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# Phonological Derivations of Synchronic Metathesis in Modern Persian

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**ABSTRACT**

This study discusses phonological derivations in Modern Persian which result from synchronic metathesis in light of Optimality Theory (OT). Synchronic metathesis to follow the Sonority Sequencing Principle (SSP) is operated by two phonological rules; metathesis of word-final cluster and Sonority-Driven epenthesis. In this context, the first rule blocks the environment for the second. This phonological derivation is known as *bleeding* which is also a type of phonological derivation of synchronic metathesis that is motivated by the Syllable Contact Law. The first rule, as the metathesis of heterosyllabic consonants, blocks the environment for the second, as in contact anaptyxis. OT Parallelism is capable of accounting for this bleeding as a transparent rule interaction yielded by synchronic metathesis, which is motivated by the Syllable Contact Law as well as the SSP since reference to the intermediate steps between input and output is not necessary. To that end OT Parallelism is capable of accounting for transparency in the bleeding order.

## INTRODUCTION

Metathesis refers to a phonological process in which the ordering of proximate segments, which are usually adjacent, is reversed. This phonological process is considered an attempt to preserve more acceptable phonotactics. In other words, metathesis is intentionally utilised to comply with essential syllable structures in some languages. As an example, CV metathesis targets words which have word-initial clusters in Persian, since the language does not allow syllables with word-initial clusters. Likewise, the Sonority Sequencing Principle (SSP) motivates metathesis in Persian when dealing with word-final clusters that constitute Sonority Reversal as a manner of SSP violation. Metathesis in Persian is also provoked by heterosyllabic clusters that are counter to the Syllable Contact Law (Hooper, 1972).

Blevins and Garrett (2004: 128) demonstrate four different types of metathesis occurring in language:

1) Perceptual Metathesis: For easier perception, as in the prehistory of Classical Armenian, where the linear order of stop (or affricate) + r clusters was regularly reversed, as in/subr/→[surb] 'holly'.
2) Compensatory Metathesis: This is peculiar to sound changes where a peripheral vowel undergoes phonetic weakening in both quality and duration. This is used to compensate for the weakening, as in the metathesis shown at the right edge of the word with reference to Rotuman, an oceanic language:/tíko/→ [tíok] 'flesh'.
3) Co-articulatory Metathesis: This has an articulatory origin related to a sequence of stops which involve closure of distinct articulators but whose gestural overlap results in nearly simultaneous closure. In Micronesian language all/pk/sequences are optionally realised as [kp]:/apkas/→ [apkas], [akpas] 'now'.
4) Auditory Metathesis: This pertains to auditory-stream decoupling such as that involving sibilant-stop and stop-sibilant. It can be seen in the late West Saxon dialect of Old English:/frosk/→[forsk] (late West Saxon) 'frog'.

This paper aims to investigate phonological derivations found in synchronic metathesis in Modern Persian using OT as a framework.

In order to create a framework for the study, the following questions have been taken into consideration:

- What are the phonological derivations behind synchronic metathesis in Modern Persian?
- How can phonological derivations in synchronic metathesis in Modern Persian be accounted for using OT?

The next section will introduce previous studies that have addressed metathesis in Persian. There follows a section outlining the research methods used in this study. The

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next section offers detailed results and discussions that demonstrate synchronic metathesis alongside phonological derivations and OT analysis. The section that follows presents the grammar of metathesis in Modern Persian through a unified set of OT constraints. The conclusion, set out in the final section, gives a summary of the paper and its findings.

## LITERATURE REVIEW

Synchronic metathesis as a phonological process in Persian has been considered by scholars including Jahangiri (1980), Ahmadkhani (2010) and Khalifelu & Khoshkhoonejad (2015). Jahangiri (1980) states that metathesis in Modern Persian is common amongst the working classes, with reference to examples taken from third and fourth generation speakers of the language:

(1)

| | | Standard Persian | Modern Persian | Gloss |
|---|---|---|---|---|
| (I) | a. | /nazr/ | [narz] | 'vow' |
| | b. | /qofl/ | [qolf] | 'lock' |
| (II) | a. | /haz.rat/ | [har.zat] | 'lord, Imam' |
| | b. | /bef.ruʃ/ | [ber.fuʃ] | 'sell' |

With respect to Jahangiri's (1980) socio-linguistic study on Tehrani Persian, it did not justify a reason for metathesis when dealing with the examples in (1). Metathesis is conditioned by two factors, the Sonority Sequencing Principle (SSP) and Syllable Contact Law (Hooper, 1972). By looking at the examples in (1), metathesis is only applied in these words in order to conform to SSP and Syllable Contact Law. For instance, heterosyllabic clusters in/haz.rat/and/bef.ruʃ/motivate metathesis since the tendency is to comply with Syllable Contact Law by having $C_1$ be more sonorous than $C_2$ and no rising sonority is allowed across a syllable boundary. The word-final clusters in/nazr/and/qofl/violate SSP by having a peripheral consonant that is more sonorous than the one closer to the nucleus. As a result, metathesis is utilised to achieve conformity to SSP. These statements are supported by Ahmadkhani (2010) who states that SSP as well as Syllable Contact Law motivate synchronic metathesis, as follows:

(2)

Metathesis in Persian conditioned by SSP

| | | |
|---|---|---|
| a. /luks/ | [lusk] | 'luxurious' |
| b. /boks/ | [bosk] | 'fisting' |
| c. /ʔaks/ | [ʔask] | 'photo' |
| d. /pudr/ | [purd] | 'powder' |
| e. /qofl/ | [qolf] | 'lock' |

Metathesis in Persian is conditioned by Syllable Contact Law

| | | |
|---|---|---|
| a. /mad.re.se/ | [mar.de.se] | 'school' |
| b. /tub.re/ | [tur.be] | 'bag' |
| c. /tak.si/ | [tas.ki] | 'taxi' |
| d. /qom.ri/ | [qor.mi] | 'pigeon' |
| e. /sab.zi/ | [saz.bi] | 'vegetable' |

According to Khalifelu & Khoshkhoonejad (2015), SSP and Syllable Contact motivate synchronic metathesis in the Lori dialect of Kohgilouyeh as a Persian vernacular. Consider the following examples:

(3)

| | | Standard Persian | Lordi dialect | Gloss |
|---|---|---|---|---|
| (I) | a. | /saqf/ | [safq] | 'roof' |
| | b. | /tʃetf/ | [tʃeft] | 'knob' |
| | c. | /ʃoɣl/ | [ʃolɣ] | 'job' |
| | d. | /ʔozr/ | [ʔorz] | 'pretext' |
| | e. | /zebr/ | [zerb] | 'rough' |
| (II) | a. | /naq.ʃe/ | [naʃ.qe] | 'map' |
| | b. | /mad.re.se/ | [mar.de.se] | 'school' |
| | c. | /taf.ra.qe/ | [tar.fa.qe] | 'concision' |

Although the scholars cited above have addressed synchronic metathesis in Persian, the phonological derivations behind synchronic metathesis have not yet been investigated. To that end, this study attempts to elaborate on phonological derivations pertaining to synchronic metathesis using Optimality Theory (OT) as an analytical framework. Furthermore, OT Parallelism - as an OT model - is utilised to show how this model is capable of analysing transparent rule interactions found in synchronic metathesis in Modern Persian. The next section seeks to demonstrate the research method in this study.

## METHOD

The main purpose of this study is to manifest the type of phonological derivations that result from synchronic metathesis in Modern Persian. To do that, four procedures have been employed:

- The extraction of data on synchronic metathesis in Modern Persian that can be found in the extant literature including articles, books and theses.
- Consultation with native speakers of Modern Persian to judge the data on synchronic metathesis gathered from the extant literature.
- Exploration of the type of phonological derivations yielded by synchronic metathesis in Modern Persian.
- Employing Parallel OT to account for phonological derivations arising from synchronic metathesis in Modern Persian.

## RESULTS AND DISCUSSION

As discussed in the literature review, synchronic metathesis in Persian is conditioned by two principles, SSP and Syllable Contact Law. This was identified by Jahangiri (1980), Ahmadkhani (2010) and Khalifelu & Khoshkhoonejad (2015). By virtue of SSP, synchronic metathesis in Modern Persian targets word-final clusters of the forms/stop + liquid/,/nasal + liquid/,/fricative + liquid/, and/stop + fricative/. Consider the following examples:

(4)

| | | | | |
|---|---|---|---|---|
| (I) | a) | /pudr/ | [purd] | 'powder' |
| | b) | /fekr/ | [ferk] | 'thinking' |
| (II) | a) | /namr/ | [narm] | 'soft' |
| (III) | a) | /nazr/ | [narz] | 'vow' |
| | b) | /ʒafr/ | [ʒarf] | 'deep' |
| | c) | /qofl/ | [qolf] | 'lock' |
| | d) | /suχr/ | [surχ] | 'red' |
| | e) | /tʃaχr/ | [tʃarχ] | 'wheel' |
| | f) | /vafr/ | [varf] | 'snow' |

g) /ʔasr/ [ʔars] ‘tear’

(IV) a) /luks/ [lusk] ‘luxurious’

b) /boks/ [bosk] ‘fisting’

c) /katf/ [kaft] ‘shoulder’

d) /ʔaks/ [ʔask] ‘photo’

According to the examples provided in (4), word-final clusters constitute Sonority Reversal where a peripheral consonant is more sonorous than the preceding consonant. In this situation, synchronic metathesis is applied to conform to SSP.

In light of the aim posited above, this section is devoted to exploring the type of phonological derivations of synchronic metathesis stipulated by SSP and Syllable Contact Law. Parallel OT is utilised to account for this kind of process.

With regard to phonological derivation, synchronic metathesis to comply with SSP is run by implementing two phonological rules. The first rule is that the metathesis of a word-final cluster blocks the environment for the second - Sonority-Driven Epenthesis.[1] This phonological derivation is known as *bleeding* (a transparent rule interaction). Consider the bleeding order in synchronic metathesis in Modern Persian:

(5) Bleeding order in Modern Persian

| | |
|---|---|
| Underlying: | /qofl/‘lock’ |
| Metathesis of word-final cluster: | qolf |
| Sonority-Driven Epenthesis | - |
| Surface: | [qolf] |

Bleeding, as seen in (5) above, is considered a transparent rule interaction since reference to intermediate steps between input and output is not necessary. The first rule targets the word-final cluster in order to conform to SSP. Consequently, the process of the first rule wipes out the conditions for the second rule - Sonority-Driven Epenthesis - before it can be applied.

Parallel OT can be utilised to deal with the case of the bleeding order in (5). The candidates for the input/qofl/‘lock’ undergo analysis in the next tableau using the following OT constraints:

(6) OT constraints:

a. ONSET (ONS) (Prince and Smolensky 1993):

Syllables must have onsets.

b. *COMPLEXONS (Prince and Smolensky 1993):

A syllable must not have more than one onset segment.

c. MAX-IO (McCarthy & Prince 1995):

Every segment of $S_1$ has a correspondent in $S_2$.

d. DEP-IO (McCarthy & Prince 1995):

Every segment of $S_2$ has a correspondent in $S_1$ ($S_2$ is “dependent on” $S_1$).

e. LINEARITY “No metathesis” (McCarthy and Prince 1995:123):

$S_2$ is consistent with the precedence structure of $S_1$, and vice versa.

f. *$COMPLEX_{COD}$ (Prince and Smolensky 1993):

A syllable must not have more than one coda segment.

The OT constraints in (6) mean that the most highly-ranked constraint is ONSET since onset is mandatory in Persian. Word-initial clusters are prohibited in Persian, therefore, *$COMPLEX_{ONS}$ is set as the second most highly-ranked constraint. MAX-IO and DEP-IO, as faithfulness constraints, outrank LINEARITY and *$COMPLEX_{COD}$ in order to eliminate any candidate with the deletion of any segment and those with the insertion of any segment. *$COMPLEX_{COD}$, set as the lowest-ranked constraint, is classed against candidates with complex codas. The candidates of the input/qofl/‘lock’ are evaluated in tableau below:

(7)

ONS>>*$COMPLEX_{ONS}$>>MAX-IO>>DEP-IO>> LINEARITY>>*$COMPLEX_{COD}$

| /qofl/ | ONS | *$COMPLEX_{ONS}$ | MAX-IO | DEP-IO | LINEARITY | *$COMPLEX_{COD}$ |
|---|---|---|---|---|---|---|
| a. ☜ qofl | | | | | | * |
| b. qof | | | *! | | | |
| c. ☹ qolf | | | | | *! | * |
| d. qo.f**e**l | | | | *! | | |
| e. qof.l**e** | | | | *! | | |
| f. qofl.e | *! | | | * | | * |

The tableau (7) unsuccessfully determines the wrong candidate (a) as the optimal output. In addition candidate (c), as the desired output, is eliminated due to its violation of the LINEARITY constraint. The rest of candidates violate ONS, MAX-IO and DEP-IO. To determine candidate (c) as optimal, another constraint is introduced below to eliminate candidate (a):

(8) Sonority Sequencing Principle (SSP) (Morelli 1999:22): Sonority increases towards the syllable peak and decreases towards syllable margins.

The above constraint outranks LINEARITY to eliminate candidate (a). It is then important to consider the following tableau:

(9)

ONS>>*$COMPLEX_{ONS}$>>MAX-IO>>DEP-IO>> SSP>>LINEARITY>>*$COMPLEX_{COD}$

| /qofl/ | ONS | *$COMPLEX_{ONS}$ | MAX-IO | DEP-IO | SSP | LINEARITY | *$COMPLEX_{COD}$ |
|---|---|---|---|---|---|---|---|
| a. qofl | | | | | *! | | * |
| b. qof | | | *! | | | | |
| c. ☞ qolf | | | | | | * | * |
| d. qo.f**e**l | | | | *! | | | |
| e. qof.l**e** | | | | *! | | | |
| f. qofl.e | *! | | | * | * | | * |

The SSP constraint in the tableau above helps to determine candidate (c) as being optimal, since the word-final cluster for this candidate does not constitute any manner of sonority violation. Conversely, the word-final cluster for Candidate (a), which constitutes sonority reversal, does violate SSP constraints. For that reason, this candidate fails to be optimal.

Jahangiri (1980), Ahmadkhani (2010), and Khalifelu & Khoshkhoonejad (2015) state that synchronic metathesis in Persian is also motivated by the Syllable Contact Law (Hooper, 1972). To comply with this law, $C_1$ in a heterosyl-

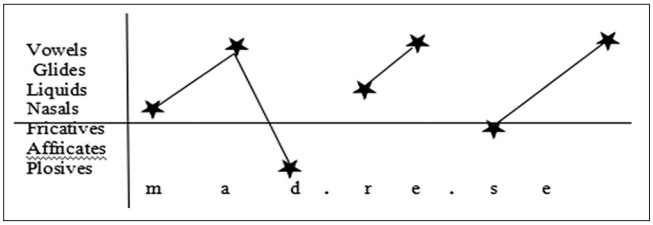
labic cluster must be more sonorous than $C_2$ in Persian. Accordingly, a heretrosyllabic cluster that violates the Syllable Contact Law in Persian undergoes metathesis. This is better expressed by considering that $C_1$ in a heterosyllabic cluster is less sonorous than $C_2$ and this will result in rising sonority across a syllable boundary. Synchronic metathesis is invoked to solve this problem and it is important to consider the following examples in Modern Persian:

(10) Synchronic metathesis is motivated by the Syllable Contact Law in Modern Persian

| | | | |
|---|---|---|---|
| a. | /mad.re.se/ | [mar.de.se] | 'school' |
| b. | /tub.re/ | [tur.be] | 'bag' |
| c. | /tak.si/ | [tas.ki] | 'taxi' |
| d. | /qom.ri/ | [qor.mi] | 'pigeon' |
| e. | /sab.zi/ | [saz.bi] | 'vegetable' |
| f. | /haz.rat/ | [har.zat] | 'lord or Imam' |
| g. | /bef.ruʃ/ | [bef.ruʃ] | 'sell' |

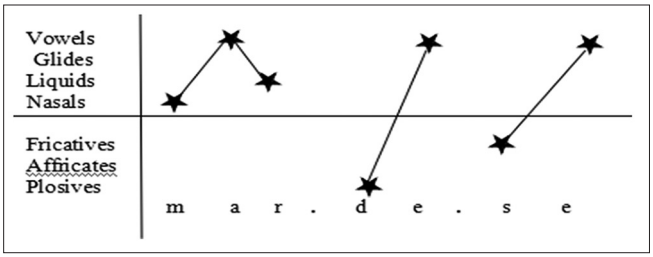
The following representation of the sonority of the word/mad.re.se/'school' in Standard Persian shows how sonority rises across a syllable boundary which is consequently against the Syllable Contact Law:

(11)




The word/mad.re.se/is, however, adapted in Modern Persian using the metathesis of the heterosyllabic cluster/d.r/in order to comply with the Syllable Contact Law as shown in the following representation of sonority:

(12)




In terms of phonological derivation, metathesis to obey the Syllable Contact Law in Modern Persian is accomplished by two phonological rules being in a particular bleeding order. This is illustrated below in the bleeding order of the input/mad.re.se/in Modern Persian:

(13) Bleeding order in Modern Persian

| | |
|---|---|
| Underlying: | /mad.re.se |
| Metathesis of heterosyllabic consonants: | mar.de.se |
| Contact anaptyxis: | - |
| Surface: | [mar.de.se] |

According to the bleeding order in (13), the first rule - as metathesis - targets hetrosyllabic consonants which do not conform to the Syllable Contact Law. The process of the first rule, metathesis, blocks the environment where the second rule, contact anaptyxis, can be applied.1The candidates for the input/mad.re.se/are evaluated in the follwing tableau:

(14)

ONS>>*COMPLEX$_{ONS}$>>MAX-IO>>DEP-IO>> SSP>>LINEARITY>>*COMPLEX$_{COD}$

| / mad.re.se / | ONS | *COMPLEX$_{ONS}$ | MAX-IO | DEP-IO | SSP | LINEARITY | *COMPLEX$_{COD}$ |
|---|---|---|---|---|---|---|---|
| a.☹ mar.de.se | | | | | | *! | |
| b.☜ mad.re.se | | | | | | | |
| c. ma.da.re.se | | | | *! | | | |
| d. ma.re.se | | | *! | | | | |
| e. ma.rde.se | | *! | | | * | | |
| f. mad.res.e | *! | | | | | | |

In the tableau above, the wrong candidate (b) is identified as optimal as it has no violation of highly-ranked constraints on the LINEARITY constraint. Candidate (a), the desired output, fails to be optimal due to violation of the LINEARITY constraint. The rest of candidates are eliminated from being optimal due to violation of highly-ranked constraints including ONS, COMPLEX$_{COD}$, MAX-IO, DEP-IO and SSP. To determine candidate (a) as optimal, the following constraint is introduced to eliminate candidate (b):

The number of this part (15) must be clearly shown, as follows:

(15) Syllable Contact (SYLLCON)[3] Bat El (1996:302)

The onset of a syllable must be less sonorous than the last segment in the immediately preceding syllable.

The above constraint outranks LINEARITY in order to eliminate candidate (b). Consider the following tableau:

(16)

ONS>>*COMPLEX$_{ONS}$>>MAX-IO>>DEP-IO>> SSP>>SYLLCON>>LINEARITY>>*COMPLEX$_{COD}$

| / mad.re.se / | ONS | *COMPLEX$_{ONS}$ | MAX-IO | DEP-IO | SSP | SYLLCON | LINEARITY | *COMPLEX$_{COD}$ |
|---|---|---|---|---|---|---|---|---|
| a.☞ mar.de.se | | | | | | | * | |
| b. mad.re.se | | | | | | *! | | |
| c. ma.da.re.se | | | | *! | | | | |
| d. ma.re.se | | | *! | | | | | |
| e. ma.rde.se | | *! | | | * | | | |
| f. mad.res.e | *! | | | | | * | | |

The SYLLCON constraint successfully helps to identify candidate (a) as optimal since this constraint is violated by the wrong candidate (b). The rest of candidates violate a range of highly-ranked constraints including ONS, COMPLEX$_{ONS}$, MAX-IO, DEP-IO, and SSP.

In conclusion, it can be seen that synchronic metathesis in Persian is conditioned by SSP and Syllable Contact Law. The metathesis that is conditioned by SSP results from a phonological derivation known as *bleeding* occurs where the first rule blocks the second. Since the reference to intermediate steps between input and output is not necessary, Parallel OT is shown as an OT model that is capable of accounting for bleeding, as a transparent rule interaction. The metathesis that is conditioned by the Syllable Contact Law results from the same phonological derivation, bleeding. This means that Parallel OT is also shown as an OT model that can handle the bleeding order that results from metathesis motivated by the Syllable Contact Law. The next section is devoted to presenting the grammar of metathesis in Modern Persian through a unified set of OT constraints.

## A UNIFIED SET OF OT CONSTRAINTS

The grammar of metathesis in Modern Persian is shown in this section through a unified set of OT constraints outlined in the following tableaux:

(17)

ONS>>*COMPLEX$_{ONS}$>>MAX-IO>>DEP-IO>>SSP>>SYLLCON>> LINEARITY>>*COMPLEX$_{COD}$

| | ONS | *COMPLEX$_{ONS}$ | MAX-IO | DEP-IO | SSP | SYLLCON | LINEARITY | *COMPLEX$_{CO}$ |
|---|---|---|---|---|---|---|---|---|
| /qofl/ | | | | | | | | |
| a. Qofl | | | | | *! | | | * |
| b. Qof | | | *! | | | | | |
| c. ☞ qolf | | | | | | | * | * |
| c. qo.fel | | | | *! | | | | |
| d. qof.le | | | | *! | | * | | |
| e. qofl.e | *! | | | * | * | | | * |
| | | | | | | | | |
| / mad.re.se / | | | | | | | | |
| a. ☞ mar.de.se | | | | | | | * | |
| b. mad.re.se | | | | | | *! | | |
| c. ma.da.re.se | | | | *! | | | | |
| d. ma.re.se | | | *! | | | | | |
| e. ma.rde.se | | *! | | | * | | | |
| f. mad.res.e | *! | | | | | * | | |

## CONCLUSION

Investigating the phonological derivations found in synchronic metathesis in Modern Persian in the light of OT has been the main concern of this paper. The findings show that synchronic metathesis conditioned by SSP occurs through two phonological rules where the first rule, metathesis of word-final cluster, blocks the environment for the second, Sonority-Driven Epenthesis. This type of phonological derivation is known as *bleeding*. It has been shown that OT Parallelism successfully accounts for bleeding since the reference to intermediate steps between input and output is not crucial. Bleeding, as a transparent rule interaction, is also found in synchronic metathesis motivated by the Syllable Contact Law. The first rule, metathesis, blocks the environment for the second, contact anaptyxis. Parallel OT is also capable of accounting for the bleeding order that results from the second phenomenon of metathesis in Modern Persian, metathesis conditioned by the Syllable Contact Law.

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## END NOTES

1 Sonority-Driven Epenthesis is when vowel epenthesis targets word-final clusters with rising sonority (Fullwood 2014).

2 Contact anaptyxis is about vowel epenthesis, which targets heterosyllabic consonants that result in the violation of Syllable Contact Law.

3 Bat El (1996) proposed this constraint based on the Syllable Contact Law introduced by Vennemann (1988).

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