, NP and VP.⁵ However, such tertiary branching is not admitted in the current syntactic theory, which claims that a syntactic operation Merge combines two syntactic objects, not three. According to Larson (1988), who assumes binary branching structure, VPs consisting a verb and two arguments such as Theme and Goal have a base structure as in (14).

(14) [she [_{VP} [her rólleblades] [_V *lóaned* [_{PP} to Róbin]]]]

Then the verb raises up to a higher V position than the direct object to derive the surface order V-DP-PP in (15), where the original copy of the verb and its projection *v'* are italicized.

(15) [she [_{VP} *lóaned* [_{VP} [her rólleblades] [_{V'} *lóaned* [to Róbin]]]]]]

This structure is mapped onto (16) by Bare Mapping (1) with the convention that empty categories are invisible to phonological rules including Bare Mapping (for the phonological invisibility of empty categories and their projections, see Tokizaki 2008: 22).

(16) / she / *lóaned* // her rólleblades // to Róbin ////

Boundary Deletion applies to this representation with $n=1$ and $n=2$ to give the phrasings in (17a) and (17b).

⁵ The status of the subject *she* is not clear here. Selkirk might assume that pronouns cliticize to the following verb or auxiliary (cf. Selkirk 1984 for function words).

- (17) a. she *lóaned* / her *róllerblades* / to *Róbin* /// ($n=1$)
 b. she *lóaned* her *róllerblades* to *Róbin* ($n=2$)

Although (17b) corresponds to the phrasing in (6a) above, (17a) corresponds to an unacceptable phrasing in (6d).

This problem can be solved by reconsidering the syntax of the sentence. I propose a base structure (18), which is alternative to (14), for sentences with a direct object and a Goal prepositional phrase.

- (18) [she [_{VP} [to *Róbin*] [_{V'} *lóaned* [her *róllerblades*]]]]

Here, verb and its object DP merge to make V', which in turn merges with the Goal PP *to Robin* to make VP. I assume that V' *lóaned her róllerblades* is then reanalyzed into V as in (19a), as Larson (1988) argues for the Heavy NP Shift construction. Then, the reanalyzed V moves to a higher verb position to derive the surface order in (19b).

- (19) a. [she [_{VP} [to *Róbin*] [_V *lóaned* [her *róllerblades*]]]]
 b. [she [_{VP} [_V *lóaned* [her *róllerblades*]]] [_{VP} [to *Róbin*] [_{V'} *lóaned* [her *róllerblades*]]]]

The base structure in (18) and V' reanalysis in (19a) can be supported by the fact that object of verb can be omitted when its meaning can be inferred from the meaning of the verb, as shown in (20).

- (20) a. she loaned (money) to Robin
 b. I wrote (a letter) to Anna
 c. he contributed (an article) to a newspaper

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In the examples in (20), the meaning of the object can be inferred from the verb. In other words, the verb and its object are tightly connected to each other to form a unit. Thus, it is plausible to assume that they make a constituent V' at the base as in (18), which is reanalyzed as V in the derivation, as shown in (19a).

If we assume the structure in (18) and the derivation in (19), Bare Mapping (1) applies to (19b) to give the phonological representation in (21).

(21) she // lóaned / her róllerblades /// to Róbin ///

If we apply Boundary Deletion (3) to (21) with $n=2$, we get (22).⁶

(22) she lóaned her róllerblades / to Róbin /

This is the phrasing in (6b). If we apply Boundary Deletion (3) to (21) with $n=3$, we get (23), which corresponds to the phrasing in (6a).

(23) she lóaned her róllerblades to Róbin

Thus, we can correctly predict the possible phrasing in (6a) and (6b) with Bare Mapping and Boundary Deletion.

Also, we can correctly exclude implausible phrasing patterns in (6c) and (6d), repeated here as (24a) and (24b).

⁶ If we apply Boundary Deletion (3) to (21) with $n=1$, we get a slightly different result from (22), as shown in (i).

(i) she / lóaned her róllerblades // to Róbin //

Here, the pronominal subject *she* is separated from the verb phrase, which is unlikely to occur in a natural context. We need to assume that pronouns do not always have a right boundary because of its clitic-like status. See the discussion in Tokizaki (2008: 50).

- (24) a. * $(_{\text{MaP}} \text{ she } \text{lóaned})$ $(_{\text{MaP}} \text{ her } \text{róllerblades } \text{to } \text{Róbin})$
 b. * $(_{\text{MaP}} \text{ she } \text{lóaned})$ $(_{\text{MaP}} \text{ her } \text{róllerblades})$ $(_{\text{MaP}} \text{ to } \text{Róbin})$

In order to derive (24a), Boundary Deletion (3) needs to delete inconsistent number of boundaries between words in the sentence, as shown in (25b)

- (25) a. she // **lóaned** / her **róllerblades** /// to **Róbin** /// (=21)
 b. she **lóaned** / her **róllerblades** to **Róbin** /
 $n=2$ $n=0$ $n=3$ $n=2$

Then, the phrasing in (24a) is correctly blocked by Consistent Boundary Deletion (5). Similarly, the phrasing in (24b) is derivable only if we make Boundary Deletion inconsistent in the sentence as shown in (26b).

- (26) a. she // **lóaned** / her **róllerblades** /// to **Róbin** /// (=21)
 b. she **lóaned** / her **róllerblades** // to **Róbin** //
 $n=2$ $n=0$ $n=1$ $n=1$

Note that the difference in the value of n in (26) ($n=0$ to $n=2$) is not so large as that in (25) ($n=0$ to $n=3$). In fact, Selkirk (2000) points out that phrasing in (24b) is possible if focus is on the verb, which is shown in bold in (27).

- (27) $(_{\text{MaP}} \text{ she } \text{lóaned})$ $(_{\text{MaP}} \text{ her } \text{róllerblades})$ $(_{\text{MaP}} \text{ to } \text{Róbin})$

I have argued in Tokizaki (1999, 2008: Ch. 7) that focus either enhances the strength of boundaries of the focused constituent or weakens the strength of boundaries of the other (non-focused or presupposed) constituents. Here I consider the latter option, deletion of boundaries in the non-focused positions. If we assume two boundaries are

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deleted at the other positions than the post-focus position, i.e. after the verb, the basic representation (28a) changes into the representation shown in (28b).

- (28) a. she // lóaned / her rólleerblades /// to Róbin /// (=21))
b. she **lóaned** / her rólleerblades / to Róbin /
 $n=2$ $n=0$ $n=2$ $n=2$

Thus, we can get the phrasing in (24b) and (27) in the case of verb focus.

4.3 Deriving prosodic categories and size constraint

Third, the theory of Bare Mapping does not specify any types of prosodic categories such as Major Phrase and Minor Phrase, whose nature is not totally clear. Boundary Deletion (3) simply makes some prosodic phrasings; the units not separated by boundaries correspond to some prosodic categories that have some phonological phenomena such as rhythm, intonation, liaison, tone sandhi and phonological changes. Tokizaki (2008: 61) argues that the number of boundaries to be deleted corresponds to the levels of prosodic hierarchy. Consider an example sentence and its prosodic categories taken from Selkirk (1984: 26).

- (29) a. (In Pakistan Tuesday is a holiday) Utterance (U)
b. (In Pakistan) (Tuesday is a holiday) Intonational Phrase (IntP)
c. (In Pakistan) (Tuesday) (is a holiday) Phonological Phrase (PhP)
d. (In) (Pakistan) (Tuesday) (is) (a) (holiday) Prosodic Word (PW)

All of these prosodic categories can be derived with Bare Mapping (1) and Boundary Deletion (3). The phrase structure (30a) is mapped to a phonological representation

(30b) by Bare Mapping.⁷

- (30) a. [[In] [Pakistan]] [[Tuesday] [[is] [[a] [holiday]]]]
 b. // In // Pakistan //// Tuesday /// is /// a // holiday ////

Boundary Deletion applies to (30b) with $n=1$ to 4 to give the phrasings in (31a) to (31d).

- (31) a. In Pakistan Tuesday is a holiday (n=4) U
 b. In Pakistan / Tuesday is a holiday / (n=3) IntP
 c. In Pakistan // Tuesday / is / a holiday // (n=2) PhP
 d. / In / Pakistan /// Tuesday // is // a / holiday /// (n=1) PW

The representations in (31a) to (31d) correspond to the prosodic phrasings in (29a) to (29d), respectively.⁸ Thus, we can take into account the size of prosodic categories by changing the value n in Boundary Deletion (3). Similarly, the example sentence (19b) in fact has the structure in (32) if we represent the brackets at the edges of a word in the same way as (30a).

- (32) [[she] [_{VP} [_V [lóaned] [[her] [róllerblades]]]] [_{VP} [[to] [Róbin]] [_V [lóaned] [[her] [róllerblades]]]]]]]]

Bare Mapping applies to (32) to give (33).

⁷ In (30), I show all the syntactic constituents including words in order to derive the level of Prosodic Word in (31d).

⁸ We need to erase the boundary between *is* and *a* in (31c) to get the exact match with the phonological phrases in (31c). We can ascribe the deletion to the fact that the boundaries of function words such as *is* and *a* are weaker than content words. See the discussion in Tokizaki (2008: 61).

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(33) // she /// lóaned /// her // rólleblades //// to // Róbin ///

If we apply Boundary Deletion (3) with $n=1$ to 5, we get the representations in (34).

- | | | | |
|---------|---|-----------|------|
| (34) a. | she lóaned her rólleblades to Róbin | ($n=5$) | U |
| b. | she lóaned her rólleblades / to Róbin | ($n=4$) | IntP |
| c. | she / lóaned her rólleblades // to Róbin / | ($n=3$) | IntP |
| d. | she // lóaned / her rólleblades /// to Róbin // | ($n=2$) | PhP |
| e. | / she /// lóaned // her / rólleblades //// to / Róbin /// | ($n=1$) | PW |

Thus, each case corresponds to a prosodic category: Utterance, Intonational Phrase, Phonological Phrase and Prosodic Word.⁹ From the two sentences (31) and (34), we can generalize that deleting one boundary between words gives the level of Prosodic Word while deleting two boundaries gives the level of Phonological Phrase. Deleting three or more boundaries makes the level of Intonational Phrase and Utterance. This is a reasonable generalization because two words in the sister relation (e.g. *to* and *Robin*) are separated by two boundaries, which are deleted to make a Phonological Phrase. In order to make Intonational Phrases, one more boundary must be deleted. Thus, the theory of Bare Mapping naturally derives the prosodic hierarchy and the size constraint such as BINARYMAP in the Optimality Theory, contrary to the argument by Hosseini (2014).

5. Conclusion

So far, I have argued that the theory of Bare Mapping proposed in Tokizaki (1999, 2008, 2012) can explain the phrasing facts that Hosseini (2014) presented as the counterexamples. The phrasing in which the whole sentence is contained in a

⁹ I assume that in (34c) the boundary between *she* and *loaned* can be deleted in a similar way to (31c). See also note 6.

prosodic phrase can be derived if we set the number of boundaries to be deleted as large enough. The phrasing in which the Goal PP makes its own prosodic phrase can also be derived if we reconsider the syntactic structure of a sentence properly: the verb and its direct object are sisters of V', which is reanalyzed as V and is moved to a higher V position. Finally, I argued that the theory of Bare Mapping can deal with the size of prosodic categories in terms of the variable number of boundaries to be deleted.

Thus, the theory of Bare Mapping can explain the alleged counterexamples straightforwardly. The next thing to consider is whether Bare Mapping is superior to OT-based analysis or not. Conceptually, the theory of Bare Mapping consists of a small number of rules such as Bare Mapping (1), Boundary Deletion (3) and Consistent Boundary Deletion (5), which can derive all the levels of prosodic categories. OT-based analyses seem to have a large number of constraints just for intonational phrases or Major Phrases. For empirical differences between Bare Mapping and OT-based analyses, we need more careful studies. I will leave this task for future research.

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