

## **Regressive Consonant Assimilation across Word Boundaries in Maliki Arabic: An Optimality-Theoretic Analysis**

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### **Abstract**

This study adopts Optimality Theory (OT) to investigate regressive consonant assimilation across word boundaries in Maliki Arabic (MA), a Hijazi variety spoken in Bani Malik in the southern region of Saudi Arabia. The study employs a qualitative approach based on 60 unstructured interviews with native speakers of MA. The analysis reveals that assimilation in MA is governed by the dominance of markedness constraints, such as AGREE (F) and SHARE (F), over faithfulness constraints like IDENT (F). As a result, complete regressive assimilation occurs more frequently than partial assimilation, particularly between neighboring obstruents that share similar features. Moreover, coronal consonants are the most frequent triggers and targets of assimilation in MA. The study concludes that assimilation in MA is governed by the interaction of markedness and faithfulness constraints.

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**Keywords:** Phonology, assimilation, regressive assimilation, optimality theory, Maliki Arabic

### **Introduction**

Arabic varieties in the Kingdom of Saudi Arabia (KSA) are typically classified into five main regional categories: Najdi, Northern, Hijazi,

Eastern, and Southern (Al-Azraqi & Alharbi, 2022; Aldarsoni, 2011; Al-Rojaie, 2021, 2023; Bayazed et al., 2020). These colloquial dialects vary in their sound systems and in how the sounds interact with one another. One of the essential phonological processes to understand such interactions is assimilation, which is defined as the process whereby one sound causes an adjacent sound to become more similar (Dirven & Verspoor, 2004). Assimilation can be classified according to the direction of influence between sounds. Regressive assimilation, which is also referred to as backward or right-to-left assimilation, is the most common type across all languages (Gaskell & Zwitserlood, 2011; Skolnick & Cohn, 2012; Hyman & Plank, 2018). In regressive assimilation, a consonant assimilates to a following consonant by acquiring one or more of its phonological features (Papillon, 1882; Sayce, 1900). This phonological process has been widely explored in most Saudi dialects, such as Najdi Arabic (NA), Zahrani Arabic (ZA), and Ghamdi Arabic (GA). Nevertheless, Maliki Arabic (henceforth, MA), a variety of Hijazi Arabic spoken in Bani Malik region in the southeast of Taif Governorate (Al-Maliki, 1997), has not yet been investigated from a phonological perspective, particularly its assimilation patterns.

The study fills this gap by investigating the following research question: How do the features of adjacent consonants influence regressive assimilation across word boundaries in MA within the Optimality Theory (OT) framework? The central hypothesis is that regressive assimilation in MA is a systematic phonological process that includes changes in place, voicing, and manner features of adjacent consonants. To test this hypothesis, the study analyzes instances of regressive assimilation in MA and then evaluates the relevant patterns through OT tableaux.

This analysis is significant for several reasons. First, it documents one of the most common phonological processes in an understudied Arabic dialect. Second, the assimilation patterns identified in MA can be compared with those reported in neighbouring dialects, such as GA and ZA, to shed light on phonological variation within Saudi dialects. Finally, analyzing the assimilation patterns within OT would determine whether the identified constraint ranking is specific to MA or applicable to other varieties. Thus, this study provides the first phonological analysis of assimilation in MA, which contributes to phonological variation in Arabic literature.

## Literature Review

Scholars have widely investigated assimilation in Classical Arabic (CA). Research shows that assimilation includes several types, such as regressive, progressive, complete, partial, local, and distant assimilation. Data from the Quran show that neighboring consonants influence one another, triggering changes in neighboring segments (Alfozan, 1989).

Similarly, research on Quranic recitation in CA demonstrates that regressive and complete assimilation occur more frequently than progressive and partial assimilation (Rahim & Yunus, 2013).

Assimilation in Modern Standard Arabic (MSA) has been examined within different phonological frameworks. Within Optimality Theory (OT), assimilation between root and verbal patterns demonstrates that the nasal in the “in-a-a” pattern assimilates in place to the following radical, except when the radical is pharyngeal or laryngeal. However, the affix /t/ in the “i-ta-a-” pattern undergoes assimilation depending on the phonological features of the following radical. It becomes voiced before voiced coronal obstruents and emphatic adjacent to emphatic consonants (Aljeradaat, 2020). Furthermore, assimilation in MSA has been described as partial or total from a generative phonology perspective, depending on the extent to which the features of the target segment are affected (Jalabneh, 2012).

Researchers have also investigated assimilation across different Arabic varieties using both descriptive and theoretical approaches. In Urban Jordanian Arabic (UJA), place assimilation is primarily regressive and conditioned by the phonological features of adjacent consonants, particularly their sonority and place of articulation (Zuraiq & Zhang, 2006). Within an Optimality-Theoretic framework, voice and emphasis assimilation have been found to occur when adjacent segments share other feature specifications (Abu-Abbas et al., 2010). Similarly, emphasis spread in southern and northern Palestinian Arabic occurs regressively within a Grounded Phonology framework (Davis, 1995). In Cairene and Baghdadi Arabic, local place assimilation is likewise conditioned by shared features between the trigger and target consonants, with a preference for coronals as targets and non-coronals as triggers. Additionally, regressive assimilation is also more common than progressive assimilation in both varieties (Youssef, 2013).

Regarding Saudi dialects, researchers have examined assimilation through phonological descriptions. In Ruwaili Bedouin Najdi Arabic (RBNA), assimilation is a productive phonological process, with coronals playing a prominent role in triggering assimilation (Alruwaili, 2016). Similarly, assimilation in Ghamdi Arabic has been described, particularly in relation to the definite article. Consonant gemination has also been reported across word boundaries (Alghamdi, 2016). Moreover, Zahrani Arabic has been found to exhibit several types of regressive assimilation, including voicing, devoicing, velar, uvular, labial, and glide assimilation (Alzahrani, 2015).

Taken together, these studies contribute significantly to the literature of Arabic phonology. However, they also highlight several gaps. To begin with, most studies on assimilation in Arabic have focused on well-known varieties and dialects, such as MSA and Najdi Arabic. This focus has left

many regional and tribal dialects unresearched in the literature. One example is MA, which receives little scholarly attention in phonology. Additionally, most studies on regional dialects provide phonological descriptions of assimilation. They generally describe how assimilation appears in speech, but do not explain why and how these patterns occur from a theoretical perspective. Thus, this study addresses these gaps by investigating one of the under-researched dialects in Saudi Arabia, MA. In addition, it explores how regressive assimilation operates within OT.

## The Phonological System of MA

### MA Consonants

**Table 1:** The consonant inventory of MA

| Manner/Place |          | Labial | Labiodental | Interdental | Alveolar | Alveo-palatal | Palatal | Velar | Uvular | Pharyngeal | Glottal |
|--------------|----------|--------|-------------|-------------|----------|---------------|---------|-------|--------|------------|---------|
| Stop         | Plain    | b      |             |             | t d      |               |         | k g   |        |            | ʔ       |
|              | Emphatic |        |             |             | tˤ       |               |         |       |        |            |         |
| Fricative    | Plain    |        | f           | θ ð         | s z      | ʃ ʒ           |         |       | χ ʁ    | ħ ʕ        | h       |
|              | Emphatic |        |             | ðˤ          | sˤ       |               |         |       |        |            |         |
| Nasals       |          | m      |             |             | n        |               |         |       |        |            |         |
| Lateral      |          |        |             |             | l        |               |         |       |        |            |         |
| Trill        |          |        |             |             | r        |               |         |       |        |            |         |
| Glide        |          | w      |             |             |          |               | j       |       |        |            |         |

As presented in Table 1, MA has twenty-seven consonants. Although MA descends from CA, it retains several consonants but also shows some differences. One difference is that CA and MSA use the voiced emphatic alveolar plosive /dˤ/ as in /dˤars/ ‘molar’, while MA uses the voiced emphatic interdental fricative /ðˤ/ as in /ðˤars/. Secondly, MA replaces the voiceless uvular plosive /q/ that is found in CA and MSA with the voiced velar plosive /g/ as in /galb/ instead of /qalb/ ‘heart’. The final difference concerns the glottal stop. CA pronounces the glottal stop in the middle of words as in /raʔs/ ‘head’, and in the final position as in /Al-maʔ/ ‘the water’, but MA substitutes it with a long vowel /ra:s/ and /alma:/. These differences appear in nearby dialects as well, such as ZA (Alzahrani, 2015) and GA (Alghamdi, 2016).

### MA vowels

**Table 2:** The vowel inventory of MA

|      | Front | Central | Back  |
|------|-------|---------|-------|
| High | i, i: |         | u, u: |
| Mid  |       | aj      | aw    |
| Low  | a, a: |         |       |

As shown in Table 2, MA has six vowels and two diphthongs. Since Arabic is a member of the Semitic language family, it has a limited vowel system in contrast to the rich consonantal system (Watson, 2002). MA has the same six vowels found in CA. MA vowel system consists of three short vowels and their corresponding long counterparts: /i/, /i:/, /u/, /u:/, /a/, and /a:/. The high front unrounded vowels are /i/ and /i:/, as exemplified by /sin/ ‘tooth’ and /ʕi:t/ ‘I came’. The high back rounded vowels are /u/ and /u:/, as in /hu/ ‘he’ and /gu:m/ ‘get up’. The low front unrounded vowels are /a/ and /a:/, as illustrated by /kam/ ‘how much’ and /tʕa:h/ ‘fell’. In addition to these vowels, MA has two diphthongs: /aw/ as in /ʕawf/ ‘inside’ and /aj/ as in /haj/ ‘alive’, as noted by Almalki (2025).

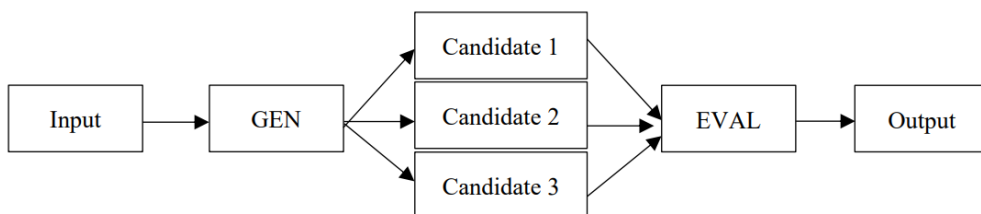
### *Syllable Structure*

The syllable structure of CA, MSA, and all dialects descended from these varieties follows three key constraints (Ryding, 2014). First, no syllable may begin with a vowel. Second, no syllable may start with a consonant cluster. Third, a syllable must not contain a cluster of three or more consonants. Regarding the first constraint, some may argue that words like /aHah/ and /al-be:t/ start with a vowel. However, these words do not begin with a vowel in terms of their phonological structure. According to Broselow (2017), the initial sound in both words is the consonantal glottal stop /ʔ/, which is inserted to prevent the syllable from starting with a vowel.

Most Arabic dialects exhibit a limited range of syllable types (Watson, 2002). The syllable types of MA are similar to those found in MSA, and they are classified as light, heavy, and superheavy syllables. In MA, each syllable must start with a consonant in the onset but never a vowel. According to Aquil (2013), onsetless syllables are prohibited in CA. Additionally, Aljumah (2008) notes that “onsetless syllables are prohibited in most, if not all, Arabic dialects” (p. 159). In total, MA has six syllable structures: (CV), (CV:), (CVC), (CV:C), (CVCC), and (CV:CC).

### **Optimality Theory**

Optimality Theory (OT) is a linguistic framework first introduced by Prince and Smolensky (1993) and then developed with many advancements by Prince and Smolensky (1997), Kager (1999), McCarthy and Prince (1993a, 1993b, 1995, 2004), and McCarthy (2002, 2007, 2008). OT adopts the Universal Grammar (UG) view that all human languages share a universal set of constraints. However, unlike the rule-based approaches, which assume that constraints are inviolable, OT proposes that constraints are violable and ranked differently across languages. According to McCarthy (2008), OT conceptualizes grammar as an input-output relationship, in which each input is associated with a specific output (see Figure 1).



**Figure 1:** Input-Output Representation in OT (McCarthy, 2002, p. 10)

OT has four components: Lexicon, Generator (GEN), Constraints (CON), and Evaluator (EVAL). The lexicon stores all the basic underlying forms of words provided by UG, and “lacks language-specific restriction” (Cooper, 2015, p. 9). The generator takes input from the lexicon and generates diverse candidate sets. According to McCarthy (2002), GEN has a property known as freedom of analysis, which allows it to generate infinite candidates to accommodate different languages. The constraints component falls into two main categories: markedness and faithfulness constraints. According to McCarthy (2002), the interaction between markedness and faithfulness constraints is the key element of any OT analysis. Markedness constraints favor outputs that have simpler structures, while faithfulness constraints aim to preserve similarity and correspondence between the input and output. In OT, it is almost impossible to satisfy both markedness and faithfulness constraints at once, so the conflict is resolved through hierarchical constraint ranking (McCarthy, 2007). The evaluator takes a large candidate set and evaluates the outputs based on the language’s constraints. The optimal candidate, or the winner, is the one that satisfies high-ranked constraints.

## Methods

This study adopts a qualitative approach to investigate the assimilation process in MA. The data were collected from 60 native speakers of MA. Ethical approval was obtained from the Research Ethics Committee at Taif University. All procedures were conducted in accordance with the relevant ethical guidelines. Verbal consent was obtained from each participant at the beginning of the recording. For minor participants under the age of 18, parental consent was obtained. All participants were assured that their identity and personal information would remain confidential and only accessible to the researchers. They were also informed of their right to withdraw from the study at any time.

The main tool employed for data collection was unstructured interviews. Each interview was recorded using the iPhone’s pre-installed app, Voice Memos. All interviews were conducted in Arabic because the participants were native speakers of Maliki Arabic. The interviews began

with a few broad topics to encourage participants to speak. The topics varied based on participants' interests. Taboo or sensitive topics were avoided, as they would make participants reluctant to speak (Clark et al., 2021). Regarding the duration, each interview lasted for twenty-five to thirty minutes.

The recordings were examined to identify instances of regressive assimilation using auditory judgments. After locating the patterns of assimilation in the audio recording, the relevant part was segmented using Praat software. Each segment was converted into text and transcribed using the International Phonetic Alphabet (IPA) symbols. The entire interviews were not transcribed, but only the parts where assimilation occurred. After finishing the transcriptions, phonological analysis was conducted to identify and classify the assimilation patterns. Finally, the data were analyzed using the framework of Optimality Theory (OT) (Prince and Smolensky, 1993).

## Results

### *Place feature*

**Tableau 1:** Regressive place assimilation of the bilabial /m/ to the labiodental /f/

| Input: /lizim fi:d ʒaddah/ | Nasal <sup>Place</sup> | IDENT-Ons (PL) | IDENT-IO (place) | IDENT-IO (nasal) |
|----------------------------|------------------------|----------------|------------------|------------------|
| a) lizim fi:d ʒaddah       | *!                     |                |                  |                  |
| b) ? lizim fi:d ʒaddah     |                        |                | *                |                  |
| c) lizim mi:d ʒaddah       |                        | *!             | *                |                  |
| d) lizif fi:d ʒaddah       |                        |                | *                | *                |

Tableau 1 illustrates that candidate (a) fatally violates Nasal <sup>Place</sup> because the bilabial nasal does not share the place of articulation with the following labiodental. Candidate (c) is also eliminated for changing the place feature of the onset, which fatally violates IDENT-Ons (PL). Although candidates (b) and (d) satisfy higher-ranked constraints, one of them loses. Candidate (d) has two violations of lower-ranked constraints, IDENT-IO (place) and IDENT-IO (nasal). Candidate (b), on the other hand, has one violation of a low-ranked constraint, IDENT-IO (place). As a result, candidate (b) wins.

**Tableau 2:** Regressive place assimilation of the inter-dental /θ/ to the alveolar /z/

| Input: /θalaθ zawaʒa:t / | AGREE (Place) | IDENT-Ons (PL) | IDENT-IO (place) | IDENT-IO (+sib) |
|--------------------------|---------------|----------------|------------------|-----------------|
| a) θalaθ zawaʒa:t        | *!            |                |                  |                 |
| b) θalaθ θawaʒa:t        |               | *!             | *                | *               |
| c) ? θalaz zawaʒa:t      |               |                | *                |                 |

Based on the analysis of Tableau 2, candidate (a) violates the top-ranked constraint, AGREE (Place), because the adjacent coronals /θ/ and /z/

do not share the same place of articulation. Although candidate (b) avoids the violation of AGREE (Place) by assimilating the inter-dental /θ/ to the alveolar /z/ progressively, it is still ruled out because it fatally violates IDENT-Ons (PL). Candidate (c) wins because it satisfies the top-ranked constraints, AGREE (Place) and IDENT-Ons (PL), by assimilating the alveolar /z/ to the inter-dental /θ/ regressively.

**Tableau 3:** Regressive place assimilation of the alveolar /t/ to the emphatic inter-dental /ðˤ/

| Input: /ga:mat ðˤarabatha/ | AGREE (Place) | IDENT-Ons (PL) | IDENT-IO (place) | IDENT (EMPHATIC) |
|----------------------------|---------------|----------------|------------------|------------------|
| a) ga:mat ðˤarabatha       | *!            |                |                  |                  |
| b) ga:mat tarabatha        |               | *!             | *                | *                |
| c) ? ga:maðˤ ðˤarabatha    |               |                | *                |                  |

In Tableau 3, candidate (a) loses because it fatally violates AGREE (Place) by having two adjacent coronals with different places of articulation. Candidate (b) is also eliminated for modifying the onset's place of articulation, which leads to the fatal violation of IDENT-Ons (PL). Candidate (c) wins because it satisfies the highest-ranked constraints, AGREE (Place) and IDENT-Ons (PL), and has the least number of violations.

**Tableau 4:** Regressive place assimilation of the glottal /h/ to pharyngeal /ħ/

| Input: /jɪʃbih hamda:n/ | AGREE (Place) | SHARE (F) | IDENT-Ons (PL) | IDENT-IO (place) |
|-------------------------|---------------|-----------|----------------|------------------|
| a) jɪʃbih hamda:n       | *!            | *!        |                |                  |
| b) jɪʃbih hamda:n       |               |           | *!             | *                |
| c) ? jɪʃbih hamda:n     |               |           |                | *                |

As shown in Tableau 4, candidate (a) is eliminated because the glottal fricative /h/ and the pharyngeal fricative /ħ/ differ in place of articulation, in addition to the secondary place feature, which leads to fatal violations of the highest-ranked constraints, AGREE (Place) and SHARE (F). Candidate (b) satisfies AGREE (Place) and SHARE (F), but fatally violates IDENT-Ons (PL) for changing the place of articulation of the onset. Candidate (c) is the winner because it satisfies the highest-ranked constraints and only violates a low-ranked one, IDENT-IO (place).

### *Voice feature*

**Tableau 5:** Regressive voicing assimilation of the voiceless interdental fricative /θ/ to the voiced interdental fricative /ð/

| Input: /ʔalħa:diθ ða:k/ | AGREE (voice) | IDONSLAR | IDLAR |
|-------------------------|---------------|----------|-------|
| a) ʔalħa:diθ ða:k       | *!            |          |       |
| b) ʔalħa:diθ θa:k       |               | *!       | *     |
| c) ? ʔalħa:dið ða:k     |               |          | *     |

In Tableau 5, candidate (a) has two adjacent obstruents that match in every feature but voicing. Thus, it fatally violates the highest-ranked constraint AGREE (voice). Candidate (b) satisfies the highest-ranked constraint by devoicing the onset /ð/ to /θ/. However, this change incurs a fatal violation of IDONSLAR. Candidate (c), the winner, voices the coda /θ/ to /ð/, which satisfies AGREE (voice).

**Tableau 6:** Regressive devoicing assimilation of the voiced alveolar stop /d/ to the voiceless alveolar stop /t/

| Input: /hammad tga:ʕad/ | AGREE (voice) | IDONSLAR | IDLAR |
|-------------------------|---------------|----------|-------|
| a) hammad tga:ʕad       | *!            |          |       |
| b) hammad dga:ʕad       |               | *!       | *     |
| c) ? hammad tga:ʕad     |               |          | *     |

Tableau 6 illustrates the elimination of the first candidate due to the disagreement of the voice feature between the two obstruents. This disagreement caused a fatal violation of the top-ranked constraint, AGREE (voice). The second candidate obeys AGREE (voice) by voicing the onset of the second word, but fatally violates the second high-ranked constraint, IDONSLAR. The final candidate (c) is the optimal one because it devoices the coda of the first word. Thus, it satisfies the high-ranked constraints, AGREE (voice) and IDONSLAR.

### *Manner feature*

**Tableau 7:** Regressive manner assimilation of the plain stop /t/ to the emphatic stop /tʕ/

| Input: /χaðat tʕabʕ ʔaʕmamaha/ | SHARE (F) | IDENT-ONSET (MANNER) | IDENT (EMPHATIC) | IDENT (STOP) |
|--------------------------------|-----------|----------------------|------------------|--------------|
| a) χaðat tʕabʕ ʔaʕmamaha       | *!        |                      |                  |              |
| b) χaðat tabʕ ʔaʕmamaha        |           | *!                   | *                |              |
| c) ? χaðatʕ tʕabʕ ʔaʕmamaha    |           |                      |                  | *            |

Candidate (a) in Tableau 7 is excluded because it fails to satisfy the highest-ranked constraint SHARE (F), as it contains two adjacent coronals that differ in the manner of articulation. Although candidate (b) satisfies SHARE (F), it is still ruled out because it fatally violates IDENT-ONSET (MANNER) by altering the manner of articulation of the onset. Candidate (c) violates the lowest-ranked constraint, IDENT (STOP), but still wins the competition because it satisfies the highest-ranked constraints by having two consecutive coronals that are identical in the manner feature.

**Tableau 8:** Regressive manner assimilation of the plain stop /t/ to the plain fricative /ð/

| Input: /ba:ʃat ðahabha/    | AGREE<br>(manner) | IDENT-<br>ONSET<br>(MANNER) | IDENT<br>(CONTINUANT) | IDENT<br>(STOP) |
|----------------------------|-------------------|-----------------------------|-----------------------|-----------------|
| a) <b>ba:ʃat ðahabha</b>   | *!                |                             |                       |                 |
| b) <b>ba:ʃat tahabha</b>   |                   | *!                          | *                     |                 |
| c) ? <b>ba:ʃað ðahabha</b> |                   |                             |                       | *               |

In Tableau 8, the first candidate is ruled out due to the fatal violation of the top-most ranked constraint, AGREE (manner), which requires the adjacent obstruents to agree on the same manner. The second candidate is also ruled out because it fatally violates a high-ranked faithfulness constraint, IDENT-ONSET (MANNER), because the manner of the onset was changed. The final candidate wins because it obeys the high-ranked constraints and only violates the lowest-ranked constraint, IDENT (STOP).

**Tableau 9:** Regressive manner assimilation of the nasal /n/ to the lateral /l/

| Input: /minajn lak fulu:s/     | AGREE<br>(manner) | IDENT-<br>ONSET<br>(MANNER) | IDENT<br>(CONTINUANT) | IDENT-<br>IO<br>(nasal) |
|--------------------------------|-------------------|-----------------------------|-----------------------|-------------------------|
| a) <b>minajn lak fulu:s?</b>   | *!                |                             |                       |                         |
| b) <b>minajn nak fulu:s?</b>   |                   | *!                          | *                     |                         |
| c) ? <b>minajl lak fulu:s?</b> |                   |                             |                       | *                       |

In Tableau 9, candidate (a) is eliminated because it fatally violates the highest-ranked constraints, AGREE (manner), for having two consecutive coronals that differ in their manner features. Candidate (b) is disqualified for altering the onset's manner of articulation, thereby violating the high-ranked faithfulness constraint IDENT-ONSET (MANNER). Candidate (c) is the optimal candidate because it satisfies all high-ranked constraints and only violates the lowest-ranked constraint, IDENT-IO (nasal).

## Discussion

The analysis reveals that assimilation in MA does not occur randomly. Rather, it is conditioned by the similarity of place, voice, or manner features between adjacent consonants. The findings align with the phonological generalization that assimilation occurs between adjacent consonants that share similar features (Hutcheson & Zwicky, 1973; Jeffers & Lehiste, 1982; Kiparsky, 1988; Alfozan, 1989). In addition to feature similarity, the data indicate that complete assimilation is the dominant form in MA. Within OT, this can be explained by constraints ranking. In MA, markedness constraints, AGREE (F) and SHARE (F), are ranked above faithfulness constraints like IDENT(F). Therefore, they enforce feature similarity between adjacent consonants. This observation is consistent with

cross-linguistic evidence, which shows that total assimilation patterns are more frequent in many languages (Rahim & Yunus, 2013; Dinneen, 1967; Jun, 1994).

Regarding the place feature, the data revealed that not all consonants assimilate in place to following consonants. Rather, place assimilation is conditioned by specific articulatory features between adjacent segments. The analysis reveals that coronal obstruents in MA are more prone to undergo regressive place assimilation in comparison to other classes. The term coronal refers to consonants specified with the feature [+coronal], that is, segments articulated with the tip or blade of the tongue, such as dental, alveolar, and postalveolar. Within OT, this pattern indicates that MA ranks AGREE (place) above IDENT (place). In other words, the grammar prohibits adjacent obstruents from differing in place of articulation. As for the bilabial /m/ and the glottal /h/, they also show place assimilation, but in certain environments. For instance, the bilabial /m/ only assimilates to the labiodental fricative /f/ (e.g., /lizi**m** fi:d ʒaddah/ → [lizi**m**i:d ʒaddah] ‘He held his grandpa’s hand’), whereas the glottal /h/ only assimilates to pharyngeal consonants (e.g., /ji/bi**h** hamda:n/ → [ji/bi**h**:amda:n] ‘He looks like Hamdan’). In these restricted environments, AGREE (place) outranks IDENT (place) and forces assimilation. However, in other environments, IDENT (place) dominates and blocks assimilation. These observations are in line with previous studies, which indicate that coronals are the most frequent triggers and targets of place assimilation (Kiparsky, 1985; Cho, 1990; Mohanan, 1993; Jun, 1995; Alruwaili, 2016). Furthermore, the fact that coronals in MA undergo assimilation in various contexts supports the cross-linguistic generalization that coronals are unmarked (Paradis & Prunet, 1991; Hannahs, 1999; Kang, 2000). In other words, they are not restricted to only one context, unlike the bilabial /m/ and glottal /h/, which assimilate only in specific environments.

In terms of the voice feature, the data reveal that regressive voicing and devoicing assimilation in MA mainly occur between adjacent obstruents, particularly coronals, velars, and pharyngeals that share the same place and manner of articulation. In the case of voicing, the [+voice] feature of the second consonant spreads regressively to the first (e.g., /ʔal**h**a:di**θ** ʔa:k/ → [ʔal**h**a:di**ð**:a:k] ‘That car accident’). In devoicing assimilation, in contrast, the voiced obstruent is neutralized because of the regressive influence of a following [-voice] obstruent (e.g., /**h**ammad tga:ʕad/ → [h**am**mat:ga:ʕad] ‘Hammad retired’). Both types result in complete assimilation. These patterns can be explained by the constraint hierarchy of MA, which ranks AGREE (voice) above IDENT (voice). This ranking is supported by cross-linguistic findings, which show that adjacent obstruents with mismatched voicing are generally disfavored (MacEachern, 1999; Lombardi, 1999;

Fortson, 2005; Kabrah, 2011; Roach, 2009). Moreover, the results are consistent with observations in Urban Jordanian Arabic (UJA) and Irbid Urban Arabic (IUA), in which voicing and devoicing assimilation occurs between neighboring obstruents that agree in all other features (Zurairi & Zhang, 2006; Abu-Abbas et al., 2010).

As for the manner feature, the data indicate that manner assimilation in MA mainly occurs between obstruents and sonorants. Regarding obstruents, when plain coronals are followed by emphatic coronals, the emphatic feature [+emphatic] spreads regressively to the preceding non-emphatic consonant, resulting in full assimilation (e.g., /*χaðat tʔabʕ ʔaʕmamaha*/ → [*χaðatʔ:abʕ ʔaʕmamaha*] ‘She inherited her uncles’ traits’). OT explains this through the dominance of the markedness constraint SHARE (F) over the faithfulness constraint IDENT (MANNER). This pattern of emphasis spread in MA is in line with the findings in Arabic, in which the secondary articulation spreads from emphatic coronals to adjacent plain coronals (Younes, 1991; Davis, 1995; Watson, 1999). Additionally, in MA, a stop becomes [+continuant] when followed by a non-sibilant fricative (e.g., /*ba:ʕat ðahabha*/ → [*ba:ʕað:ahabha*] ‘She sold her gold’). This pattern arises because AGREE (manner) is ranked above IDENT (manner), which leads to uniformity in the [±cont] feature. This pattern reflects cross-linguistic findings, where stops assimilate to the manner of a following fricative (Teifour, 1997; De Lacy, 2007; Vaux, 2011). As for sonorants, which are produced with a relatively open vocal tract and without significant oral constriction, the nasal /n/ becomes [-nasal] and totally assimilates to the following lateral /l/ (e.g., /*minajn lak fulu:s?*/ → [*minajl:ak fulu:s*] ‘where do you have the money from?’). The dominance of AGREE (manner) in MA eliminates adjacent sonorants with different manner specifications. These results parallel findings in Arabic, in which sonorant consonants undergo manner assimilation to a following sonorant (Cowell, 1964; Zurairi & Zhang, 2006; Heselwood et al., 2011; Youssef, 2023).

## Conclusions

This study examined regressive consonant assimilation across word boundaries in Maliki Arabic within Optimality Theory. The findings indicate that assimilation in MA is systematic and conditioned by the similarity of place, manner, and voice features between adjacent consonants, rather than occurring randomly. Since markedness constraints like AGREE (F) and SHARE (F) dominate faithfulness constraints such as IDENT (F) in MA, total assimilation becomes the dominant pattern. Additionally, the findings demonstrate that coronal obstruents undergo place assimilation in a wide range of phonological contexts, whereas non-coronal obstruents undergo place assimilation only in specific environments. Voicing and devoicing

assimilation occur between adjacent obstruents, while manner assimilation occurs in plain-emphatic, stop–fricative, and sonorant–sonorant sequences.

Within optimality theory, the reported patterns result from the interaction between markedness and faithfulness constraints. The top-ranked markedness constraints, AGREE(F) and SHARE(F), force feature agreement between adjacent consonants. The regressive direction of assimilation is accounted for by the dominance of IDENT-ONSET (F), which preserves the features of the onset consonant in the following word. Regressive assimilation frequently produces geminates across word boundaries. Nevertheless, total assimilation does not occur in all phonological contexts. The place assimilation of the bilabial nasal to the labiodental fricative, for example, remains partial.

This study offers several noteworthy contributions. To begin with, it documents an under-researched Saudi dialect that has never been the subject of phonological investigation. Therefore, it adds to the growing body of work on Arabic dialects. Moreover, this study contributes to the field of theoretical phonology by accounting for assimilation patterns within the framework of Optimality Theory. Nevertheless, by focusing primarily on regressive consonant-to-consonant assimilation across word boundaries, the study addresses only one aspect of assimilation patterns in MA. Therefore, future research should examine other types and directions of assimilation to provide a more comprehensive account of assimilation in MA.

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