

## **Contiguous Metathesis in Spoken Iraqi Arabic: An Optimality–Theoretic Study**

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### **Abstract:**

This study investigates the phonological process of contiguous metathesis in Spoken Iraqi Arabic (SIA) using the framework of Optimality Theory (OT). The study aims to assess OT's effectiveness in explaining contiguous metathesis in SIA and to identify the underlying factors that drive this process. Through an analysis of SIA data, the study applies an OT-based approach to evaluate the patterns involved. The findings reveal that OT effectively accounts for contiguous metathesis in SIA, identifying three distinct patterns of the phenomenon, each governed by specific markedness constraints. The first pattern is influenced by the sonority-related constraint SYLLCON, the second by constraints related to onset and coda restrictions, and the third by syllable structure constraints. These results highlight that, in SIA, the elimination of marked structures is prioritized over preserving the original linear order of segments.

**Keywords: (Metathesis, Contiguous Metathesis, Spoken Iraqi Arabic, Optimality Theory, Phonological Processes).**

### **1. Introduction**

Metathesis, the rearrangement of the linear sequence of segments in a word, is a phonological phenomenon found in many languages around the world. Despite its widespread occurrence, it remains relatively understudied compared to other well-researched phonological processes such as assimilation, deletion, and epenthesis. In certain Arabic dialects, including SIA, metathesis presents challenges to phonological theory, with many aspects of the process remaining unexplored. To address this gap, the present study offers an analysis of metathesis in SIA within the framework of OT (Prince

& Smolensky, 1993/2004; McCarthy & Prince, 1995). Specifically, this study focuses on one type of metathesis: contiguous metathesis. The study aims to address two primary research questions:

1. Can OT adequately account for contiguous metathesis in SIA?
2. What factors trigger contiguous metathesis in SIA?

The study is structured as follows: Section 2 provides an overview of OT. Section 3 examines metathesis as a phonological process. Section 4 delves into the linguistic features of SIA. Section 5 reviews prior research on metathesis, highlighting gaps in the literature. Section 6 describes the methodology employed. Section 7 presents an OT-based analysis of contiguous metathesis in SIA. Finally, Section 8 concludes the study by summarizing its main findings.

## **2. OT**

OT is a contemporary grammatical framework introduced by Prince and Smolensky in 1993, emerging from the foundations of Generative Phonology. However, OT represents a significant departure from traditional rule-based theories, such as autosegmental and linear phonology. Rather than relying on prescriptive rules, OT operates on constraints.

The core principle of OT is that the surface forms of a language result from resolving conflicts among competing constraints. These constraints are universal but ranked differently across languages, which accounts for linguistic variation. The optimal surface form is the one that best satisfies the ranked constraints, incurring the fewest significant violations of the higher-ranked constraints while potentially violating lower-ranked ones.

### **2.1 OT: Principles**

OT is built on several fundamental principles that define its approach to understanding linguistic phenomena. These principles, as outlined by Prince and Smolensky (1993/2004), McCarthy and Prince (1993a, 1993b, 1994a), and Kager (1999), are as follows:

1. **Universality:** Constraints in OT are universal, meaning they exist across all languages' grammars.
2. **Ranking:** Each language has its own specific hierarchy of constraints, which determines its unique grammar. The relative ranking of these universal constraints explains the variations observed across languages.
3. **Violability:** In OT, constraints can be violated, but only minimally and when necessary to satisfy higher-ranked constraints.
4. **Domination:** When constraints conflict, the higher-ranked constraint takes precedence.
5. **Fallacy of Perfection:** No candidate can satisfy all constraints simultaneously. Instead, the goal is to select the most harmonious output.
6. **Inclusiveness:** Only plausible and well-formed candidates are generated and evaluated to ensure an inclusive analysis.
7. **Parallelism:** In OT, all possible candidates are generated and evaluated simultaneously, rather than in a step-by-step sequence.

## 2.2 OT: Framework

OT operates on a simple mechanism that establishes a relationship between input and output, where each input corresponds to a specific output (McCarthy, 2008). This process relies on essential components to evaluate and generate outputs systematically. While scholars differ slightly on the exact number of components, the consensus is that OT consists of four primary elements: LEX, GEN, EVAL, and CON (Zsiga, 2013; Cooper, 2015).

### 2.2.1 LEX

The first component of OT is the Lexicon (LEX), which provides the underlying forms or lexical representations that serve as inputs to GEN (Kager, 1999). Unlike outputs, inputs from the lexicon are not subject to constraints or evaluation. This principle aligns with the Richness of the Base hypothesis proposed by Prince and Smolensky (1993/2004) and elaborated by Smolensky (1996). According to this hypothesis, no

constraints apply at the level of underlying forms. As Kager (1999) explains, the lexicon operates independently of constraints, ensuring that any theoretically possible input can be generated and evaluated, regardless of its initial structure.

### 2.2.2 GEN

The second component of OT is the Generator (GEN). GEN's primary role is to create a range of possible output forms, collectively referred to as the candidate set. For each input, GEN generates potential outputs, allowing the grammar to evaluate and select the most optimal or accurate pronunciation. Prince and Smolensky (2002) describe the candidate set as the collection of alternative outputs that GEN produces for a given input. While the candidate set contains many ungrammatical forms, only one is ultimately chosen as the optimal output.

The relationship between the input, GEN, and the candidate set can be represented as follows (McCarthy, 2008, p. 16):

$$/input/ \rightarrow \text{GEN} \rightarrow \{\text{cand}_1, \text{cand}_2, \dots, \text{cand}_n\}$$

This representation shows that for any given input, GEN generates a universal set of potential candidates, from which the grammar identifies the optimal output.

### 2.2.3 EVAL

The third component of OT is the Evaluator (EVAL), which plays a crucial role in determining the most optimal candidate from the set of potential outputs generated by GEN. EVAL applies a hierarchy of constraints specific to the language to assess the candidates. McCarthy (2008, p. 19) describes EVAL's primary function as "finding the optimal candidate."

Using the ranked constraints defined in CON, EVAL evaluates the candidate set and identifies the form that best satisfies the constraints while incurring the fewest violations. This evaluation process ensures that the chosen output aligns with the language's specific grammatical structure.

McCarthy (2008, p. 19) illustrates the complete interaction between the input, GEN, the candidate set, EVAL, and the final output using the following representation:

**/input/ → Gen → {cand<sub>1</sub>, cand<sub>2</sub>, . . . } → Eval → [output]**

This highlights how GEN produces all logically possible candidates for a given input, and EVAL systematically assesses these candidates to select the optimal form. The optimal candidate is the one that strikes the best balance between satisfying the higher-ranked constraints and minimally violating lower-ranked ones.

#### 2.2.4 CON

The fourth component of OT is the Constraint Set (CON). These constraints guide the evaluation process, as EVAL uses CON to analyze the outputs generated by GEN and determine the optimal output. Kager (1999) defines a constraint as “a structural requirement that may be either satisfied or violated by an output form” (p. 9). Simply put, an output satisfies a constraint when it adheres to its structural requirement, and a violation occurs when it does not.

Constraints in OT are divided into two primary categories: markedness constraints and faithfulness constraints.

Markedness constraints focus on structural requirements that ensure the well-formedness of output forms, independent of their corresponding input forms (Kager, 1999). These constraints evaluate outputs based on preferred structural patterns. For instance, syllables with onsets are considered more desirable than onsetless syllables. Markedness constraints thus prioritize outputs that conform to universal preferences for linguistic structure (McCarthy, 2002).

Faithfulness constraints, on the other hand, evaluate outputs by maintaining their resemblance to the input forms (Kager, 1999). Unlike markedness constraints, faithfulness constraints operate on both inputs and outputs. Their primary aim is to preserve the integrity of the input in the output, ensuring minimal deviation. McCarthy (2007) describes faithfulness constraints as inherently conservative because they resist changes to the input's structure, emphasizing adherence to the original form.

### 2.3 OT: Tableau

McCarthy (2008) illustrates the evaluation process in OT using a tableau. A sample OT tableau is presented below:

**Tableau 2.3**

*Con1 » Con2 » Con3» Con4*

/Input/	Con1	Con2	Con 3	Con 4
Cand-a	*!			
Cand-b		*!		
☞ Cand-c			*	*
Cand-d			**!	

In this tableau, the input form is displayed at the top left and is enclosed in slashes, following standard phonological conventions. Below the input, potential output candidates are listed in the first column. The constraints are organized from left to right in a hierarchy, ranked from the most dominant (Con1) to the least dominant (Con4). The ranking hierarchy is expressed as Con1 » Con2 » Con3 » Con4, where the symbol (») indicates that the constraint on the left outranks the one on the right.

A solid line between columns represents strict ranking, while a dotted line indicates equal ranking. Blank cells signify that a candidate satisfies a given constraint, while shaded cells denote violations deemed irrelevant after the candidate has been eliminated due to a higher-ranked fatal violation. For the winning candidate, any remaining violations are shaded, as there is no further competition. For instance, in the tableau above, candidate (c) satisfies all relevant constraints and has no competitors under Con4.

Violations are marked with an asterisk (\*), and a fatal violation—when a candidate breaches a higher-ranked constraint that others satisfy—is indicated by an asterisk paired with an exclamation mark (\*!).

In this example, candidate (a) is eliminated due to a fatal violation of Con1, which other candidates satisfy. Similarly, candidate (b) is disqualified for violating Con2, leaving candidates (c) and (d) in competition. At Con3, candidate (c) incurs fewer violations than

candidate (d), making it the optimal output. The winning candidate is marked with a pointing finger symbol (☞).

### 3. Metathesis

Metathesis is a phonological phenomenon in which two segments within a word switch positions, leading to a reordering of sounds. These segments can involve two consonants, a consonant and a vowel, or two vowels. From a linguistic perspective, one sequence is regarded as the original input form, while the reordered version represents the output produced through the process of metathesis (Hume, 1998).

Hume (2001) defines metathesis as “the process whereby in certain languages, under certain conditions, sounds appear to switch positions with one another. Thus, in a string of sounds where we would expect the linear ordering of two sounds to be ...xy..., we find instead ...yx...” (p. 1).

Metathesis can be categorized into two types based on the distance between the reordered segments. Contiguous metathesis occurs when the segments involved are directly next to each other, with no intervening sounds. Non-contiguous metathesis takes place when the segments undergoing metathesis are separated by one or more intermediate segments (Leslau, 1992).

### 4. Spoken Iraqi Arabic

Iraqi Arabic, also referred to as Mesopotamian Arabic, is the most widely spoken dialect in Iraq, with nearly 80% of the population using it as their native language (Al-Ani & Al-Birazy, 1979; Peoples & Bailey, 2012).

The phonological system of SIA includes 40 phonemes, comprising 8 monophthongal vowels and 32 consonants. The vowels consist of 3 short vowels: /i, u, a/, and 5 long vowels: /i:, e:, a:, o:, u:/. The consonantal inventory includes: /p, b, t, ʈ, d, ɖ, k, g, q, ʔ, f, θ, ð, ʒ, s, ʂ, z, ʃ, x, ɣ, ɸ, ʕ, h, tʃ, dʒ, m, n, l, ɭ, r, w, y/ (Abdul Sattar, 1989).

In terms of syllable structure, SIA features eleven syllabic patterns, encompassing open, closed, and double-closed syllables. These patterns include: /cv, cvv, cvc, ccv, ccvv, cvcc, ccvc, cvvc, ccvcc, ccvvc, cvvcc/. The structure allows a maximum of two

consonants in both onset and coda positions, represented by the formula  $C_{0-2} V C_{0-2}$  (Abdul Sattar, 2015).

## 5. Previous Studies

OT has been utilized to explore metathesis in several Arabic dialects, including Algerian Arabic (Benyoucef, 2013), Najdi Arabic (Alqahtani, 2014), Libyan Arabic (Elramli, 2014), Syrian Arabic (Habib, 2022), and Moroccan Arabic (Idrissi, 2023). Despite these advancements, no study has yet applied OT to analyze metathesis in SIA. The only study addressing metathesis in SIA is by Jasim and Sharhan (2013), who approached it synchronically. Their findings revealed that metathesis in SIA involves shifts in both adjacent and non-adjacent consonant sounds. They also found that metathesis in this dialect serves no grammatical purpose and concluded that it is a sporadic and abrupt process, rather than a gradual or systematic phenomenon. This gap highlights the need for further research to apply OT to SIA, offering a more comprehensive understanding of the mechanisms driving metathesis in this dialect.

## 6. Procedures of the Study

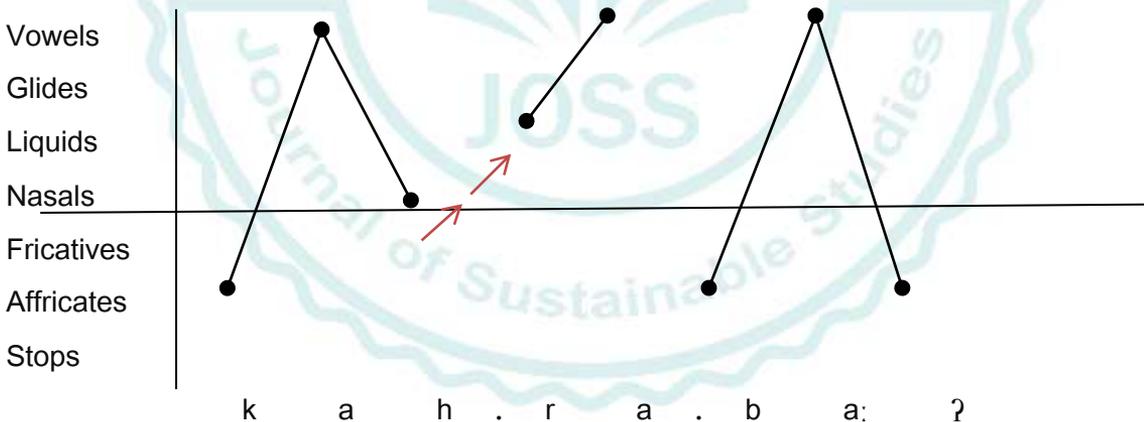
The study follows these steps:

1. Linguistic data are collected through personal observations and documented studies. The selected words are carefully verified to exclude speech errors or slips of the tongue, ensuring that only words commonly used by Iraqi speakers are included.
2. The collected words are transcribed into their phonetic forms, syllabified, and their stress patterns are identified.
3. The data are analyzed within the framework of OT.
4. The findings are interpreted through the lens of OT, addressing the study's research questions.
5. Conclusions are drawn, and suggestions for future research are provided.

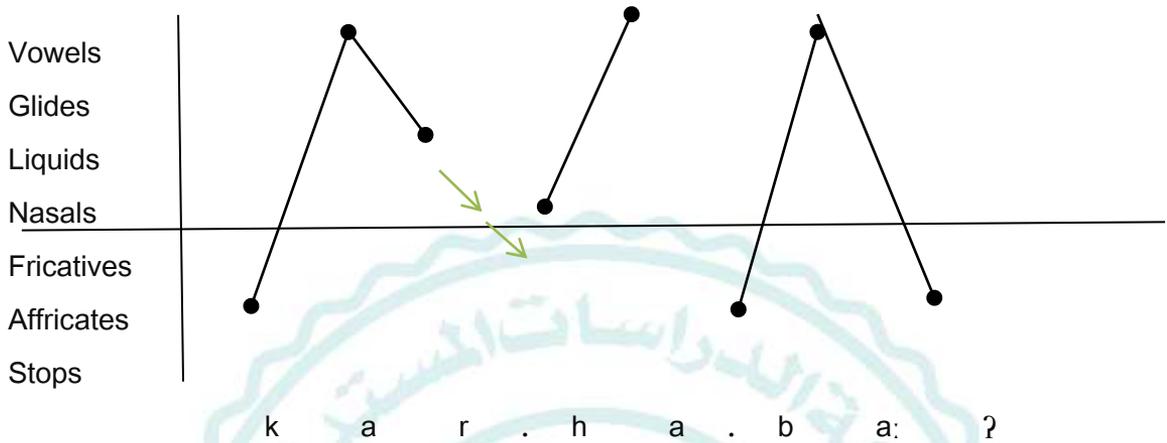


In the inputs /kah.ra.'ba:ʔ/, /daʕ.ram/, and /ʕaʔ.'ʃa:n/, the coda of the first syllable has lower sonority than the onset of the second syllable, leading to a rising sonority across the syllable boundary. This pattern violates the markedness constraint SYLLCON, which requires a falling sonority across syllable boundaries. To resolve this violation, metathesis occurs, reordering the segments to create the required falling sonority and thus satisfying the constraint.

For example, in the input /kah.ra.'ba:ʔ/, the first syllable ends with the fricative /h/, while the second syllable begins with the liquid /r/. Since /r/ is more sonorous than /h/, this results in a rising sonority across the syllable boundary, violating SYLLCON. Metathesis addresses this issue by switching the order of /h/ and /r/ in the output [kar.ha.'ba:ʔ]. This adjustment creates a falling sonority across the syllable boundary, aligning with the constraint's requirements. The figures below illustrate the sonority pattern before and after metathesis, showing the initial rise across the syllable boundary and the subsequent fall achieved after metathesis.

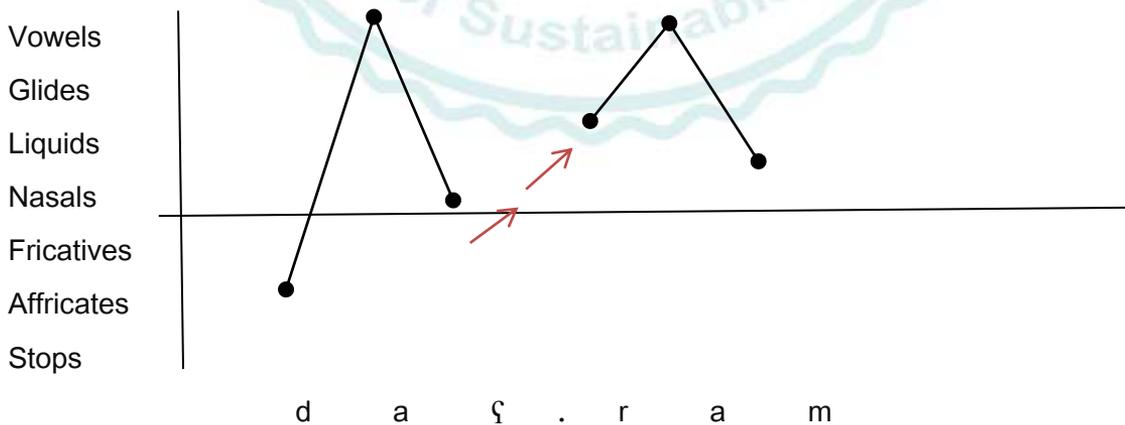


**Figure 7.2.** *The Sonority Representation of the Input /kah.ra.'ba:ʔ/*

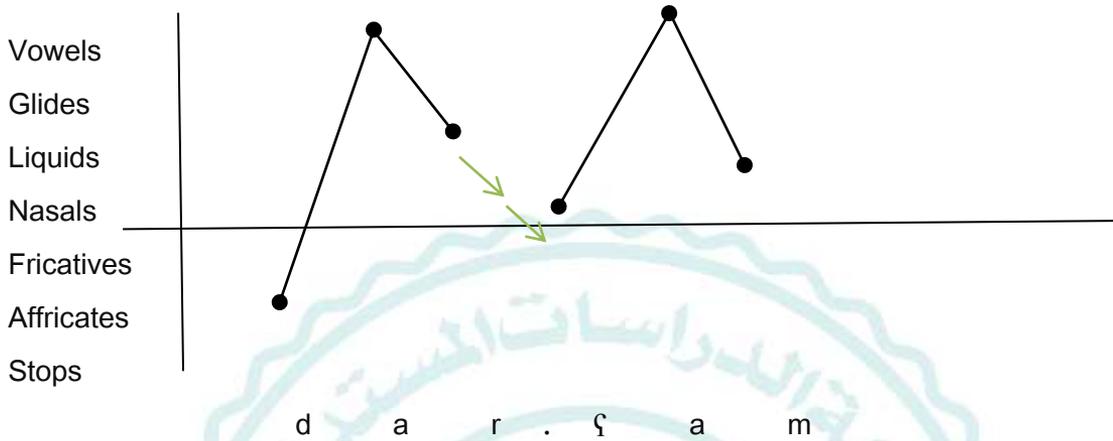


**Figure 7.3.** *The Sonority Representation of the Output [kar.ha.'ba:ʔ]*

Similarly, in the input /'daʕ.ram/, the first syllable ends with the fricative /ʕ/, and the second syllable begins with the liquid /r/. Because /r/ is more sonorous than /ʕ/, this configuration creates a rising sonority across the syllable boundary, violating the markedness constraint SYLLCON. To resolve this, metathesis reorders the segments /ʕ/ and /r/ in the output ['dar.ʕam], resulting in a falling sonority that satisfies SYLLCON. The figures below illustrate how the sonority changes across the syllable boundary, showing the rising pattern before metathesis and the falling pattern after the segments are reordered.

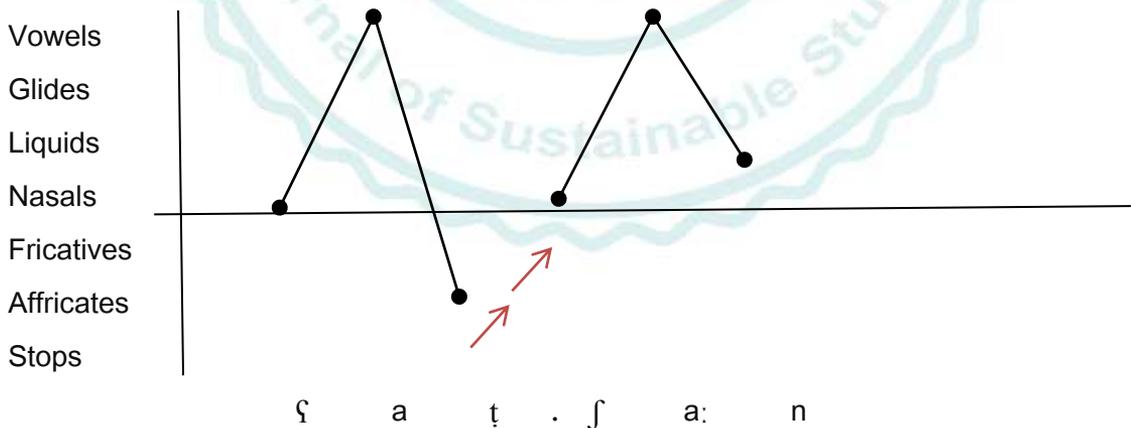


**Figure 7.4.** *The Sonority Representation of the Input /daʕ.ram/*

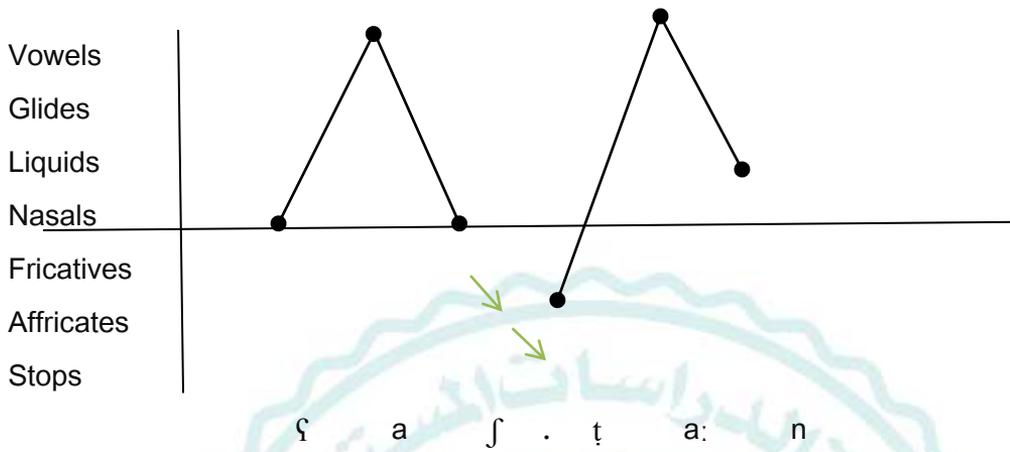


**Figure 7.5.** *The Sonority Representation of the Output ['dar.ʕam]*

Lastly, in the input /ʕaʕ.'ja:n/, the first syllable ends with the stop /t/, while the second syllable begins with the fricative /ʃ/. Since /ʃ/ is more sonorous than /t/, this configuration also leads to a rising sonority, which violates SYLLCON. Metathesis addresses this issue by switching the positions of /t/ and /ʃ/ in the output [ʕaʕ.'ʔa:n], creating a falling sonority that complies with the constraint. The figures below depict the rise and fall in sonority across the syllable boundary before and after metathesis.



**Figure 7.6.** *The Sonority Representation of the Input /ʕaʕ.'ja:n/*



**Figure 7.7.** *The Sonority Representation of the Output [ʕaʃ.ʔa:n]*

The constraints considered essential for this analysis include:

- **SYLLABLE CONTACT LAW (SYLLCON):** “The onset of a syllable must be less sonorous than the last segment in the immediately preceding syllable, and the greater the slope in sonority, the better” (Bat-El, 1996, p. 302).
- **\*COMPLEX<sup>ONS</sup> (\*<sub>6</sub>CC):** “Onsets must be simple” (Kager, 1999, p. 97).
- **DEPENDENCE-INPUT-OUTPUT (DEP-IO):** “Every element of  $S_2$  has a correspondent in  $S_1$ ,” ensuring no epenthesis occurs (McCarthy & Prince, 1995, p. 122).
- **LINEARITY-INPUT-OUTPUT (LIN-IO):** “ $S_1$  is consistent with the precedence structure of  $S_2$ ,” prohibiting metathesis (McCarthy & Prince, 1995, p. 123).

The analysis adopts the following constraint hierarchy:

**SYLLCON, \*<sub>6</sub>CC, DEP-IO » LIN-IO**

In this hierarchy, the markedness constraints SYLLCON and \*<sub>6</sub>CC, together with the faithfulness constraint DEP-IO, are ranked equally at the top and take precedence over the lower-ranked faithfulness constraint LIN-IO. The interaction of these constraints is demonstrated through the following tableaux.

**Tableau 7.1.** Mapping of /kah.ra.'ba:ʔ/ onto [kar.ha.'ba:ʔ]

**SYLLCON, \*<sub>l</sub>CC, DEP-IO » LIN-IO**

/kah.ra.'ba:ʔ/	SYLLCON	* <sub>l</sub> CC	DEP-IO	LIN-IO
a. [kah.ra.'ba:ʔ]	*!			
b. [kha.ra.'ba:ʔ]		*!		*
c. [ka.hi.ra.'ba:ʔ]			*!	
☞ d. [kar.ha.'ba:ʔ]				*

**Tableau 7.2.** Mapping of /'daʕ.ram/ onto ['dar.ʕam]

**SYLLCON, \*<sub>l</sub>CC, DEP-IO » LIN-I**

/'daʕ.ram/	SYLLCON	* <sub>l</sub> CC	DEP-IO	LIN-IO
a. ['daʕ.ram]	*!			
b. ['dʕa.ram]		*!		*
c. ['da.ʕi.ram]			*!	
☞ d. ['dar.ʕam]				*

**Tableau 7.3.** Mapping of /ʕaʔ.'ʕa:n/ onto [ʕaʕ.'ʕa:n]

**SYLLCON, \*<sub>l</sub>CC, DEP-IO » LIN-IO**

/ʕaʔ.'ʕa:n/	SYLLCON	* <sub>l</sub> CC	DEP-IO	LIN-IO
a. [ʕaʔ.'ʕa:n]	*!			
b. [ʕʔa.'ʕa:n]		*!		*
c. [ʕa.ʔi.'ʕa:n]			*!	
☞ d. [ʕaʕ.'ʕa:n]				*

The following analysis applies to all three instances discussed above, as the phonological patterns and constraint interactions are consistent across these cases.

In the tableaux above, the faithful candidate (a) is eliminated because it fatally violates the highly ranked constraint SYLLCON. Candidate (b) satisfies SYLLCON but is disqualified because it fatally violates the equally highly ranked constraint \*<sub>l</sub>CC by allowing complex onsets in the first syllable. Similarly, candidate (c), which satisfies both

SYLLCON and  $*[_{\sigma}CC]$ , is ruled out due to a fatal violation of DEP-IO for introducing a segment not present in the input. Candidate (d), however, satisfies the highly ranked constraints SYLLCON,  $*[_{\sigma}CC]$ , and DEP-IO, while violating the lower-ranked constraint LIN-IO due to metathesis. Since this violation is non-fatal, candidate (d) is selected as the most optimal output.

The examples illustrating the second pattern of contiguous metathesis in SIA are presented in the following table:

**Table 7.2.** *Examples of the Second Pattern of Contiguous Metathesis in SIA*

No.	Original Form	Transcription	Metathesized Form	Transcription	Metathesized Sounds	Gloss
1	نزغة	/ˈnaz.ɡa/	نغزة	/ˈnaɡ.za/	/z/ & /ɡ/	Sudden ache
2	قبضة	/ˈqab.ɖa/	كضبة	/ˈqaɖ.ba/	/b/ & /ɖ/	Fist
3	يتنفرز	/jit.ˈnar.faz/	يتنفرز	/jit.ˈnaf.raz/	/r/ & /f/	He gets nervous

In all these cases, the primary factors driving metathesis are markedness constraints that govern the placement of consonants in syllable onsets and codas. These constraints impose specific restrictions on the permissible positions of consonants within syllables.

In addition to the previously discussed faithfulness constraints DEP-IO and LIN-IO, the following constraints are crucial for analyzing this pattern:

- $*[_{\sigma}+CONT,+VOICE,-ANT]$  ( $*[_{\sigma}ɡ]$ ): “Any [+cont,+voice,-ant] segment is not allowed in onset position” (Hayes & Wilson, 2008, p. 16).
- **NO-CODA-r** ( $*r]_{\sigma}$ ): “[r] is not allowed in coda position” (Hayes & Wilson, 2008, p. 33).
- **NO-LABIAL-CODA** ( $*LAB]_{\sigma}$ ): “Labial consonants are not allowed in coda position” (Hayes & Wilson, 2008, p. 33).
- **MAXIMALITY-INPUT-OUTPUT (MAX-IO)**: “Every element of  $S_1$  has a correspondent in  $S_2$ ” (no deletion) (McCarthy & Prince, 1995, p. 122).

- **IDENTITY-INPUT-OUTPUT (IDENT-IO):** “Correspondent segments in  $S_1$  and  $S_2$  have identical values for the feature F” (McCarthy & Prince, 1995, p. 122).

For the input /'naz.ǧa/, the consonant /ǧ/ appears in the onset position of the second syllable /.ǧa/, violating the constraint  $*[_{\sigma}\text{ǧ}]$ , which prohibits /ǧ/ from appearing in onset positions. To address this violation, metathesis occurs, causing the consonants /z/ and /ǧ/ to switch places. This results in the output ['naǧ.za], where /ǧ/ is shifted to the coda of the first syllable, and /z/ becomes the onset of the second syllable, thereby satisfying the  $*[_{\sigma}\text{ǧ}]$  constraint.

In the case of /'qab.ða/, the labial consonant /b/ is found in the coda position of the first syllable /qab./, violating the constraint  $*\text{LAB}]_{\sigma}$ , which disallows labial consonants in coda positions. Metathesis resolves this issue by swapping /b/ and /ð/, resulting in the output ['gað.ba]. In this new configuration, /b/ moves to the onset of the second syllable, while /ð/ occupies the coda of the first syllable, ensuring compliance with the  $*\text{LAB}]_{\sigma}$  constraint.

Lastly, for the input /jit.'nar.faz/, the consonant /r/ appears in the coda of the second syllable /.nar./, violating the constraint  $*r]_{\sigma}$ , which prohibits /r/ from appearing in coda positions. To resolve this violation, metathesis occurs, switching /r/ and /f/. This produces the output [jit.'naf.raz], where /r/ moves to the onset of the third syllable, and /f/ takes the coda position of the second syllable, thereby satisfying the  $*r]_{\sigma}$  constraint.

The analyses for these cases are illustrated in the following tableaux:

**Tableau 7.4.** Mapping of /'naz.ǧa/ / onto ['naǧ.za]

$*[_{\sigma}\text{ǧ}]$ , MAX-IO, DEP-IO » LIN-IO

/'naz.ǧa/	$*[_{\sigma}\text{ǧ}]$	MAX-IO	DEP-IO	LIN-IO
a. ['naz.ǧa]	*!			
b. ['naz.a]		*!		
c. ['na.zi.ǧa]			*!	
☞ d. ['naǧ.za]				*

**Tableau 7.5.** Mapping of /'qab.ða/ onto ['gað.ba]

**\*LAB]<sub>σ</sub>, MAX-IO, DEP-IO » IDENT-IO, LIN-IO**

/qab.ða/	*LAB] <sub>σ</sub>	MAX-IO	DEP-IO	IDENT-IO	LIN-IO
a. [qab.ða]	*!				
b. [qa.ða]		*!			
c. [qa.ba.ða]			*!		
☞d. [gað.ba]				*	*

**Tableau 7.6. Mapping of /jit.'nar.faz/ onto [jit.'naf.raz]**

**\*r]<sub>σ</sub>, MAX-IO, DEP-IO » LIN-IO**

/jit.'nar.faz/	*r] <sub>σ</sub>	MAX-IO	DEP-IO	LIN-IO
a. [jit.'nar.faz]	*!			
b. [jit.'na.faz]		*!		
c. [jit.'na.ri.faz]			*!	
☞d. [jit.'naf.raz]				*

Similar to the analysis of the first pattern, the following explanation applies to all three instances discussed above.

In the tableaux above, the faithful candidate (a) is eliminated because it places segments in positions prohibited by the highly ranked onset and coda restriction constraints. These violations are fatal, disqualifying the candidate from further consideration. Candidate (b) resolves the violations of onset and coda restriction constraints by deleting the prohibited segment. However, this deletion results in a fatal violation of the equally highly ranked constraint MAX-IO. Consequently, candidate (b) is also excluded. Candidate (c) satisfies both the onset and coda restriction constraints and MAX-IO but introduces a new segment that is not present in the input. This fatally violates DEP-IO, leading to the candidate's exclusion. Candidate (d) satisfies the highly ranked constraints, including the onset and coda restriction constraints, as well as MAX-IO and DEP-IO, while violating the lower-ranked constraint LIN-IO due to metathesis.

Since the violation of LIN-IO is non-fatal, candidate (d) is selected as the most optimal output.

The examples illustrating the third and last pattern of contiguous metathesis observed in SIA are presented in the following table:

**Table 7.3.** *Examples of the Third Pattern of Contiguous Metathesis in SIA*

No.	Original Form	Transcription	Metathesized Form	Transcription	Metathesized Sounds	Gloss
1	منيلك	/mne:l.lak/	مينلك	/me:n.lak/	/n/ & /e:/	Where did you get it from?
2	هيج	/hi:tʃ/	هجي	/hi.tʃi:/	/i:/ & /tʃ/	Like this

Unlike the earlier patterns involving consonant-consonant (CC) metathesis, this pattern features consonant-vowel (CV) metathesis, which is relatively rare in SIA. In these cases, the driving forces behind metathesis are syllable structure constraints, specifically \* $[\sigma\text{CC}]$  (which prohibits complex onsets within a syllable) and \*CODA (which prohibits syllables from ending in a consonant).

For the input /mne:l.lak/, the first syllable includes a complex onset /mn-/, violating the \* $[\sigma\text{CC}]$  constraint. To resolve this violation, metathesis occurs between the consonant /n/ and the vowel /e:/, resulting in the output [me:n.lak]. In this restructured form, the problematic onset cluster /mn-/ is eliminated, satisfying \* $[\sigma\text{CC}]$  constraint.

In the case of the input /hi:tʃ/, the word ends with a coda /tʃ/, which violates the \*CODA constraint. To satisfy this constraint, metathesis occurs between the consonant /tʃ/ and the vowel /i:/, accompanied by the epenthesis of a short vowel /i/. This process results in the output [hi.tʃi:], where both syllables are now open.

In addition to the constraints \* $[\sigma\text{CC}]$ , DEP-IO, IDENT-IO, and LIN-IO presented earlier, the relevant constraints selected for the analysis of these instances are as follows:

- **\*GEMINATE (\*GEM)**: “Geminate consonants are prohibited” (Crosswhite, 1998 as cited in Apostolopoulou, 2022, p. 256).
- **\*CODA**: “A syllable must not have a coda” (Prince and Smolensky, 1993/2004, p. 96).

The analysis of these two instances is illustrated in the following tableaux:

**Tableau 7.7.** Mapping of /'mni:l.lak/ onto ['mi:n.lak]

**\*<sub>σ</sub>CC, \*GEM, » IDENT-IO, LIN-IO**

/ 'mni:l.lak/	* <sub>σ</sub> CC	*GEM	IDENT-IO	LIN-IO
a. ['mni:l.lak]	*!	*		
b. ['mi:l.lak]		*!		
☞ c. ['mi:n.lak]			*	*

In this tableau, the faithful candidate (a) fatally violates the highly ranked constraint \*<sub>σ</sub>CC, which prohibits complex onsets, leading to its elimination from consideration. Candidate (b) satisfies \*<sub>σ</sub>CC but fatally violates the equally highly ranked constraint \*GEM, as it retains the geminated consonant /ll/. This fatal violation disqualifies candidate (b). Candidate (c) ['me:n.lak] successfully satisfies both \*<sub>σ</sub>CC and \*GEM, addressing the complex onset and avoiding the geminate consonant. However, it incurs violations of the lower-ranked constraints IDENT-IO, due to the substitution of the geminated consonant /ll/ with /l/, and LIN-IO, due to the occurrence of metathesis. Since these violations are non-fatal, candidate (c) emerges as the most optimal output.

**Tableau 7.8.** Mapping of /'hi:tʃ/ onto ['hi.tʃi:]

**\*CODA, \*<sub>σ</sub>CC » DEP-IO, LIN-IO**

/ 'hi:tʃ/	*CODA	* <sub>σ</sub> CC	DEP-IO	LIN-IO
a. ['hi:tʃ]	*!			
b. ['htʃi:]		*!		
☞ c. ['hi.tʃi:]			*	*

In this tableau, the faithful candidate (a) fatally violates the equally top-ranked constraint \*CODA, as the word ends with the consonant /tʃ/, leading to its elimination. Candidate (b) satisfies \*CODA but violates the equally top-ranked constraint \*[<sub>σ</sub>CC, due to the presence of the complex onset /htʃ-/. This fatal violation also disqualifies candidate (b). Candidate (c), on the other hand, successfully satisfies both \*CODA and \*[<sub>σ</sub>CC. Although it violates the lower-ranked constraints DEP-IO (through the insertion of the vowel /i/) and LIN-IO (due to metathesis), these violations are tolerated because they occur in lower-ranked constraints. Therefore, Candidate c emerges as the optimal output.

## 8. Conclusions

This study investigated the process of contiguous metathesis in SIA with two primary objectives: to assess the applicability of OT in explaining this phonological phenomenon and to identify the factors that trigger it. The findings confirmed that OT effectively accounts for all instances of contiguous metathesis observed in SIA. The analysis identified three distinct patterns of contiguous metathesis in SIA, each driven by specific markedness constraints. The first pattern is influenced by the sonority-related constraint SYLLCON. The second pattern is shaped by constraints on onset and coda positions. The third pattern is driven by syllable structure constraints. These results indicate that resolving marked structures in SIA's phonology takes precedence over maintaining the original linear order of segments, as reflected in the consistent ranking of markedness constraints above faithfulness constraints. Furthermore, the study found that contiguous metathesis in SIA predominantly involves consonant-consonant (CC) metathesis, with only a few instances of consonant-vowel (CV) metathesis. While this research provides a detailed analysis of metathesis, future studies could extend the investigation to other phonological processes in SIA, such as assimilation, elision, substitution, or epenthesis, within the OT framework. Such research would offer a more comprehensive

understanding of the phonological system of SIA and contribute further to the field of phonological theory.

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