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Harmonic Parallelism versus Harmonic Serialism: The Case of Nasal Place Assimilation in Modern Colloquial Persian

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This paper elaborates on the comparison between Harmonic Parallelism (HP) and Harmonic Serialism (HS) as Optimality Theory (OT) models concerning nasal place assimilation in Modern Colloquial Persian. The data of this study were harvested from extant literature on place assimilation, including books, articles, and theses. Also, four native speakers (two males and two females) of Persian from Tehran were consulted to verify data extracted from the literature. The study concludes that place assimilation in this variety of Persian is restrictively regressive due to the impact of the coda condition when dealing with the serial application of place assimilation; hence, regressive place assimilation is executed in two steps where the first one is to delete the place feature of the coda which facilitates the leftward spread of the place feature of the following onset, as the second step; i.e., feeding order. HP encounters difficulty generalizing the place assimilation above since it is inherently derivational. Unlike HP, HS successfully expresses the serial relation beyond nasal place assimilation in Modern Colloquial Persian. Furthermore, HS can explain the directional asymmetry in place assimilation in Modern Colloquial Persian.

Keywords: *modern colloquial Persian, nasal place assimilation, harmonic parallelism, harmonic serialism, optimality theory*

1 Introduction

The current study sheds light on the comparison between HP and HS regarding nasal place assimilation in Modern Colloquial Persian as a style of informal speech mostly spoken in Tehran.

The consonant inventory Modern Colloquial Persian in Table 1 presents 23 consonants in the conventional arrangement based on place and manner of articulation as per Windfuhr (1987), Mahootian (1997), and Hosseini (2014), Bijankhan (2018), Alqahtani (2020). The following table provides the reader with the features of the relevant consonants of Modern Colloquial Persian.[1]

[1] The author referred to Durand's (1990) version of distinctive features.

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Table 1: Manners and places of articulation of the consonants of Modern Colloquial Persian (Windfuhr 1987; Mahootian 1997; Hosseini 2014; Bijankhan 2018; Alqahtani 2020)

	Bilabial	Labio-dental	Dental	Alveolar	Post-alveolar	Palatal	Uvular	Glottal
Plosives	p b		t d			c ɟ	ɢ	ʔ
Nasals	m			n				
Fricatives		f v		s z	ʃ ʒ		χ	h
Affricates					ʧ ʤ			
Approximants				r		j		
Lateral approximant				l				

Table 2: The list of features of the relevant Modern Colloquial Persian consonants (Bijankhan 2018)

Features in Colloquial Persian	p	b	t	d	c	ɟ	ʔ	m	n	f	v	s	z	ʃ	ʒ	h	χ	ɢ	ʧ	ʤ	r	j	l
Consonant	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+
Sonorant	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	+	+	+
Approximant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+
Continuant	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	-	±	±	+	+	-
Nasal	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lateral	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Voice	-	+	-	+	-	+	-	+	+	-	+	-	+	-	+	-	-	+	-	+	+	+	+
Coronal	-	-	+	+	-	-	-	-	+	-	-	+	+	+	+	-	-	-	+	+	+	-	+
Anterior	+	+	+	+	-	-	-	+	+	+	+	+	+	-	-	-	-	-	-	-	+	-	+
Distributed	-	-	+	+	-	-	-	-	±	-	-	-	-	+	+	-	-	-	+	+	-	+	±
Labial	+	+	-	-	-	-	-	+	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Dorsal	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-
High	-	-	-	-	+	+	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	+	-
Back	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Low	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-

Place assimilation has been considered an adaptation to the listener's need and an articulatorily motivated process (Kohler 1991, 1992; Mohanan 1993; Jun 1995). Several implicational statements on place assimilation have been established in Mohanan's (1993) and Jun's (1995) typological works. These statements are summarized below:

(1) Jun's (1995: 92) implicational statements on place assimilation:

a. Target manner:
i. If fricatives or non-nasal sonorants are targets of place assimilation, so are stops.

ii. If stops are targets of place assimilation, so are nasals.
b. Target Place:
i. If velars are targets of place assimilation, so are labials.
ii. If labials are targets of place assimilation, so are coronals.
c. Trigger manner:
i. If non-nasal sonorants trigger place assimilation, so do nasals and fricatives.
ii. If nasals or fricatives trigger place assimilation, so do stops.
d. Trigger place:
If coronals are triggers, so are velars.
e. Syllable positions:
If the onset is the target, so is the coda.

With regard to syllable position, codas are more likely to be liable to assimilation cross- and intra-linguistically than onsets (Webb 1982; Jun 1995; Lamont 2015); i.e., place assimilation is regressive primarily. By contrast, Webb (1982: 317) mentions that progressive assimilation, where the onset is the target, is rare. Accordingly, nasal place assimilation in Modern Colloquial Persian is regressive, as it targets the nasals /n/ and /m/, which are followed by consonants produced at different places of articulation. The deletion of the place of articulation for the nasals /n/ and /m/ results in the placeless nasal **N** (the bold capital **N** indicates the placeless nasal), which facilitates the spread of the place feature of the following onset leftwards, as the final step. The examples of regressive place assimilation in this variety of Persian are shown in (2):

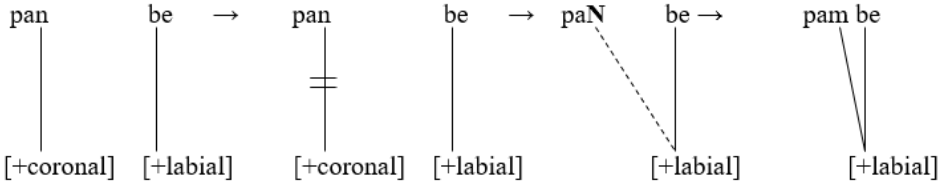
(2) Examples of the regressive place assimilation of nasal stops in Modern Colloquial Persian

i)	a.	/panbe/ →	/pa**N**be/ →	[pa**mb**e]	‘cotton’
	b.	/tanbɑku/→	/ta**N**bɑku/→	[ta**mb**ɑku]	‘tobacco’
ii)	a.	/tænvir/→	/tæ**N**vir/→	[tæ**ŋv**ir]	‘enlightenment /illumination’
	b.	/kamfor/	/ka**N**for/	[ka**ŋf**or]	‘camphor’
iii)	a.	/mænʃæʔ/→	/mæ**N**ʃæʔ/→	[mæ**ɲʃ**æʔ]	‘origin’
iv)	a.	/bɑnce/→	/bɑ**N**ce/→	[bɑ**ɲc**e]	‘container’
v)	a.	/mænguʃ/→	/mæ**N**guʃ/→	[mæ**NG**uʃ]	‘engraved’

Based on the data above, nasals assimilate in place rather than orals in Modern Colloquial Persian since the place contrasts in nasals are less perceptible than those in oral stops; thus, native speakers of Modern Colloquial Persian tend to neutralize place contrasts in oral stops less than in nasals. This finding is supported by Jun (1995, 2004) and Blevins (2005), who investigated cross-linguistic place assimilation. They agree that nasal consonant place assimilation is perceptually more tolerable than oral consonant place assimilation because the former involves less perceptual change. Two points are relevant regarding the surface forms above; first, codas have no independent place of articulation from the following onset, which

would otherwise violate the Coda Condition. Therefore, regressive place assimilation is utilized to avoid such a violation. The second point is peculiar to the regressive place assimilation itself being inherently derivational: the place assimilation is a two-step process where the spreading of the licensed place feature occurs after the deletion of the unlicensed one. Thus, per the coda condition, the place feature of a coda is not permitted unless it is associated with the place feature of the following onset or if a coda has the same place feature as does the following onset (Poser 1982; Mascaró 1987; Itô 1989; Goldsmith 1990; Cho 1990; Kiparsky 1993; McCarthy 2008, 2016). Therefore, the first step is to delete the place feature of the coda if different from the place feature of the following onset, /n, m/→ **N**. The final step is the spread of the place feature to the left of the onset. Consider the following representation of /panbe/→ [pambe] 'cotton.'

(3) /panbe/→ [pambe] 'cotton'



The next section explores the previous analyses of place assimilation in Persian varieties. The following sections analyze nasal place assimilation in modern colloquial Persian in light of harmonic parallelism and serialism. After that, section 5 summarizes the current study and its findings.

2 The Previous Analyses of Place Assimilation in Persian Varieties

Place assimilation has been the subject of previous investigations by scholars who conducted their studies on the phonology of Persian varieties, including Aldaghi & Tavakoli (2011), Zahedi & Fakharian (2011), Okati et al. (2012), Hosseinzadeh et al. (2014), Saeeidi & Atabakhsh (2015), Atabakhsh & Saeeidi (2016), Soohani (2017). They all agree upon place assimilation in Persian varieties being regressive, targeting nasal consonants followed by onsets of the following syllables with different places of articulation; hence, the place features of codas in the coda position are determined by the onsets of the following syllables to conform to coda condition. However, those scholars differ in terms of the way they account for place assimilation in Persian varieties. For instance, Aldaghi & Tavakoli (2011), Okati et al. (2012), and Saeeidi & Atabakhsh (2015) descriptively account for place assimilation in Sabzevari Persian, Sistani Persian of Iran, and the speech of North Khuszestan. However, their studies do not exhibit a cause-and-effect relationship. On the other hand, Hosseinzadeh et al. (2014) and Atabakhsh & Saeeidi (2016) refer to rule-based theory to account for place assimilation in Eghlidian Persian and Dezfuli-Shushtari speech in Iran. The rule-based theory is not exempt from criticism since it encounters two problems: *Duplication and Conspiracy problems* (Kenstowicz & Kisseberth 1977; Zuraw & Lu 2009). Kenstowicz & Kisseberth (1977) express the *Duplication problem* as the case where morpheme structure changes and rules duplicate each other's effects. The *Conspiracy problem*, as demonstrated by Zuraw & Lu

(2009), is the case where different rules in different languages aim for the same surface pattern. Zahedi & Fakharian (2011) analyze place assimilation in Modern Persian using Feature Geometry, which grew out of Autosegmental Phonology. However, this theory and autosegmental phonology are subject to criticism as they are continuations of rule-based theory. Goldsmith (1990: 1) mentions that autosegmental phonology is a "direct continuation of the traditional works in generative phonology codified in Chomsky and Halle's *Sound Pattern of English* in 1968." Goldsmith (1979: 202) reports that the difference between autosegmental theory and the SPE is "the development of a multi-linear phonological analysis in which different features may be placed on separate tiers, and in which the various tiers are organized by 'association lines'". Therefore, these theories encounter the *Duplication* and *Conspiracy* problems discussed above. Unlike the above phonological approaches, the issues mentioned earlier can be solved by Optimality Theory (OT) because it eliminates the use of rules and derivations and replaces them with well-formedness constraints which interact to determine the actual output (Prince & Smolensky 1993; McCarthy & Prince 1995; Lombardi 2001: 1). Accordingly, Soohani (2017) accounts for place assimilation in Iranian Balochi dialects using Standard Optimality Theory (Parallel OT) as a framework. Parallel OT successfully addresses many problematic issues in phonology even though it encounters an obstacle in accounting for other phonological phenomena, including phonological opacity, process interaction, and some cases of variation (Prince & Smolensky, 1993; Rakhieh, 2009; Al Taisan, 2022; Alqahtani 2023).

With respect to the scholars above, none of them compares Harmonic Parallelism (HP) and Harmonic Serialism (HS) concerning nasal place assimilation in Modern Colloquial Persian. Therefore, the current study aims to reveal which OT model can express nasal place assimilation as inherently derivational (Poser 1982; Mascaró 1987; Itô 1989; Goldsmith 1990; Cho 1990; Kiparsky 1993; McCarthy 2008, 2016). To achieve the goal of this study, it is crucial to address the question of "Which OT model captures the generalization about nasal place assimilation in Modern Colloquial Persian?". The following section is particularly about the analysis of nasal place assimilation in Modern Colloquial Persian using HP.

3 Data Analysis within Harmonic Parallelism (HP)

Harmonic Parallelism (HP) is an OT model in which the ultimate output is determined after a single pass through GENERATOR (GEN) and EVALUATOR (EVAL) (McCarthy 2000). This mechanism is shown in the following diagram.

(4) Parallel architecture for OT
Input → **GEN**→ cand-set → **EVAL** → Output (McCarthy 2000: 502)

Regarding the above diagram, this section explores whether HP can capture the generalization about nasal place assimilation in Modern Colloquial Persian. Before any further analysis, let us consider the following OT constraints:

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(5) OT constraints:

a. CODA-COND (Goldsmith 1990; Itô 1989)
Assign one violation mark every coda consonant that does not license a place feature.
b. HAVE-PL (McCarthy 2016)
Assign one violation mark for every placeless segment.
c. IDENT(PL) (McCarthy & Prince 1995: 16)[2]
Assign one violation mark for every place feature in the input that differs from its corresponding place feature in the output.

Regarding the list of OT constraints above, HAVE-PL is the highest-ranked constraint, which opposes candidates with coda consonants that have unlicensed place features. CODA-COND, as the second most highly ranked constraint, also opposes candidates with unlicensed coda consonants. IDENT(PL), being the lowest-ranked constraint, guarantees that the place feature of the input and output remains fully faithful. Consider the following set of OT constraints.

(6)

HAVE-PL>> CODA-COND>>IDENT(PL)

The above set of OT constraints is used to evaluate the candidates for the input /panbe/ 'cotton' in the following tableau:

Tableau [I] *Evaluating the candidates of the input /panbe/ 'cotton.'*

HAVE-PL >>CODA-COND>>IDENT(PL)

/panbe/	HAVE-PL	CODA-COND	IDENT(PL)
a. panbe		*!	
b. pa**N**be	*!		*
c. ☞pambe			*

Based on the tableau above, candidate (c), as the desired output, has been chosen as optimal since it avoids the violation of HAVE-PL and CODA-COND, unlike candidates (a) and (b). Although candidate (a) is the most faithful output to the input /panbe/, it fails to be optimal due

[2] This constraint is shortened in tableaux to IDENT(PL).

to the violation of CODA-COND. Candidate (b) satisfies CODA-COND through the deletion of the place feature of a coda, which consequently incurs the violation of HAVE-PL.

Although HP reveals candidate (c) as the true optimal output, there are two comments on this model. First, this model has only two levels, i.e., the underlying and surface levels, which are incapable of capturing generalisations about place assimilation because they are essentially derivational. In other words, regressive place assimilation requires intermediate steps that cannot be expressed in two levels. Secondly, GEN (Generator) in HP, according to McCarthy (2000), is unrestricted and would also produce the output [pande], which is equal in evaluation to [pambe].[3] Consider the following tableau:

Tableau [II] *Evaluating the candidates of the input /panbe/ 'cotton.'*

HAVE-PL >>CODA-COND>>IDENT(PL)

/panbe/	HAVE-PL	CODA-COND	IDENT(PL)
a. panbe		*!	
b. pa**N**be	*!		*
c. pambe			*
d. pande			*

The tableau fails to identify candidate (c), i.e., the desired output, as optimal, since both candidate (c) and candidate (d) equally violate IDENT(PL). This shows that HP fails to capture the generalization about any derivational process, including place assimilation.[4] Thus, invoking a derivational model that potentially accounts for any derivational process, including place assimilation, is crucial. To differentiate between candidates (c) and (d), it is worth mentioning that candidate (d), produced by progressive place assimilation, targets the onset with a different place articulation from the preceding coda, whereas candidate (c), produced by regressive place assimilation, targets the preceding coda with a different place articulation from the following onset. Consider the following derivational orders of regressive and progressive place assimilation in Modern Colloquial Persian:

(7)

a. The derivational order of the regressive place assimilation in Modern Colloquial Persian:

Underlying representation	/panbe/ 'cotton'
Deleting the place feature of the coda:	pa**N**be

[3] McCarthy (2016) states that through GEN in Parallel OT many changes are made at once when producing a candidate: To put it simply, one or more operations are applied together by GEN in Parallel OT.

[4] Parallel OT apparently fails to explain why place assimilation is from the onset to the coda and never the other way around (McCarthy 2016).

Spreading the place feature of the following onset leftwards:	pambe
Surface	[pambe]

b. The derivational order of the progressive place assimilation in Modern Colloquial Persian

Underlying representation	/panbe/ ‘cotton’
Deleting the place feature of the onset:	pan**ʔ**e[5]
Spreading the place feature of the coda rightwards:	pande
Surface	*[pande]

The above asymmetry can successfully be explained by Harmonic Serialism (HS), as demonstrated in the following section.

4 Data Analysis within Harmonic Serialism (HS)

Harmonic Serialism (HS) explains the asymmetry in place assimilation in Modern Colloquial Persian discussed in the previous section since GEN in this model, unlike Parallel OT, is restricted to one change in every step, i.e., gradualness.[6] This means that GEN in HS is not a one-time process, as it is in Parallel OT, and thus produces a new candidate set after each change (McCarthy 2016). HS is merely a derivational version of Classical OT where multiple passes are made by the input through the same set of constraints until the derivation coverages (McCarthy 2016). The HS-OT model is presented by McCarthy (2016: 50) in the following flowchart.

[5] McCarthy (2016) notes that deleting the place feature from the onset yields the placeless **ʔ**.

[6] McCarthy (2010) states that Harmonic Serialism results in a more restrictive typology of place assimilation, unlike parallel OT, due to gradualness and harmonic improvement.

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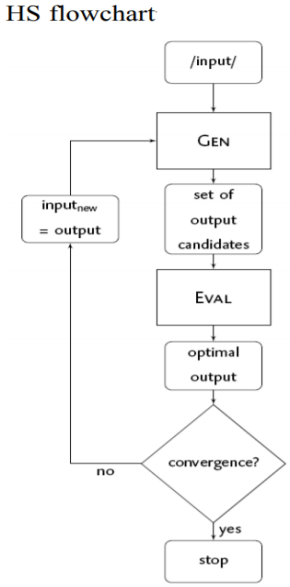
(8) HS flowchart (McCarthy 2016: 50):



In HS, CODA-COND must dominate HAVE-PL and IDENT(PL) to apply the first derivational step, i.e., deleting the place feature of the preceding coda that differs from the following onset. Consider the following constraint ranking in HS-OT.

(9) CODA-COND >>HAVE-PL>>IDENT(PL)

The HS-OT analysis of the candidates derived from the input /panbe/ 'cotton' is shown below:

Tableau [III]: Step 1: Deleting the place feature of a coda: /panbe/→ /pa**N**be/

CODA-COND>>HAVE-PL>>IDENT(PL)

/panbe/	CODA-COND	HAVE-PL	IDENT(PL)
a. panbe	*!		
b. ☞paNbe		*	*
c. panʔe	*!	*	*

In the tableau above, candidate (b) has been determined as optimal due to its correspondence with the CODA-COND constraint. On the other hand, the same constraint is fatally violated by candidates (a) and (c) since the coda in both candidates is not licensed by the following onset. Consequently, they are eliminated. Candidate (b), distinguished as optimal, serves as the input in the following tableau as the next step.

Tableau [IV]: Step 2: Spreading the place feature of the following onset leftwards: /pa**N**be/→ [pambe]

CODA-COND >> HAVE-PL >>IDENT(PL)

/pa**N**be/	CODA-COND	HAVE-PL	IDENT(PL)
a. pa**N**be		*!	
b. ☞pambe			*
c. pa**NʔN**e		*!*	

The placeless nasal in candidates (a) and (c) incurs the fatal violation of HAVE-PL. As a result, candidate (b) is chosen as optimal. The final step in the next tableau shows the convergence [pambe], which is the input in this step: the loop of GEN/EVAL terminates.

Tableau [V]: Step 3: Convergence

CODA-COND >> HAVE-PL >>IDENT(PL)

/pambe/	CODACOND	HAVE-PL	IDENT(PL)
a. ☞ pambe			

In summary, HP has been shown as an OT model capable of accounting for any one-step process since it is of a two-level representation. However, this OT model encounters difficulty accounting for any phonological process that is inherently derivational, in this case, place assimilation in Modern Colloquial Persian; hence, candidates liable to regressive and progressive place assimilation satisfy the coda condition since the serial relation is not considered. As a result, HP cannot account for this asymmetry. In contrast, HS, concerned with the serial relation of place assimilation, successfully accounts for this asymmetry since gradualness and Harmonic improvement are its core properties. In this case, the impact of the coda condition on place assimilation in Modern Colloquial Persian is revealed by considering intermediate steps between the input and output, where every step is restricted to one and only one change. Deleting the place feature of the onset as the first step for the progressive place assimilation incurs the violation of the coda condition, while deleting the place feature of the coda would meet the same condition. This shows there is no possible progressive place

assimilation in Modern Colloquial Persian due to the coda condition when using HS rather than HP.

5 Conclusion

The current research manifests the comparison of HS and HP as OT models, dealing with the nasal place assimilation in Modern Colloquial Persian. The directionality of nasal place assimilation in this variety of Persian is regressive due to the coda condition; hence, it is run by two steps where the first step is the deletion of the place feature of the coda, and the second step is to spread the place feature of the following onset leftwards. Intermediate steps are required to express the process of nasal place assimilation in Modern Colloquial Persian. Accordingly, HP encounters an obstacle in accounting for the serial relation behind regressive place assimilation in Modern Colloquial Persian since it has two representation levels, i.e., input and output. Furthermore, the impact of the coda condition on nasal place assimilation in Persian is not revealed when using HP since GEN makes many changes once when producing a candidate. As a result, both the progressive place assimilation and the regressive place assimilation match with the coda condition. However, the progressive place assimilation, which does not exist in this variety of Persian, violates the coda condition in a serial relation where every step is restricted to one change only. Therefore, this serial relation has successfully been addressed by HS, where its properties are gradualness and Harmonic improvement. To put it simply, HS exerts the influence of the coda condition on place assimilation in Modern Colloquial Persian. The findings in this paper underscore the role of HS in accounting for other types of assimilation, including manner assimilation and total assimilation in different varieties of Persian.

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