Sympathy and Positional Faithfulness*

Jongho Jun
(Yeungnam University)

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It has been observed in the literature that certain positions and segment types—which may be considered perceptually prominent—are more resistant to phonological changes, compared to less prominent counterparts. For instance, prevocalic consonants are rarely targeted in place assimilation, compared to preconsonantal ones. For a formal analysis of such asymmetries within the framework of Optimality Theory, Positional Faithfulness has been invoked as a main mechanism. In the present study, based on the discussion of consonant deletion typology, I will first show that the perceptibility differences motivating the projection of Positional Faithfulness constraints cannot be captured in the standard Positional Faithfulness approach, regardless of whether the constraints refer to the output or input. I will then propose an alternative approach based on the one adopting the formal mechanism of Sympathy Theory (McCarthy 1998, 1999).

Key words: positional faithfulness, sympathy, optimality theory, place assimilation, consonant deletion

0. Introduction

It has been observed in the literature that certain positions and segment types—which may be considered perceptually prominent—are more resistant to phonological changes, compared to less prominent counterparts. For instance, prevocalic consonants are rarely targeted in place assimilation, compared to preconsonantal ones. For a formal analysis of such asymmetries within the framework of Optimality Theory (Prince and Smolensky 1993; McCarthy and Prince 1993, 1995), Positional Faithfulness (most notably, Beckman 1998) has been invoked as a main mechanism. Various processes including place assimilation, deletion, and voicing assimilation have been

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analyzed under Positional Faithfulness.[1]

In the present study, based on the discussion of consonant deletion typology, I will first show that the perceptibility differences motivating the projection of Positional Faithfulness constraints cannot be captured in the standard Positional Faithfulness approach, regardless of whether the constraints refer to the output or input. I will then propose an alternative approach based on the one adopting the formal mechanism of Sympathy Theory (McCarthy 1998, 1999). It will be shown that the Sympathy-based theory can correctly incorporate the perceptibility differences into Positional Faithfulness constraints and thus account for all the attested asymmetric patterns including complex ones. Finally, I will discuss the remaining problems with the proposed mechanism, pointing out that although the proposed Sympathy-based Positional Faithfulness approach succeeds in incorporating crucial perceptibility information into the constraints, the mechanism involved is not restrictive enough to produce only attested patterns.

1. Positional Faithfulness

The present study is mainly concerned with the following three asymmetries. In intervocalic C_1C_2 clusters, C_2 is rarely targeted in place assimilation (Webb 1982; Ohala 1990; Mohanan 1993; Steriade 1995, 2001; Jun 1995, 2004; Beckman 1998), consonant deletion (Steriade 2000; Wilson 2001; Côté 2000), and voicing assimilation (Steriade 1997, 2000; Beckman 1998; Lombardi 1996), compared to C_1. This positional asymmetry will be referred to as C_2 dominance effect throughout the paper. The remaining two asymmetries involve specific segment types, fricatives and released stops. Fricatives, especially sibilants and stridents, are rarely targeted in place assimilation (Kohler 1990, 1991; Mohanan 1993; Jun 1995, 2004) and consonant deletion (Steriade 2000; Côté 2000), compared to stops (as well as nasals and non-strident fricatives). Released stops likewise are rare targets of place assimilation, compared to unreleased stops (Kohler 1990, 1991; Lamontagne 1993; Steriade 1997). These three position/segment-specific asymmetries are chosen because they are useful in identifying the

1) Relevant references include Steriade (1995, 2000), Jun (1995, 2004), Casali (1996), Lombardi (1996, 1999), Kirchner (1998), Boersma (1998), Fleischhacker (2001, 2002) and Côté (2000).

characteristic properties, as well as unavoidable problems, of the standard Positional Faithfulness approach.

In most recent discussions of the positional/segmental asymmetries, it has been claimed or assumed that they are related to relative perceptibility of phonological elements involved: less likely target positions/segments in phonological changes are perceptually more prominent than more likely ones. Within the framework of Optimality Theory, it has been proposed that such relative perceptibility differences motivate the projection of higher-ranked Faithfulness constraints for prominent positions/segments, relative to corresponding context-free Faithfulness constraints or those for non-prominent ones.[2] Some Position/segment-specific Faithfulness (henceforth, PF) constraints proposed in the literature are shown below:

(1) PF constraints for the analysis of place assimilation
  a. C_2 dominance effect: IDENT-**onset**(place) >> IDENT(place) (Beckman 1998)
  b. Rare target of fricatives, compared to stops:
  PRESERVE(pl($\underset{[+cont]}{\underline{\quad\quad}}$C)) >> PRESERVE(pl($\underset{[stop]}{\underline{\quad\quad}}$C)) (Jun 1995, 2004)

  c. Rare target of released stops, compared to unreleased stops:
  MAX_{REL}(PLACE) >> MAX(PLACE) (Padgett 1995)[3]

(2) PF constraints for the analysis of consonant deletion
  a. C_2 dominance effect: MAX-C/__V >> MAX-C/V__ (Côté 2000)
  b. Rare target of fricatives, compared to stops:
  MAX-C(-stop) >> MAX-C (Côté 2000)
  MAX[strident]/C_C >> MAX[-cont]/C_C (Steriade 2000)

In the above pairs of universally ranked Faithfulness constraints, higher-ranked ones refer to perceptually more prominent positions/segments, such

2) An alternative mechanism involves position/segment-specific Markedness constraints (Steriade 1995, 1999; Zoll 1996, 1998; Hume 1999; Zhang 2001). In the present study, no aspects of this alternative, which may be called Positional Markedness, will be discussed. See Wilson (2001) for the criticism on the Positional Markedness approach for consonant deletion and Zoll (1998) for a discussion of the comparison between Positional Faithfulness and Markedness theories.

3) Padgett proposes MAX_{REL}(place) for the purpose of explaining the C_2 dominance effect under the assumption that prevocalic C_2 is always released.

as onsets or prevocalic consonants (as opposed to codas or preconsonantal ones); continuants, non-stops or strident fricatives (as opposed to stops); and released consonants (as opposed to unreleased ones). These Faithfulness constraints interact with (Markedness) constraints triggering the changes to produce attested asymmetric patterns. The following tableau from Beckman (1998: 109) shows how the PF approach can analyze the C_2 dominance effect in Tamil nasal place assimilation:

(3) Analysis of Tamil nasal place assimilation (Beckman p. 109)

/pasan̪ + kaɭ/	ID-ONSET(place)	*LAB	*DORS	*COR	IDENT(place)
a. ☞ pa.sɛŋ.gɛ		p	ŋg	s	*
b. pa.sɛn̪.d̪ɛ	* !	p		s, n̪d̪	*
c. ta.sɛn̪.d̪ɛ	** !			t, s, n̪d̪	**

The crucial ranking here is ID-ONSET(place) >> Markedness constraints >> IDENT(place). Candidates (3b, c), with progressive assimilation, violate the high-ranking ID-ONSET(place) which requires the identity in place features between an onset segment and its input correspondent. In contrast, candidate (3a) with regressive assimilation obeys the higher-ranked PF constraint, violating only the lower-ranked Ident(place) and Markedness constraints, and thus is optimal.

All PF constraints must refer to certain (prominent) positions or segment types which I will call the constraint focus in the remainder of this paper. One implicit assumption concerning the constraint focus in the PF literature is that the focus may be either input or output forms. Indeed, most PF approaches proposed thus far employ the output, not input, as the constraint focus. This reference to the output is clear from their definitions of PF constraints, as shown below, and conventional assumptions on phonological units involved.

(4) MAX_{REL}(place) (Padgett 1995: 19)
Let S be a [+release] output segment. Then every place feature in the input correspondent of S has an output correspondent in S.

(5) IDENT-ONSET(place) (Beckman 1998: 105)
A segment in the onset of a syllable and its input correspondent must have identical place specifications.

Here, released and onset segments in the output are mentioned as the focus, directly, for $\mathrm{MAX}_{\mathrm{REL}}$(place) and, less directly, for Ident-onset(place), respectively. This adoption of the output focus is also clear from the conventional assumptions that distinctions between coda vs. onset and released vs. unreleased are specified only on the surface.[4]

To summarize, in the standard PF approach—which is proposed to analyze positional/segmental asymmetries—the output, not input, has been employed as the focus of PF constraints.

2. Released Stops

As mentioned earlier, it has been noted in the literature (Kohler 1990, 1991; Ohala 1990; Jun 1995; Padgett 1995) that released stops are rarely targeted in place assimilation, compared to unreleased stops. This cross-linguistic generalization has been subsumed under the C_2 dominance effect since prevocalic C_2 stops are always released whereas preconsonantal C_1 may be unreleased. However, it seems that the generalization is not confined to released stops in C_2 position. Preconsonantal C_1 stops may be released, and they are also resistant to phonological changes such as place assimilation.

This asymmetry involving released C_1 stops follows from a claim in the articulatory phonology (e.g. Browman & Goldstein 1989, 1990, 1992; Byrd 1992) that much-overlapped consonants are more likely subject to casual speech weakening processes, such as place assimilation and deletion, than little-overlapped ones. Notice that in preconsonantal position, the distinction between released vs. unreleased stops may be equivalent with that between much- vs. little-overlapped ones, since the release status of C_1 stops mostly depends on the degrees of inter-consonantal overlap: specifically, C_1, which slightly overlaps with C_2, may be released, whereas much overlapped C_1 is necessarily unreleased (Ladefoged 1993; Lamontagne 1993; Wright 1996 among others).

To verify the claim that released—as opposed to unreleased—stops in C_1 position are rare targets in place assimilation and consonant deletion, consider two cases in which degrees of inter-consonantal overlap typically

4) Below, we will discuss a possibility that such distinctions can be made underlyingly, and the input is adopted as the focus of PF constraints.

differ. First, different languages may employ different canonical degrees of inter-consonantal overlap. It has been observed that many contrasts including place feature contrast in consonant clusters are neutralized in languages with significant interconsonantal overlap, whereas most contrasts can be maintained in languages with no such overlap (Browman & Goldstein 1992, Lamontagne 1993, Steriade 1999). Languages—in which pre-obstruent C_1 stops are canonically released, and thus must be little overlapped with C_2—include Twana; Arabic, Wikchamni, Tillamook (Lamontagne 1993); Chontal (Keller 1959: 45), Hindi (Rhee 1999), Motilone (Hanes 1952), Kutenai (Garvin 1948), Upper Chehalis (Kinkade 1963), Zoque (Wonderly 1951), Russian (Jones and Ward 1969, Zsiga 2000). In all these languages, various heterorganic obstruent clusters are observed, and thus stop place assimilation and deletion do not occur, confirming the dispreference for released C_1 targets. In contrast, in languages—where C_1 stops are targeted in place assimilation or deletion—, canonical forms of preconsonantal (or word-final) stops are unreleased. For instance, stop place assimilation occurs in German (Kohler 1992), Korean (Kim-Renaud 1974), English, Malay, Thai (Lodge 1986, 1992), Yakut (Krueger 1962), and Catalan (Pilar Prieto, p.c.), in which preconsonantal (or word-final) C_1 stops are typically unreleased. In addition, C_1 stops delete in Diola-Fogny (Sapir 1965), English (Guy 1980, Neu 1980), German (Kohler 1992), Thai, Malay (Lodge 1986, 1992), West Greenlandic (Rischel 1974), Basque (Côté 2000). Again, in these languages, canonical forms of preconsonantal (or word-final) C_1 stops are unreleased.[5] In the absence of counter-examples, we assume that the dispreference for released C_1 targets in place assimilation and consonant deletion is robust cross-linguistically.

In addition, degrees of inter-consonantal overlap may differ according to speech rate/style. Adjacent consonants overlap more significantly in casual/fast speech than in slow/formal speech. It is well known in the literature (Browman and Goldstein 1989, 1990, 1992; Kohler 1990, 1991, 1992; and many others) that reduction processes such as assimilation and deletion occur more often in casual/fast speech than in slow/formal speech. For

5) Unreleased C_1 stops can be observed in languages displaying optional deletion, such as English and German. By contrast, if deletion is obligatory, and thus preconsonantal stops are never attested, it would be impossible to see whether preconsonantal stops are released or not. Languages such as Diola-Fogny seem to belong to such cases. However, based on the fact that "in final position and before a pause [a stop] is optionally unreleased" (Sapir 1965: 5), we assume that preconsonantal stops would be unreleased in Diola-Fogny.

instance, for an English phrase 'late call', there are several alternative pronunciation forms: [let˺ kɔl] and [lekkɔl] (casual/fast speech); and [let^{L} kɔl] (formal/slow speech) (cf. Barry 1985). The assimilated form [lekkɔl] occurs mainly in casual speech—where C_1 stops are typically unreleased as in [let˺ kɔl]—, but not in formal speech—where C_1 stops are released as in [let^{L} kɔl]. This confirms the claim that little-overlapped, thus released, C_1 stops are rare targets in assimilation compared to much-overlapped, thus possibly unreleased, C_1 stops.

In summary, little-overlapped, released, C_1 stops are rarely involved as a target in place assimilation and deletion, compared to much-overlapped, unreleased, C_1 stops. Indeed, even a more strict generalization seems true: released C_1 stops are never targeted. In discussing how to formally capture this asymmetry, let us now consider the standard PF analyses of place assimilation and consonant deletion.

2.1. Place Assimilation

To explain the resistance of released C_1 stops to place assimilation, we may adopt the high-ranking PF constraint MAX$_{REL}$(place) (Padgett: 1995), as shown below.

(6) Fixed universal rankings
 a. MAX$_{REL}$(place) >> Max(place)
 b. MAX$_{REL}$(place) >> *[αplace][βplace]

Here we take *[αplace][βplace] as a constraint prohibiting heterorganic consonant clusters.[6] The ranking in (6a) would capture the fact that released C_1 stops are less likely to be targeted in place assimilation than unreleased ones, and the one in (6b) the fact that released C_1 stops are never targeted.

With these PF constraints and universal rankings at hand, consider how to block place assimilation in languages such as Zoque where preconsonantal C_1 stops are required to be released as the result of the interaction of the following two constraints:

6) This constraint is chosen as one of many possible constraints triggering place assimilation including AGREE, ALIGN, and SPREAD; none of our claims should crucially rely on this choice.

(7) Constraints governing the release quality
  a. RELEASE: Stops are released.
  b. *RELEASE(CODA): Coda stops are unreleased

The tableau below illustrates a standard PF analysis of the absence of place assimilation in Zoque:

(8) PF analysis (with output focus)[7]: Zoque, /petkuy/ → [pet^{L} kuy] 'broom'

/petkuy/	RELEASE	MAX$_{REL}$(place)	*[α pl][β pl]	MAX(place)
a. pet$^{\urcorner}$ kuy	*!		*	
b. ☞ pet^{L} kuy			*	
c. pek^{L} kuy		*!		*
d. pekkuy	*!			*

The ranking employed above is consistent with universal rankings in (6). Candidates (8a, d), with unreleased C_1 stops, violate top-ranked RELEASE although they satisfy the other dominant MAX$_{REL}$(place) vacuously. Of candidates (8b, c) in which C_1 stops are released, and thus satisfies RELEASE, only candidate (8b) preserves underlying coronal place in C_1 position, satisfying MAX$_{REL}$(place), and thus is optimal. Here high-ranked MAX$_{REL}$(place) plays a crucial role in preventing place assimilation in (8c).

The same mechanism should be able to derive the occurrence of place assimilation in languages such as Yakut where stops in C_1 position are typically unreleased. The tableau below illustrates a standard PF analysis of the occurrence of place assimilation in Yakut:

(9) PF analysis (with output focus): Yakut, /at+ka/ → [akka] 'to a horse'

/ at+ka /	*RELEASE(CODA)	MAX$_{REL}$(place)	*[α pl][β pl]	MAX(place)
a. at$^{\urcorner}$ ka			*!	
b. at^{L} ka	*!		*	
c. ☞ akka				*
d. ak^{L} ka	*!	*		*

Candidates (9b, d) include released C_1 stops, thus violating top-ranked

7) For the sake of simplicity, *RELEASE(CODA), which is outranked by RELEASE, is omitted in the tableau.

*RELEASE(CODA). Candidates (9a, c), with unreleased C_1 stops, obey the two top-ranked constraints. Between the two candidates, only candidate (9c) obeys the next-ranked Markedness constraint prohibiting heterorganic clusters, and thus is optimal.

In summary, the standard PF approach to place assimilation can correctly account for the asymmetry involving released C_1 stops. Here the output is employed as the focus of PF constraints. Let us now consider a possibility that the input, not output, is employed as the focus of PF constraints, reformulating MAX$_{\text{REL}}$(place) as below:

(10) MAX$_{\text{REL}}$(place)
Let S be a [+release] **input** segment. Then every place feature in S has an output correspondent.

The following tableaux are for the patterns of Zoque and Yakut.

(11) PF analysis (with input focus): Zoque, /pet^{L}kuy/ → [pet^{L} kuy] 'broom'

/pet^{L}kuy/	RELEASE	MAX$_{\text{REL}}$(place)	*[α pl][β pl]	MAX((place)
a. pet˺ kuy	*!		*	
b. ☞ pet^{L} kuy			*	
c. pek^{L} kuy		*!		*
d. pekkuy	*!	<u>*</u>		*

(12) PF analysis (with input focus): Yakut, /at+ka/ → [akka] 'to a horse'

/at˺ka/	*RELEASE(CODA)	MAX$_{\text{REL}}$(place)	*[α pl][β pl]	MAX(place)
a. at˺ ka			*!	
b. at^{L} ka	*!		*	
c. ☞ akka				*
d. ak^{L} ka	*!	_		*

MAX$_{\text{REL}}$(place) here can be violated only when stops in C_1 position are released in the input, and thus all candidates in (12)—whose input includes unreleased C_1 stops—satisfy Max$_{\text{rel}}$(place) vacuously. If we compare violation marks in the above tableaux with those in (8, 9), there are minor differences: insertion of a mark in (11d) and deletion of a mark in (12d), both marked with an underline. The same output candidates are chosen as optimal forms. Thus, one might think that the PF approach employing the input focus accounts for the asymmetry involving released C_1 stops as well as that employing the output focus does.

However, there are problems with the input focus. For such analyses shown in (11, 12), the input specification of the feature [release] is necessary: e.g. /pet^{L}kuy/ and /at$^⌝$ka/. This is not compatible with the conventional assumption that no released/unreleased distinction is made in the underlying representation. Furthermore, it causes some serious problems for principles of Optimality Theory. The [release] specifications have to be consistent within the same language (and same speech rate/style). For instance, it must be assumed that C_1 stops are always [+release] in the input in languages, such as Zoque, with released C_1 stops on the surface. If some C_1 stops are allowed to be [-release] in the input, the high-ranking MAX$_{REL}$(place) will be satisfied vacuously, and thus place assimilation may occur. This will violate the cross-linguistic generalization that released stops are never targeted in place assimilation. To ensure the consistent feature specifications, language-specific constraints on the input are needed. This will violate the 'Richness of the Base' Principle (Prince and Smolensky 1993). In addition, such language-specific input constraints would require exactly the same pattern of feature specifications as the corresponding output constraints. For instance, in languages where C_1 stops are typically released, both input and output constraints for the [release] feature would require the specification of [+release] for preconsonantal stops. This causes a type of duplication problem (Kenstowicz and Kisseberth 1977).

In conclusion, the PF approach to place assimilation can correctly account for the asymmetry involving released C_1 stops, only when the output, but not input, is employed as the focus of PF constraints.

2.2. Deletion

This section discusses a PF analysis of the asymmetry involving released C_1 stops in consonant deletion. To begin, it will be useful to consider the motivation of the present discussion. As mentioned earlier, same positional/segmental asymmetries have been observed in both place assimilation and consonant deletion: for instance, C_2 dominance effect and the resistance of fricatives and released stops. If Positional Faithfulness is a right theory for the analysis of asymmetries in place assimilation, it should be able to account for the same asymmetries of consonant deletion in similar ways.

In fact, PF constraints have been proposed for the analysis of the asymmetries in consonant deletion, as shown in (2). However, as discussed and concluded by Wilson (2001), asymmetries in consonant deletion are not analyzable within the standard PF approach. This paper, while discussing a different type of data and different PF constraints, provides additional arguments for Wilson's conclusion. Specifically, this section focuses on the data displaying the asymmetry involving released C_1 stops. I think this asymmetry is important since, as shown above, a correct PF analysis of the asymmetry in place assimilation requires the output focus, justifying the general adoption of the output focus in the standard PF approach. In addition, an Optimality-Theoretic analysis of consonant deletion normally involves segmental—as opposed to featural—Faithfulness constraints, and thus this section will be mainly concerned with MAX-C type constraints.

To explain the resistance of released C_1 stops to consonant deletion, I will extend the standard PF analysis, presented above, for place assimilation. Based on constraints and universal rankings employed in the analysis of place assimilation in (6), I may propose the following constraints and universal rankings:

(13) Fixed universal rankings
- a. MAX_{REL}-C >> MAX-C
- b. MAX_{REL}-C >> *CC

Here, I take *CC as a constraint prohibiting the occurrence of two consecutive consonants, and thus triggering consonant deletion. The ranking in (13a) would capture the fact that released C_1 stops are less likely to be targeted in consonant deletion than unreleased ones, and the one in (13b) the fact that released C_1 stops are never targeted. What could be the proper definition of MAX_{REL}-C? A simple extension of the definition, given in (4) above, of MAX_{REL}(place) would provide a following definition:

(14) MAX_{REL}-C (with output focus)
Let S be a [+release] **output** consonant. Then the input correspondent of S must have an output correspondent.

Notice that the evaluation of this constraint will be meaningless since it can never be violated. There are only two logical possibilities: an output candidate may include a released stop or not. In the latter case, MAX_{REL}-C will be satisfied vacuously. In the former case, in which a released stop is included in the candidate, the stop is the output correspondent of its corresponding input segment, thus obeying MAX$_{REL}$-C.[8] Obviously, MAX$_{REL}$-C would play no role in the selection of an optimal candidate. Therefore, the loss of released and unreleased stops cannot be differentiated in the constraint evaluation. This point will be clear in the standard PF analysis of the Zoque pattern below:

(15) PF analysis (with output focus): Zoque, /petkuy/ → [pet^L kuy] 'broom'

/petkuy/	RELEASE	MAX$_{REL}$-C	*CC	MAX-C
a. pet˺ kuy	*!		*	
b. pet^L kuy			*!	
c. ☞ pe kuy				*

A ranking here is consistent with universal rankings in (13), but it derives a wrong optimal output in which C_1 deletes. MAX$_{REL}$-C is expected to prevent C_1 deletion in Zoque. However, it cannot since no released C_1 stop is present in candidate (15c), with deletion, and thus PF constraint, MAX$_{REL}$-C, is vacuously satisfied. This type of analysis can produce the correct output for languages such as Diola Fogny, with unreleased C_1 stops:

(16) PF analysis (with output focus): Diola Fogny, /let+ku+jaw/ → [lekujaw] 'they won't go'

/ let + ku + jaw /	*RELEASE	MAX$_{REL}$-C	*CC	MAX-C
a. let˺ kujaw			*!	
b. let^L kujaw	*!		*	
c. ☞ le kujaw				*

According to this analysis, stops in C_1 position may delete, regardless of whether it is canonically released or not in a language under consideration. Therefore, the asymmetry in the target of deletion between released and unreleased stops cannot be captured. The problem is not specific for the asymmetry involving released C_1 stops. None of asymmetries observed

8) Even if there is no corresponding input segment for a released output segment, it would violate DEP-C, not MAX-C.

in consonant deletion can be analyzed in the standard PF approach. For instance, to account for the resistance of fricatives to consonant deletion, one might propose the high-ranking MAX-C type constraint for fricatives, e.g. $\text{MAX}_{\text{FRICATIVE}}$-C. Notice that once C_1 is deleted, there would be no way to distinguish between fricative deletion and stop deletion in the output. Likewise, to explain the C_2 dominance effect in consonant deletion, one might rely on the high-ranking MAX-C type constraint for prevocalic consonants, e.g. MAX-C/_V. Again, there would be no way to distinguish between C_1 deletion and C_2 deletion in the output: both [VC_1V] and [VC_2V] will satisfy the dominant MAX-C/_V. The source of the problem is lack of crucial perceptibility information in the output. In the standard PF theory, high-ranked PF constraints refer to perceptually more prominent positions and segments in the output, for a purpose of preventing changes in those prominent units. However, when perceptually prominent units delete, they are not present any more in the output, and thus the high-ranked PF constraints would be satisfied vacuously. In other words, in the case of total deletion, there is no way to distinguish between perceptually more and less prominent units in the output. As a result, insofar as the output is the focus of PF constraints, no asymmetries in consonant deletion can be captured. One might attempt to analyze the asymmetries by employing the input focus. Such an attempt, however, would be subject to the problems discussed in the previous section, such as violation of the 'Richness of the Base' Principle and 'duplication' problem.

In conclusion, standard PF approach cannot account for any of position- and segment-specific asymmetries observed in consonant deletion, regardless of whether it employs the output or input as the focus of PF constraints involved.

3. Sympathy

This section presents an alternative PF approach to deal with positional/segmental asymmetries observed in both place assimilation and consonant deletion. From discussions provided in the previous section, it follows that in order for PF constraints to function properly, it is necessary to have access to an input segment's perceptibility information such as stop releasing even when the segment fails to surface. To employ the constraint focus which can incorporate such perceptibility information, I will rely on

Sympathy Theory (McCarthy 1998, 1999). To begin, here is a brief introduction of Sympathy Theory. Its original purpose is to account for phonological opacities. For instance, in Tiberian Hebrew, vowel epenthesis and [ʔ]-deletion occur as shown in (17a,b).

(17) Interaction of epenthesis and [ʔ]-deletion in Tiberian Hebrew (from McCarthy 1999 #2)
a. Epenthesis into final clusters:
/melk/ → mele̱x 'king'
b. ʔ-Deletion outside onsets
/qaraʔ/ → qārā 'he called'
c. Interaction: epenthesis → ʔ-deletion
/dešʔ/ → deše̱ʔ → deše 'tender grass'

An epenthetic vowel is inserted in a word-final cluster (17a). Independently, [ʔ] deletes in the coda (17b). As shown in (17c), the interaction of epenthesis and [ʔ]-deletion has been traditionally analyzed in terms of the counter-bleeding order: UR /dešʔ/ first undergoes the epenthesis, and then the epenthesized intermediate form [deše̱ʔ] undergoes [ʔ]-deletion, deriving the surface form [deše]. The actual output includes a gratuitous epenthetic vowel. This type of surface opacity has been a serious problem for parallel versions of Optimality Theory. In Sympathy Theory, one failed candidate is chosen as the model which all the other candidates are required to resemble. Its selection primarily relies on a designated input-to-output (IO) Faithfulness constraint. The model form, which is called the sympathetic candidate, must obey the designated IO faithfulness constraint, which is called the sympathy-selector. There are usually several candidates which obey the sympathy-selector. Among those obeying the selector, the candidate which is most harmonic with respect to the rest of the constraints is chosen as the sympathetic candidate. In Tiberian Hebrew, the sympathy selector is MAX-C. Once the sympathy candidate is chosen, all the other candidates are required to resemble this model candidate through candidate-to-candidate faithfulness, i.e. Sympathy. In the Tiberian Hebrew example, a crucial sympathetic faithfulness constraint is ❀MAX-V which requires preservation of vowels of the sympathetic candidate. Notice that an actual output [deše] resembles [dešeʔ] more than the transparent competitor [deš] does in that [deše] preserves all the vowels of [dešeʔ]. This Sympathy analysis of Tiberian Hebrew data is illustrated by the following tableau.

(18) Sympathy analysis of Tiberian Hebrew (slightly modified from McCarthy 1999 #5)

	/dešʔ/	CODA-COND	*COMPLEX	❀MAX-V	☆MAX-C	DEP-V
opaque	a. ☞ deše				*	*
transparent	b. deš			*!	*	
sympathetic	c. ❀ dešeʔ	*!				*
faithful	d. dešʔ	*!	*!	*!		

Based on this formalism, I will now propose an alternative PF approach. Specifically, the focus of PF constraints is a sympathetic candidate, and all PF constraints are in fact sympathetic faithfulness. For instance, to explain the asymmetry involving released C$_1$ stops in consonant deletion, I propose PF constraint ❀MAX$_{\text{REL}}$-C, defined as below, and fixed universal rankings involving it:

(19) a. ❀MAX$_{\text{REL}}$-C
Every [+release] segment in the **sympathetic candidate** has a correspondent in the output.
b. Fixed universal rankings
❀MAX$_{\text{REL}}$-C >> ❀Max-C
❀MAX$_{\text{REL}}$-C >> *CC

For the PF analyses of patterns attested in languages like Diola Fogny in which preconsonantal stops are assumed to be unreleased, the C$_1$ stops must be unreleased in the sympathetic candidate: e.g. [let˺ kujaw] for the underlying sequence /let+ku+jaw/. A ranking in (20), which is consistent with universal rankings in (19b), produces a correct analysis of Diola Fogny, as can be seen in (21):

(20) Ranking: *RELEASE(CODA), ❀MAX$_{\text{REL}}$-C >> *CC >> MAX-C

(21) PF analysis (with sympathetic candidate focus): Diola Fogny, /let+ku+jaw/ → [lekujaw]

/ let+ku+jaw /	*RELEASE(CODA)	❀MAX$_{REL}$-C	*CC	❀MAX-C	☆MAX-C
a. ❀ let˺ kujaw			*!		
b. let^L kujaw	*!		*		
c. ☞ le kujaw				*	*

Candidate (21a) is a sympathetic candidate since it is the most harmonic one among those which obey the sympathy selector, ☆MAX-C here. But, it cannot be optimal since it violates *CC. In candidate (21c), with C_1 deleted, high-ranking ❀MAX$_{REL}$-C is vacuously satisfied since the preconsonantal coronal consonant in the sympathetic candidate is not released. It also obeys the other top-ranked *RELEASE(CODA) and *CC, being an optimal output.

The analysis process for patterns of languages with little interconsonantal overlap like Zoque, would be same except for dominant ranking of RELEASE, not *RELEASE(CODA). This can be illustrated by the following tableau:

(22) PF analysis (with sympathetic candidate focus): Zoque, /petkuy/ → [pet^L kuy]

/petkuy/	RELEASE	❀MAX$_{REL}$-C	*CC	❀MAX-C	☆MAX-C
a. pet˺ kuy	*!		*		
b. ☞❀ pet^L kuy			*		
c. pe kuy		*!			*

Candidate (22b) is a sympathetic candidate since it is the most harmonic one among those which obey the sympathy selector, ☆MAX-C. Notice that unlike in (21), RELEASE is dominant in the above. The preconsonantal coronal stop is released in the sympathetic candidate, and thus ❀MAX$_{REL}$-C is active. Candidate (22c) displaying C_1 deletion violates this high-ranking PF constraint and cannot be optimal. In conclusion, this Sympathy-based analysis can correctly explain the occurrence of consonant deletion in languages with significant interconsonantal overlap, and at the same time its absence in languages where C_1 stops are typically released. The same type of asymmetric occurrence of place assimilation, which can be seen in languages like Yakut with significant interconsonantal overlap, will be subject to a very similar treatment: the only difference will be in that the sympathy selector is MAX(place).

Consequently, the Sympathy-based PF theory can account for all simple asymmetric patterns. In the following section, I will consider how the proposed approach can treat the complex patterns.

4. Complex Patterns

Above, I have considered only simple patterns in which place assimilation and consonant deletion do not interact with other phonological processes such as vowel deletion. Complex cases, in which different phonological processes interact, exist. There are two types of complex patterns, opaque and transparent.

Let us first consider opaque patterns which can be seen in Hindi nasal place assimilation (See Moreton and Smolensky 2002 for more relevant cases). In Hindi, nasals in C_1 assimilate in place to a following consonant in C_2: e.g. /sam+kiirt̪an/ → [saŋkiirt̪an] 'collective devotional singing' (Mohanan 1993: 75). However, if C_1 becomes adjacent to C_2 as a result of vowel deletion, assimilation is blocked: e.g. /sənək/ > [sənki], not *[səŋki], 'whim' (Ohala 1983: 110). Let us now consider how the proposed mechanism can explain this opaque pattern. The following PF constraint and fixed ranking are assumed.

(23) a. ❀MAX-ons(place): Let S be an onset segment in the sympathetic candidate. Then every place feature in S has a correspondent in the output.

b. Fixed universal ranking
❀MAX-ons(place)) >> ❀MAX(place)

The language-particular ranking in (24) produces a correct analysis of Hindi nasal assimilation, as can be seen in (25):

(24) ❀MAX-ons(place), SYNCOPE >> *[α pl][β pl] >> ❀MAX(place), MAX-V

(25) PF analysis (with sympathetic candidate focus)

input = /sənəki/	❀MAX-ons (place)	SYNCOPE	$*[\alpha\ \mathrm{pl}][\beta\ \mathrm{pl}]$	❀MAX-(place)	☆MAX-V
a. ❀ sənəki		*!			
b. ☞ sənəki			*		*
c. səŋki	*!			*	*

Candidate (25a) is the sympathetic candidate since it obeys the selector MAX-V, but it cannot be optimal due to its violation of a top-ranked constraint SYNCOPE which has the effect of a vowel deletion. Candidate (25c), which is a transparent output, incurs a violation of the other top-ranked PF constraint since it does not preserve the coronality of C_1 of the word-medial cluster, which is an onset in the sympathetic candidate. Candidate (25b) violates neither top-ranked constraints and thus becomes an optimal candidate.

Transparent patterns can be seen in Korean fricative place assimilation. As mentioned above, fricatives are rarely involved in place assimilation as a target, compared to stops and nasals (Mohanan 1993; Jun 1995). One apparent exception to this generalization can be found in Korean. Not only stops (26a) but also sibilant fricatives (26b) can be targeted in place assimilation:

(26) Korean place assimilation[9]

a. Stop target: coronals and labials (only before dorsals)

(i) /mit+ko/ → [mikko] 'believe + and'

(ii) /mut+ko/ → [mukko] 'ask + and'

(iii) /ip+ko/ → [ikko] 'wear + and'

(iv) /pap+kwa/ → [pakkwa] 'rice + and'

9) Broad phonetic transcriptions are employed for these examples. For instance, actual phonetic forms must be subject to the regular process of post-obstruent fortition where lenis obstruents become fortis after an obstruent. See Kim-Renaud (1986) for more details of this process.

b. Fricative target

(i) /pis+ko/ → [pikko] 'comb (verb) + and'
cf. /pis+ə/ [pisə] 'comb! (imperative)'

(ii) /s'is+ko/ → [s'ikko] 'wash + and'
cf. /s'is+ə/ [s'isə] 'wash! (imperative)'

(iii) /mas+kwa/ → [makkwa] 'taste + and'
cf. /mas+i/ [masi] (nominative)

(iv) /nas+kwa/ → [nakkwa] 'sickle + and'
cf. /nas+i/ [nasi] (nominative)

This seemingly exceptional pattern can be better understood if we consider coda neutralization in which all Korean obstruents become their homorganic unreleased lenis stops in coda position. Specifically, the underlying sibilant /s/ surfaces as a coronal stop [t˺] in the coda:

(27) Coda neutralization in Korean

		Citation form	Nominative
a. /mas/	'taste'	[mat˺]	[masi]
b. /nas/	'sickle'	[nat˺]	[nasi]
c. /pus/	'brush'	[put˺]	[pusi]
d. /os/	'clothes'	[ot˺]	[osi]
e. /pis/	'comb (noun)'	[pit˺]	[pisi]

In derivational terms, after sibilant fricatives—which are resistant to place assimilation—undergo the coda neutralization, they become unreleased stops, and thus they are likely to be targeted in place assimilation just like underlying stops.

Let us now consider the Sympathy-based PF analysis of Korean fricative place assimilation. The resistance of fricatives to place assimilation can be captured by the PF constraint ❀Max-fric(place), defined as below, and fixed universal rankings involving it:

(28) a. ❀MAX-fric(place)
Let S be a fricative in the sympathetic candidate. Then every place feature in S has a correspondent in the output.

b. ❀MAX-stop(place)
Let S be a stop in the sympathetic candidate. Then every place feature in S has a correspondent in the output.

c. Fixed universal rankings
  (i) ❀MAX-fric(place) >> ❀MAX-stop(place)
  (ii) ❀MAX-fric(place) >> *[α place][β place]

For the PF analysis of fricative assimilation in Korean in which coronal fricatives become an unreleased coronal stop, the C_1 fricative must have a stop correspondent in the sympathetic candidate: e.g. [pit˺ko] for the underlying sequence /pisko/. The ranking in (29) produces a correct analysis of Korean fricative assimilation, as can be seen in (30):

(29) *RELCODA, ❀MAX_fric(place) >> *[α pl][β pl] >> ❀MAX_stop(place), MAX(place)

(30) PF analysis (with sympathetic candidate focus): Korean fricative place assimilation

input = /pis+ko/	*RELCODA	❀MAX-fric (place)	*[α pl][β pl]	❀MAX-stop (place)	☆MAX (place)
a. pisko	*!		*		
b. ❀ pit˺ko			*!		
c. ☞ pikko				*	*

Candidate (30b) is selected as a sympathetic candidate since it is the most harmonic one among those which obey the sympathy selector, ☆MAX(place) here. But, it cannot be optimal since it violates *[α place][β place]. In candidate (30c) displaying place assimilation, high-ranking ❀MAX-fric(place) is vacuously satisfied since the preconsonantal consonant in the sympathetic candidate is not a fricative. It also obeys the other top-ranked *RELCODA (Obstruents are unreleased in the coda) and the next high-ranked *[α pl][β pl], being an optimal output. Consequently, the Sympathy-based PF approach can provide a correct analysis of Korean fricative assimilation.

In summary, the Sympathy-based PF approach can produce all the attested asymmetric patterns of consonant deletion and place assimilation, whether simple or complex.

5. Remaining Problems

So far I have shown that the Sympathy-based PF approach succeeds in incorporating the crucial perceptibility information into PF constraints, explaining all attested asymmetric patterns. An important question here is whether it is sufficiently constrained to exclude unattested patterns? According to Sympathy Theory, any IO Faithfulness constraint like DEP-V can be a sympathy selector, and thus we should consider such cases to prove that Sympathy Theory provides a sufficiently constrained formalism for a PF theory. It seems that unattested patterns can fall out if we employ, as a selector, IO Faithfulness constraints other than MAX-C or MAX(place). Let us take, for instance, DEP-V as a selector. One possible ranking will be *CC >> MAX-C. Then, the sympathetic candidate would be the one with one member of consonant cluster deleted. Notice that no PF constraints are available in the choice of a sympathetic candidate since in the Sympathy-based approach, all PF constraints must be assumed to be sympathetic faithfulness. The choice of the target consonant in deletion will then depend on the segmental markedness: e.g. *DORSAL >> *CORONAL. If the input cluster consists of C_1 dorsal and C_2 coronal, as in /ak+ta/, a sympathetic candidate would be the one with C_2 deleted, [aka]. Notice that this candidate does not violate Markedness constraint *CC, and thus it will be optimal as well. In conclusion, the C_2 deletion, which is believed to be unattested, is possible. It seems that this type of problem is unavoidable as long as we adopt the standard Sympathy Theory, without revision, in formal implementation of the conception of Positional Faithfulness. The selection of the sympathetic candidate is processed with Sympathy constraints turned off (Invisibility Principle, McCarthy 1998, 1999). Therefore, PF constraints regulate only the correspondence between the sympathetic candidates and output forms; then, the correspondence between the input and sympathetic candidate is free to violate the generalizations motivating the PF constraints: for instance, C_2, but not C_1, stops can be deleted in consonant deletion. This can be seen in the following schematic representation for the correspondence relations among three different representations:

(31)

IO Faithfulness: Context-free only

Input → ❀candidate → Output

Input → Output

❀candidate → Output: Sympathy: PF

Such violations may be transferred onto the actual output form through sympathetic faithfulness. Therefore, unattested processes like C_2 deletion can freely occur.

In conclusion, if we adopt the standard Sympathy Theory in formulating the conception of Positional Faithfulness, the resulting PF theory can produce all attested asymmetric patterns. However, such Sympathy-based PF theory cannot be constrained enough to produce only attested patterns.

6. Conclusions

In the present study, I have first shown that standard Positional Faithfulness approach—employing the output constraint focus—cannot be extended to account for any positional/segmental asymmetries observed in consonant deletion typology. The source of the problem is that perceptibility information—which is crucial in the evaluation of PF constraints—is absent when input segments fail to surface.

I have then proposed an alternative PF approach by adopting the formalism of Sympathy Theory (McCarthy 1998, 1999) which can capture the crucial perceptibility information. I have shown that it can correctly analyze all the attested asymmetries in place assimilation and consonant deletion. But, it also has been pointed out that the proposed mechanism has a remaining problem: it is not sufficiently constrained.

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Jongho Jun
Department of English Language and Literature
Yeungnam University
Kyongsan 712-749, Korea
E-mail: jongho@yumail.ac.kr

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