

Velar Palatalization in Southwest Saudi Arabia: An Optimality-Theoretic Perspective

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Abstract—By using an optimality-theoretic perspective, this paper examines an opaque phonological process in Southwest Saudi Arabic (SSA). The objective of this study is twofold: first, to explain how the second-person singular possessive suffix /k/ is palatalized to the voiceless palato-alveolar fricative [ç] in Southwest Saudi Arabic (SSA); and second, to show how such a velar palatalization process is phonologically conditioned. The alternation is triggered by the presence of a high front vowel /i/ (in the suffix /-ki/), which is subsequently deleted, yielding a surface form with [ç] but no overt trigger. This counterbleeding interaction defies a single-level analysis and necessitates a multi-level derivational account. Within the framework of Optimality Theory (OT), a multi-stratal approach is adopted to model the interaction of markedness and faithfulness constraints that drive both the velar palatalization and the vowel deletion. The study reveals three main findings: first, the analysis successfully captures the opacity of the process by invoking constraint re-ranking across derivational strata, accounting for the palatalized [ç] even after its conditioning environment has been removed. Second, it is analytically accentuated that there is a crucial need for multi-stratal evaluations in OT to handle opaque phonological phenomena. Third, the analysis highlights OT's explanatory power, showing that an enriched constraint-based approach can accommodate complex interactions like SSA velar palatalization and enrich our understanding of phonological opacity in theory.

Index Terms—Arabic, optimality theory, phonetic changes, Southwest Saudi Arabia, velar palatalization

I. INTRODUCTION

Variation studies have received a lot of interest in language research (e.g., Alfaihi & Davis, 2021; Almbark & Hellmuth, 2015; Davis et al., 2024; Mahzari, 2023; Melissa et al., 2003; Ruthan, 2024; Watson & Al-Azraqi, 2011), among others. It is commonly known that dialects and languages can differ from one another. It is also evident that variation may be manifested at various levels of language, such as the morphological, syntactic, and phonological levels. This study's primary focus is phonologically based, as it investigates the phonological process of velar palatalization in Southwest Saudi Arabic (SSA). Crucially, there are two primary types of Arabic: Modern Standard Arabic (MSA) and Classical Arabic (CA), which is the language of the Holy Quran. The second one (MSA) has altered its lexicons rather than its syntactic elements. Seventeen Arab nations have made Modern Standard Arabic their official language. For instance, it is used in written materials, political speeches, sermons, lectures, news broadcasts, and conferences. Furthermore, schoolchildren are formally taught Modern Standard Arabic. Colloquial Arabic, on the other hand, comprises the dialect of Arabic that is most frequently used in everyday interactions, such as in casual settings and online. There are differences in colloquial Arabic between countries as well as between provinces within these nations. Phonological, morphological, syntactic, and lexical differences among sociolects are discernible (Watson, 2002; Alghamdi, 2009).

Despite the fact that there are differences between Modern Standard Arabic and Colloquial Arabic in terms of the phonological structure pertaining to each variety, they still share the same inflectional system in common. In MSA, there are twenty-eight consonants, and it also has a number of guttural consonants, such as laryngeals (ʔ and h), pharyngeals (ʕ and ħ), and uvular affricatives (ç, ʁ). According to Watson (2002), there are thirty-one consonants in Arabic dialects; nevertheless, not all of the consonants found in MSA are utilized in Arabic dialects. Further, the basic vowel system in Modern Standard Arabic (MSA) constitutes three long vowels, /i:/, /u:/, and /a:/, and their short counterparts, /i/ and /u/, together with two diphthongs, /ay/ and /aw/ (Ryding, 2005). MSA is only utilized in formal and educational circumstances (such as news broadcasting) and is not employed in everyday discussions (Holes, 2004). Various regional dialects are used in everyday discussions by Arab speakers all around the Arab globe. The phonological structure of these dialects can differ greatly (Ryding, 2005). For example, there are differences among spoken Arabic dialects in terms of phonetic realizations and vowel inventory (Watson, 2007; Almbark & Hellmuth, 2015; Melissa et al., 2003).

This paper, therefore, offers a linguistic investigation of the phonological process of velar palatalization in Southwest Saudi Arabic (SSA). More specifically, it focuses on the systematic conversion of the second-person singular possessive suffix /k/ to the voiceless palato-alveolar fricative [ç]. When the high front vowel /i/ in the suffix /-ki/ is removed, this alternation is demonstrated to occur, leading to an ambiguous derivation that necessitates a multi-level investigation.

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Perceived as a universal phonological phenomenon in languages, palatalization is defined as "any instance of a consonant acquiring a secondary palatal articulation" (Bateman, 2007, p. 5), or, in other words, it is a phonological process that describes any situation, regardless of the trigger, in which a consonant shifts to palatal-like place characteristics. Palatalization occurs for two phonological reasons: first, when front and high vowels, as well as the palatal glide [j], interact with consonants; and second, in rapidly connected speech (Syrika et al., 2011).

Using Modern Standard Arabic as the underlying comparison form, the study expands on the intuition and observation of native speakers and uses a multi-stratal approach to analyze the interplay between fidelity and markedness requirements that lead to palatalization and subsequent vowel deletion within the framework of Optimality Theory (OT). Adopting optimality theory as a theoretical framework for this study is due to its universal plausibility. One crucial feature of OT is its adaptability, which allows it to combine various processes into a single one. This study, therefore, contributes to understanding dialect-specific phonological processes and demonstrates the explanatory power of OT in handling complex phonological phenomena, such as opacity and variation, by placing SSA within the larger typology of palatalization found in world languages and other Arabic dialects.

This study is significant since it advances the science of linguistics in general and will help with the theoretical description of Saudi dialects, an area that requires greater attention. Furthermore, this study can be a helpful resource for creating further, more targeted research. When we consider this work as an attempt to create an atlas of the Saudi dialects, or, more broadly, an atlas of Arabic dialects, its significance becomes even more evident. The dearth of research on Saudi Arabian dialects is what spurred this investigation, as it highlights the necessity for additional studies that examine the connections between regional dialects spoken throughout the Arab world and standard Arabic.

Research Questions

This study attempts to provide answers for three overarching research questions:

1. How does the second-person singular possessive suffix /k/ palatalize to the voiceless palato-alveolar fricative [ç] in Southwest Saudi Arabic (SSA)?
2. To what extent is such a velar palatalization process phonologically conditioned?
3. How does optimality theory contribute to the palatalization process in Southwest Saudi Arabic (SSA)?

The answer to these research questions encompasses the main objective this study attempts to achieve, that is, to explore how the second-person singular possessive suffix /k/ is palatalized to the voiceless palato-alveolar fricative [ç] in Southwest Saudi Arabic (SSA). This research objective is pursued in an optimality-theoretic perspective to highlight the contribution of the theory to the palatalization process in Southwest Saudi Arabic (SSA).

The rest of this study is structured as follows: Section II reviews the literature of the study, wherein discussions of the Southwestern Saudi dialects, *language variation in Arabic and world languages*, and palatalization and its types are provided. Section III presents the theoretical framework of the current study, in which a detailed discussion on the optimality theory is offered. Section IV demonstrates the methodology of the study by presenting data collection and description, as well as the procedures of the analysis adopted in this paper. Section V provides the analysis of the collected data, the results, and the discussion of the obtained results. Section VI is the conclusion of the study.

II. LITERATURE REVIEW

A. Southwestern Saudi Dialects

There are a number of different dialect groupings in the southwestern Saudi Arabian region. Spoken in places like Abha and Khamis Mushait, the 'Asīr dialects are renowned for their intricate phonological characteristics and sporadic archaic elements (Alahmari, 2018). Softer consonants and strong links to Yemeni Tihami speech patterns define the Tihāmah dialects, which are spoken along the southern Red Sea coast (Behnstedt, 2016). Near the Yemeni border, the Jizani dialects have unique palatalization phenomena and conservative phonological characteristics (Watson & Al-Azraqi, 2011). Spoken by Yam and other tribes in the Najran region, the Najrani dialects retain characteristics of old South Arabian languages (Al-Wer & Al-Qahtani, 2016). Figure 1 displays the main dialects spoken in Saudi Arabia, with particular attention paid to those spoken in the southwestern Saudi Arabian region (SSA), which serves as the study's geographic setting.

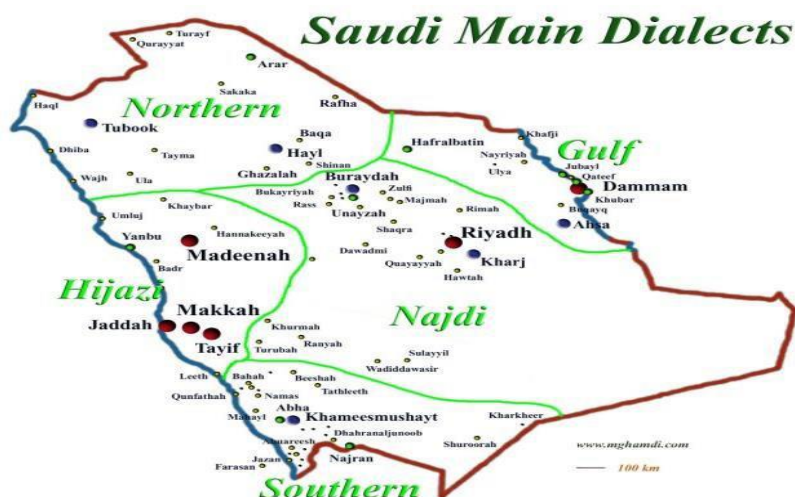


Figure 1. Major Arabic Dialects in Saudi Arabia, With SSA Highlighted in Dark Orange

Crucially, studies on palatalization of /k/ in Saudi Arabia have shown that in some varieties, especially Najdi Arabic, spoken in the central part of the Arabian Peninsula (see the map in figure 1), the /k/ becomes [ts] in most words with front vowels (Ingham, 1994; Watson, 2002; Alghamdi, 2020; Mahzari, 2023). It is worth noting that the phoneme /k/ in Najdi Arabic (as a sound, not only as a possessive suffix) is a voiceless velar stop in Modern Standard Arabic. It is also pronounced [ts] as it is merged with /s/ (voiceless alveolar affricate). The following figure shows a map of major Saudi Arabic varieties.

B. Language Variation in Arabic and World Languages

Language variation is a common issue in a large country like Saudi Arabia, and research has shown differences in Arabic varieties across the country. Such differences, and sometimes unique features to a variety, can be phonological, morphological, or syntactic. Studies on aspects of these differences/features have been carried out on different varieties of Arabic spoken in 'Asir and Tihāmah, as documented in research conducted in the last few decades by Alahmari (2018), Watson and Al-Azraqi (2011), Al-Wer and Al-Qahtani (2016), Alfaifi and Behnstedt (2010), Alfaifi and Davis (2021), Behnstedt (2016), and Alkhonini et al. (2023), and on varieties spoken in other areas of the country, especially in Najd (Ingham, 1982, 1994; Al-Rogaie, 2013; Mahzari, 2023; Davis et al., 2024; Ruthan, 2024) and Hijaz (Al-Essa, 2019; Davis et al., 2024). However, features of some of these varieties have been little studied. The following section reviews literature on the different realizations of the second-person possessive suffix in the Arabian Peninsula, with emphasis on Saudi Arabia.

In classical Arabic, the genitive suffix (masculine second-person singular possessive) takes the form of /-ka/ as in the example *kitaabu-ka* (your book). However, in colloquial Arabic dialects, this genitive suffix has different realizations. It becomes, in Cairene Arabic, for example, *-k* or *-ak* depending on the ending of the word, as in *abuu-k* 'your father' or *ašaa-k* 'your dinner' for words that end in a vowel, and *balad-ak* 'your country', *riġlak* and *kitaab-ak* 'your book' for all other words (Davis et al., 2024). The allomorph *-ak* is also used in the feminine words that end in *tā marbūta* as in *taalibt-ak* 'your student (F)', whose stem is *taaliba*.

In Saudi varieties of Arabic, especially Central Najdi Arabic, the pattern is different from Cairene Arabic (Ruthan et al., 2021). According to Ingham (1982, p. 96), the suffix /-ak/ becomes /-k/ when it occurs after a syllable that ends in VC, as in *naxal-k* 'your (MS) palms' and *walad-k* 'your (MS) son'. However, in other varieties of Saudi Arabic, the suffix /ak/ becomes /ik/, as in *beet-ak* (or *beet-ik*, depending on the subvariety), 'your (MS) house' (op. cit.). This is also different from Urban Hijazi Arabic, where the second-person masculine singular possessive suffix is *-ak*, and the corresponding second-person feminine singular possessive suffix is *-ik* after words that end in a consonant and *-ki* after a word that ends in a vowel (Al-Essa, 2019; cited in Davis et al., 2024, pp. 148-149). Moreover, the Southwestern Saudi Arabian variety of Arabic (SSA), which is spoken in Northern Tihama, according to Alahmari (2018), also shows a three-way allomorphy between *-k*, *-ak*, and *-ka* depending on the last syllable of the word to which the suffix is attached (the details of this are beyond the scope of the current paper).

All the above-mentioned studies discussed the realization of the second possessive pronoun /k/ from a *morphosyntactic* point of view, but this paper focuses on the phonological aspect of realizing the suffix as a palatal sound. The following section discusses palatalization in different languages and the typology of palatalization based on Bateman's (2007) taxonomy.

C. Palatalization

Palatalization is a phonological process common across languages. It can be defined as "any instance where a consonant changes its place features to palatal-like, regardless of the nature of the trigger" (Bateman, 2007, p. 5), and it is also "any instance of a consonant acquiring a secondary palatal articulation." There are two main types of

palatalization: primary and secondary. The primary palatalization entails a complete assimilation between the consonant and a front non-low vowel or the high glide /j/, leading to a shift in the primary place of articulation of the consonant, from dorsal to coronal. The secondary palatalization, on the other hand, involves adding a secondary articulation to the consonant without changing the primary place of articulation of the consonant. This change results in sounds like [kʲ, pʰ, tʰ, dʲ], etc.

Among the languages that are well-known for palatalization of consonants are Slavic languages, especially Russian. Almost all its consonants are palatalized. Since this paper focuses on velar palatalization, here are some examples of palatalized velars in Russian, as shown in Table 1.

TABLE 1
EXAMPLES OF PALATALIZED VELARS IN RUSSIAN (PADGETT, 2003A, P. 46)

| Nominative singular | Nominative plural | Gloss |
|---------------------|-------------------|--------|
| /ˈruka/ | /ˈrukʲi/ | ‘hand’ |
| /ˈknʲiɡa/ | /ˈknʲiɡʲi/ | ‘book’ |
| /vzˈdox/ | /vzˈdoxʲi/ | ‘sigh’ |

As a result of historical sound change, velars occur in their palatalized forms not only before front vowels but also before back vowels. However, palatalization is predictable only before front vowels, as in the following examples in Table 2 (Padgett, 2003a, p. 48).

TABLE 2
PALATALIZATION BEFORE FRONT VOWELS

| Word | Gloss | Word | Gloss |
|-------------|-------------------|-----------|---------------|
| /kʲipa/ | ‘pile’ | /kʲubʲik/ | ‘brick’ |
| /kʲem/ | ‘who (instr.sg.)’ | /koʃka/ | ‘cat’ |
| /qʲiʲpkʲiʲ/ | ‘flexible’ | /qurt/ | ‘herd, flock’ |
| /qʲerp/ | ‘(coat of) arms’ | /qot/ | ‘year’ |

One major issue with Russian velar palatalization is that while /i/ follows palatalized velars, /i/ occurs after non-palatalized ones (Padgett, 2003b). Rubach (2002) argues that different phonological frameworks approach this issue in different ways, as each is based on different theoretical premises. He argues that Optimality Theory (OT) is the approach that provides a more comprehensive analysis by treating all palatalization-related processes as a single unified phenomenon, leading to a more powerful universal generalization.

[T]he most important contribution of OT to phonological theory is the tenet that phonological generalizations, now stated as constraints rather than as rules, are universal. This is a logical extension of the system that existed prior to the advent of OT. (Rubach, 2002, p. 177)

Palatalization also occurs in some Arabic dialects. Cairene Arabic (the dialect spoken in Cairo, Egypt), for example, exhibits two types of palatalization: secondary, as in /t/ → [tʲ] and /d/ → [dʲ], and primary, as in /t/ → [cʲ] and /d/ → [jʲ]. In this dialect, palatalization is triggered by /j/, /i/, /i:/, /e:/, or [ɪ], but the triggering power varies among these sounds.

According to Watson (2002, p. 258), this variation occurs because "the higher the palatal trigger, the greater its palatality, and hence the more likely palatalization of adjacent segments will occur." For example, in the word *bi-yibtidi* (he begins), palatalization is more likely before the final /i/ than before the medial /i/, as the former is higher in vowel height. Although it is less obvious than in Cairene Arabic, palatalization also occurs in Sanʻani Arabic, spoken in Sanʻa, Yemen. In this dialect, only secondary palatalization occurs, and it is primarily triggered by the glide /j/ and occasionally by the high vowel /i:/ (Watson, 2002). Although less frequently, palatalization can occur across word boundaries in both Cairene and Sanʻani Arabic dialects.

C. Types of Palatalization

According to Bateman's (2007, p. 1) taxonomy, there are five processes under which palatalization occurs. These are as follows:

- Palatalization: a consonant acquiring a secondary palatal articulation, as in /t/ → [tʲ].
- Coronalization (fronting): a change of a velar stop to a coronal affricate, such as /k/ → [tʃ], which is the focus of this paper.
- Raising: the raising of a consonant, as in /t/ → [tʃ].
- Spirantization: "a consonant is spirantized in a palatalizing environment, such as r → s
- Assibilation: as in /t/ → [ts] before the front vowel /i/.

III. THEORETICAL FRAMEWORK: OPTIMALITY THEORY

This paper will analyze data using the Optimality Theory (OT), which was proposed by Prince and Smolensky (1993, 1997) as a theoretical framework for linguistic analysis and understanding linguistic phenomena, such as palatalization, by prioritizing universal constraints and their language-specific rankings. The theory gained popularity with Kager (2004) with his entry-level introduction to OT and McCarthy's (2001) surveys of advanced topics. The OT has largely

replaced rule-based frameworks in phonology, and it has also been used in syntax and semantics, but to a lesser extent (Bousabaa et al., 2021; Legendre et al., 2001; Zuraw, 2002).

OT emerged in response to a "conceptual crisis at the center of phonological thought" (Prince & Smolensky, 1993, p. 1) with regard to the role of output constraints. In a study on Yawelmani, an endangered American Indian language, Kisseberth (1970) found that each consonant is positioned next to a vowel. He proposed introducing a CCC constraint (forbidding three-consonant clusters) to set rules either by blocking or triggering them. This would simplify rule systems and account for consistency across languages. Despite the increase in using output constraints in the literature, many aspects of their use were unclear (Zuraw, 2002).

One advantage of OT over rule-based approaches is its ability to predict The Emergence of The Unmarked (TETU), as coined by McCarthy and Prince (1995). This means that if a markedness constraint is frequently violated in a language, it may still influence outputs. For instance, in Yawelmani, the preference for CiCC over CCiC is not strictly followed at the surface level, as CCiC sequences appear due to high-ranking faithfulness constraints preserving them. However, when CCC necessitates vowel insertion, CiCC is chosen over CCiC. A key contribution of OT has been highlighting the significance of TETU, leading to the discovery of many new cases that have always been unclear (Zuraw, 2002).

Another advantage of OT is its clear account of what McCarthy (2001) terms "homogeneity of target/heterogeneity of process." In rule-based approaches, a rule specifies both the structure it applies to (the target) and the operation performed on it (the process). However, linguistic patterns often show that different processes can apply to the same target, both within a single language and across languages. Rule-based theories offer no explanation why a structure should repeatedly be targeted. In OT, however, the explanation is simple: "There is a markedness constraint against the target, but whether and how the target is repaired depends on interaction with other constraints" (Zuraw, 2002, p. 5). On the other hand, OT was criticized for dealing with opacity, which occurs when a structure that triggered an earlier rule is eliminated by a later rule. It could also introduce a structure that would have triggered an earlier rule. OT was successful in accounting for most cases of opacity. To solve this issue, several modifications of OT were proposed (see McCarthy, 2001, chapter 3, for more information).

Optimality Theory was chosen for analyzing palatalization in SSA due to its capacity to explain variation through constraint ranking, capture dialect-specific patterns, model gradience and optionality, and highlight the role of front vowels and glides. Palatalization varies between languages and varieties of the same language, and SSA is no exception. OT allows the researcher to explain the phonological context in which palatalization occurs by ranking universal constraints such as markedness and faithfulness constraints. In SSA, for example, palatalization of the possessive sound /k/ to [tʃ] can be explained by prioritizing markedness constraints such as [k] before [i] is avoided over faithfulness constraints such as retaining [k] as it is (Alahmari, 2018). Like many dialects of Arabic, SSA shows regional variations in its palatalization patterns. Therefore, the flexibility of OT allows for analyzing how ranking of constraints differs within the same dialect. For instance, in one variety, /k/ may palatalize to [tʃ] before [i], whereas in another variety, this process could be blocked. OT offers a systematic approach to model these differences by re-ranking constraints.

Palatalization in SSA might be influenced by sociolinguistic or phonetic factors, resulting in optionality in certain contexts. OT, particularly with frameworks like Stochastic OT or Gradient Harmonic Grammar, allows for modeling this variation by assigning probabilistic weights to constraints (Boersma, 2004). This approach can be useful for understanding why palatalization might occur more frequently in casual speech compared to formal contexts. In SSA, palatalization is often triggered by front vowels and glides where velar consonants like /k/ and /g/ are transformed into palatal or palato-alveolar sounds such as [tʃ] and [dʒ]. OT helps understand why certain environments trigger palatalization, while others do not (Alahmari, 2018; Bokhari, 2020). Having reviewed the relevant literature on palatalization in Arabic in Saudi Arabia and world languages, we turn now to the methodology section of this paper. The next section discusses how data was collected and analyzed.

IV. METHODOLOGY

A. Data Collection and Description

Data for this paper was collected through personal encounters with seven participants who are native speakers of the southwest Saudi Arabian dialect. All participants were born in the southwest region of Saudi Arabia. They were males whose ages ranged between 25 and 55 years old, and they belonged to 4 governorates located in the southwest region of Saudi Arabia. To test the validity of the way data was collected in this study, two experts verified the collected list of words prepared by the researcher before delivering it to the seven participants. The two experts are university English professors who specialize in teaching phonology and phonetics. The two experts are also native speakers of the dialect under investigation (i.e., the Southwest Saudi Arabia dialect). They reviewed and verified the prepared list in terms of clarity, suitability, relevance, and objectivity. They recommended a number of changes and modifications, which were conducted by the researcher. Also, to guarantee the suitability of data collection, the researcher finds out that there are other studies that have collected data in similar ways. One example is Bokhari (2020), who collected data relying on his and other people's knowledge of Hijazi Arabic as native speakers of the language. He also observed the speech of several people from Makkah, Jeddah, Taif, and Madinah in addition to spoken language on audiovisual media.

B. Procedures

The procedures followed in this paper encompass three stages. The first stage constitutes the preparation of a list of words in MSA to be the main focus via which the velar palatalization phenomenon is highly presented. The second stage comprises the personal meeting of the seven participants. The researcher met each participant in isolation and asked them to pronounce a list of words written in MSA, one time in the standard way of pronunciation (MSA) and another in the way they pronounce them in the region they live. In the third stage, the researcher started to analyze the collected data by monitoring the phonological differences in the pronunciation of the same word both in MSA and in the southwest Saudi dialect. At the end of the three procedural stages, the researcher started to obtain some results that show the extent to which velar palatalization is represented in the collected data.

Significantly, this study does not offer a complete phonological inventory (i.e., consonant and vowel systems) of the Southwestern Saudi Arabic dialects, even if it focuses on a particular phonological process, the palatalization of the velar [k] to [j]. This choice is in line with the paper's narrowly circumscribed analytical scope, which looks at the circumstances and theoretical ramifications of a specific sound alteration. There have been previous studies that provide thorough phonemic descriptions of these dialects, including Watson and Al-Azraqi (2011) and Alahmari (2018). Instead of providing a broad phonological overview, this study provides a thorough optimality-theoretic description of a phenomenon that was previously understudied by focusing on a particular phonological alternation.

V. RESULTS AND DISCUSSION

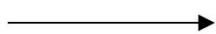
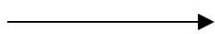
Now that we have reviewed what OT is and the rationale for its use to analyze the selected data, Table 3 presents a set of data that illustrate the possible environment where palatalization can occur in SSA as well as other cases where palatalization does not occur, as in Table 3.

TABLE 3
EXAMPLES OF PALATALIZATION IN SSA

| | 2 nd P Sin. M | 2 nd P Sin. F | 3 rd P M Pl | 3 rd P F Pl | Gloss |
|---|--------------------------|--------------------------|------------------------|------------------------|----------------|
| 1 | ha:l-ik | ha:l-ɪʃ | ha:l-kum | ha:l-kum | 'Yourself' |
| 2 | nu:r-ik | nu:r-ɪʃ | nu:r-kum | nu:r-kum | 'Your light' |
| 3 | ka:s-ik | ka:s-ɪʃ | ka:s-kum | ka:s-kum | 'Your cup' |
| 4 | hadf-k | ha:df-ʃ | ha:df-kum | ha:df-kum | 'Your goal' |
| 5 | rasi:d-ik | rasi:d-ɪʃ | rasi:d-kum | rasi:d-kum | 'Your account' |
| 6 | ra:s-ik | ra:s-ɪʃ | ra:s-kum | ra:s-kum | 'Your head' |
| 7 | kta:b-ik | kta:b-ɪʃ | kta:b-kum | kta:b-kum | 'Your book' |
| 8 | ʃmal-ik | ʃmal-ʃ | ʃmal-kum | ʃmal-kum | 'Your hope' |
| 9 | malaf-ik | ma:lɪf-ɪʃ | ma:lɪf-kum | ma:lɪf-kum | 'Your file' |

Palatalization targets the /k/ in the singular possessive pronoun, causing it to change to [j] due to the presence of a high front vowel, which is later deleted, as shown in Table 4.

TABLE 4
PROCESS OF PALATALIZATION IN SSA

| Underlying form | | Surface form | Gloss |
|-----------------|--|--------------|-----------------------|
| kr | <i>Palatalization</i>  | -ʃɪ | 'you (accusative)' or |
| | <i>final vowel deletion</i>  | -ʃ | 'your' |

While this pattern can be easily analyzed using rule-based phonology, the limitations of that approach lead us to frame our analysis within optimality theory. The data exemplifies an opacity issue, as the discrepancy between the input and output suggests that the trigger for the surface process is not apparent in the final form. This means that the use of the multi-stratal approach is necessary to explain the process of changing from the input to the output as shown in Table 5.

In the first column in Table 3 above, which represents the second-person singular masculine form, the /k/ in the possessive pronoun remains unpalatalized. This is because palatalization is triggered by the deletion of a high front vowel, which is absent in this case.

As shown in the third and fourth columns, /k/ is not palatalized because the high front vowel, which triggers the change, is deleted. Instead, a high back vowel /u/ is present and retained in both the input and output. Since back vowels do not trigger palatalization, the /k/ sound remains unchanged.

TABLE 5
PALATALIZATION BEFORE THE HIGH FRONT VOWEL /i/

| | Underlying Form | Root Final Vowel Deletion | Root Vowel Insertion | Palatalization | Suffix Final Vowel Deletion | Gloss |
|---|-----------------|---------------------------|----------------------|----------------|-----------------------------|---------------------|
| 1 | kta:bu-ki | kta:b-ki | kta:bi-ki | kta:bi-fi | kta:bi-f | 'your book' |
| 2 | da:ru-ki | da:r-ki | da:ri-ki | da:ri-fi | da:ri-f | 'your house' |
| 3 | ʔaʕdʕeto-ki | ʔaʕdʕet-ki | ʔaʕdʕeti-ki | ʔaʕdʕeti-fi | ʔaʕdʕeti-f | 'I gave you' |
| 4 | sinnu-ki | sinn-ki | sinni-ki | sinni-fi | sinni-f | 'your tooth' |
| 5 | madʒlisu-ki | madʒlis-ki | NA | madʒlis-fi | madʒlis-f | 'your sitting room' |
| 6 | ʕamal-ki | ʕamal-ki | NA | ʕamal-fi | ʕamal-f | 'your job' |
| 7 | hadafu-ki | hadaf-ki | NA | hadaf-fi | hadaf-f | 'your goal' |

In Table 5, all forms end in [ʃ]. However, this segment differs from its underlying representation, where it is originally [k]. The change to [ʃ] occurs due to palatalization before the high front vowel /i/, as shown in the stage of palatalization in Table 5. This change is then rendered opaque when the /i/ vowel is deleted at the stage of suffix final vowel deletion. In some other dialects, such as Najdi dialects, this change does not occur, though that is beyond the scope of this paper.

With a clear understanding of the data, we can now use OT to explain how /k/ transforms into [ʃ]. To account for the opacity of this process, a multi-stratal framework, an OT approach specifically designed to handle opaque phenomena, needs to be used. In this framework, the underlying form is first processed in an initial stratum, where candidates are generated and evaluated against constraints to determine the optimal output. This selected output then serves as the input for the next stratum, where the process is repeated until the final surface form emerges. The advantage of this two-level evaluation is that the optimal candidate from the first stratum functions as an intermediate representation, similar to that in rule-based phonology, preserving crucial information that would otherwise be lost in the final evaluation. Using the multi-stratal approach as described in Kager (2004), the author proposes the following analysis. Below are definitions of the constraints that will be used in the analysis:

PAL-i: A consonant agrees in backness with a following high front vowel.

MAX-IO: Input segment must have output correspondent (no deletion).

*IC: No alveolar lateral approximant followed by a consonant.

*S: No voiceless alveolar fricative.

*č: Don't be a voiceless non-anterior affricate.

*tʃ: Don't be a voiceless alveolar affricate.

*ʒ: Don't be a voiced palatal-alveolar fricative.

Syncope: Don't delete final vowels.

DEP-IO: Output segment must have input correspondents (don't insert).

IDENT-PAL: A palatal segment should remain palatal in the output.

The output of Stratum 1 is determined by a specific ranking of constraints designed to select the intermediate form [ha:lʃi]. The ranking follows this sequence: PAL-i >> MAX-IO >> *IC, *s, *č, *tʃ, *ʒ >> Syncope >> DEP-IO. Tableau 1 demonstrates how EVAL identifies [ha:lʃi] as the optimal intermediate output. At this stage, the final vowel must be preserved to ensure it triggers palatalization, which requires syncope to be ranked low and MAX-IO to be ranked high. Additionally, for the winning candidate to undergo palatalization, the PAL-i constraint must also be ranked high. Constraints that favor the output of [ʃ] over /s/, /č/, and /tʃ/ are also ranked high. It is important to note here that in some forms such as /ha:lki/, a short vowel /ɪ/ is inserted before /k/. This occurs when the syllable before /ki/ is heavy, which means that it has a long vowel or a geminate. To illustrate this, I will provide two examples from the data, one where vowel insertion occurs and one where it does not.

TABLEAU 1

| Input: /ha:lki/ | PAL-i | MAX-IO | *IC | *s | *č | *tʃ | *ʒ | Syncope | DEP-IO | IDENT-PAL |
|-----------------|-------|--------|-----|----|----|-----|----|---------|--------|-----------|
| ha:lki | * | | | | | | | * | * | |
| ha:lɪk | | * | | | | | | | * | |
| ha:lɪf | | * | | | | | | | * | * |
| ha:lʃi | | | * | | | | | * | | * |
| ha:ls | | * | | * | | | | | | * |
| ha:lsi | | | | * | | | | * | * | * |
| ha:lči | | | | | * | | | * | * | * |
| ha:lɪč | | * | | | * | | | | | * |
| ha:lɪʒ | | * | | | | * | | | * | * |
| ha:lɪtʃ | | * | | | | * | | | * | * |
| ☞ ha:lʃi | | | | | | | | * | * | * |

In Tableau 1, it is illustrated that the form /ha:lʃi/ is the most optimal option because it only infringes upon three constraints, which are relatively low-ranked. All other candidates breach constraints that are prioritized higher than the ones violated by /ha:lʃi/. This form is used as input and evaluates several candidates against the constraints to

determine the optimal one. The form [ha:lɪʃi] does not emerge. Thus, eliminating /i/ is necessary. Therefore, the constraints were rearranged as follows: Syncope>>PAL-I>>, IDENT-PAL>> *IC, *s, *č, *t^s, *ʒ >> MAX-IO¹.

In Tableau 2 below, the form /ha:lɪʃ/ emerges as the optimal candidate because it violates only a single lowly-ranked constraint, MAX-IO. In contrast, all other candidates violate constraints that are ranked higher than MAX-IO. Overall, the two strata differ slightly due to the reordering of constraints.

TABLEAU 2

| Input: /ha:lɪʃi/ | Syncope | PAL-I | IDENT-PAL-IO | IC | *s | *č | *t ^s | *ʒ | MAX-IO | DEP-IO |
|---------------------|---------|-------|--------------|----|----|----|-----------------|----|--------|--------|
| ha:lɪʃi | * | | | | | | | | | |
| ha:lɪʃ | | | | | | | | | * | |
| ha:lɪʃi | * | | | * | | | | | * | |
| ha:lɪki | * | * | * | | | | | | | |
| ha:lɪk | | | * | | | | | | | |
| ha:ls | | | | * | * | | | | * | |
| ha:lɪsi | * | | | | | | | | | |
| ha:lɪči | * | | | | | * | | | | |
| ha:lɪč | | | | | | * | | | * | |
| ha:lɪʒ | | | | | | | | * | * | |
| ha:lɪt ^s | | | | | | | * | | * | |
| ha:lɪʃi | * | | | | | | | | | |

Not all examples from the previous data display epenthesis. Nonetheless, the presence of this insertion does not appear to influence the palatalization process. The occurrence of epenthesis relates to the characteristics of the preceding syllable. If the preceding syllable is considered heavy, which indicates it features either a long vowel or a geminate, the vowel /i/ will be inserted. Conversely, if the syllable lacks these features, there is no need for vowel insertion. The existence of forms without epenthesis necessitates a slight adjustment in the hierarchy of constraints to achieve the optimal candidate. In the subsequent section, I will slightly revise my system to accommodate this change. The following is an analysis of the form /ʃamalki/.

Stratum 1: I₁ /ʃamalki/

PAL-i,>>MAX-IO>> DEP-IO>>, *s, *č, *t^s, *ʒ >>Syncope, IDENT-IO, PAL-IO

O₁ [ʃamalʃi]

TABLEAU 3

| Input: [ʃamalki] | PAL-i | MAX-IO | DEP-IO | *s | *č | *t ^s | *ʒ | *IC | Syncope | IDENT-IO | IDENT-PAL |
|----------------------|-------|--------|--------|----|----|-----------------|----|-----|---------|----------|-----------|
| ʃamalki | * | | | | | | | * | * | | |
| ʃamalɪk | | * | * | | | | | | | | |
| ʃamalɪʃ | | * | * | | | | | | | * | * |
| ʃamalʃ | | * | | | | | | * | | * | * |
| ʃamalʃi | | | | | | | | * | * | * | * |
| ʃamals | | * | | * | | | | * | | * | * |
| ʃamalɪsi | | | * | * | | | | | * | * | * |
| ʃamalɪči | | | * | | * | | | | * | * | * |
| ʃamalɪč | | * | * | | * | | | | | * | * |
| ʃamalɪʒ | | * | * | | | | * | | | * | * |
| ʃamalɪt ^s | | * | * | | | * | | | | * | * |
| ʃamalɪʃi | | * | * | | | | | | * | * | * |

The evaluation of the input /ʃamalki/ in Stratum 1 is seen in Tableau 3, where the high front vowel /i/ causes palatalization, which results in the ideal output [ʃamalʃi]. This stratum evaluates the input form /ʃamalki/ according to a constraint hierarchy that gives priority to PAL-i, which necessitates backness agreement between consonants and high front vowels. The palatalization of /k/ to [ʃ] to meet this high-ranked constraint is reflected in the chosen output [ʃamalʃi]. Because they fatally breach PAL-i by keeping the velar consonant in the presence of a front vowel, candidates like [ʃamalki] and [ʃamalɪk] are disqualified. Although [ʃamalʃi] does violate IDENT-PAL and DEP-IO, these breaches are accepted because those constraints are ranked lower. Furthermore, outputs that violate higher-ranked markedness constraints (*č, *t^s), such as [ʃamalɪči] or [ʃamalɪt^s], are removed. The combination of markedness and faithfulness constraints required at this derivational stage is best satisfied by [ʃamalʃi], as Tableau 3 demonstrates.

Stratum 2: I₂ /ʃamalʃi/

Syncope>>PAL-i>> IDENT-PAL>>, *s, *č, *t^s, *ʒ >> DEP-IO >>MAX-IO

O₂ [ʃamalʃ]

¹ Note that the constraint IDENT-PAL (faithfulness constraint), which requires that a consonant and a following high front vowel agree in backness, was added. This constraint was added to prevent the form [ha:lɪk] from surfacing as the output, because this form does not violate any other constraint except IDENT-PAL. See Tableau 2 for illustration.

TABLEAU 4

| Input: [ʕamalʔi] | Syncope | PAL-I | IDENT-PAL-IO | *s | *č | *t ^s | *ʒ | *IC | DEP-IO | MAX-IO |
|----------------------|---------|-------|--------------|----|----|-----------------|----|-----|--------|--------|
| ʕamalʔi | * | | | | | | | | | |
| ʕamalʔ | | | | | | | | | | * |
| ʕamalʔi | * | | | | | | | | * | * |
| ʕamalki | * | * | | | | | | | | |
| ʕamalɪk | | | | | | | | | * | * |
| ʕamals | | | * | * | | | | | | * |
| ʕamalisi | * | | * | * | | | | | * | |
| ʕamalɪči | * | | | | * | | | | * | |
| ʕamalɪč | | | | | * | | | | * | * |
| ʕamalɪʒ | | | | | | | * | | * | * |
| ʕamalɪt ^s | | | | | | * | | | * | * |
| ʕamalʔi | * | | | | | | | | * | |

The assessment of the intermediate form [ʕamalʔi] in Stratum 2, where vowel deletion takes precedence over faithfulness, is shown in Tableau 4. At this level, syncope is favored by constraint re-ranking, which encourages the removal of final vowels. While avoiding violations of other highly ranked markedness restrictions, the ideal surface form [ʕamalʔ] meets this dominant constraint. Although [ʕamalʔ] incurs a MAX-IO violation due to the loss of /i/, this is permissible because MAX-IO is now subordinated. Due to their deadly violation of syncope, competing options such as [ʕamalʔi] and [ʕamalʔi] are not preferred because they keep the last vowel. Other alternatives, such as [ʕamalki] or [ʕamalɪk], do not follow the defined derivational path or break high-ranking restrictions like PAL-i. Multi-level OT analysis successfully simulates this kind of non-surface-apparent alternation, as evidenced by the stratum's critical capture of the process' opacity: the vowel that first prompted palatalization is no longer present in the final output.

In brief, the multi-stratal approach clearly explains how palatalization occurs in this dialect group. In Stratum 1, /k/ is palatalized to [ʃ] due to the high-ranking PAL-i constraint, which requires consonants to agree in backness with the following high front vowel /i/. This palatalization is selected despite violating lower-ranked constraints such as IDENT-PAL and DEP-IO. In Stratum 2, the vowel /i/, which originally triggered palatalization, is deleted as a result of syncope being ranked above MAX-IO. This explains the opacity observed in the surface form, where [ʃ] appears without the original triggering vowel, and confirms that only a multi-level analysis can adequately account for the derivation.

VI. CONCLUSION

This paper discussed the palatalization phenomenon that characterizes the SSA, where the second possessive suffix /k/ is palatalized and becomes [ʃ]. The paper reviewed previous research on palatalization in several languages, including Arabic. Data was collected using observation and native speakers' intuition. It was found that palatalization in SSA occurs when the vowel /i/ is deleted before /k/. Otherwise, the /k/ sound is preserved. The data was analyzed using OT and a multi-stratal approach to account for opacity. The form /ha:l-ki/ was fed to Stratum 1 and generated a number of competing candidates that were evaluated with a constraint ranking that resulted in the output [ha:l-ʃi]. Then, the form was used as an input for a second stratum to delete the lower vowel /i/, and the output became [ha:l-ʃ], where palatalization occurred. It was analytically clarified that the whole process of velar palatalization in SSA is phonologically conditioned. The paper also discussed the cases in which the /k/ sound does not undergo palatalization and the high back vowel that does prevents palatalization from being realized. The paper also demonstrated the relevance and explanatory capacity of optimality theory to the study of phonological changes in SSA by demonstrating that an expanded constraint-based approach can handle intricate interactions such as SSA velar palatalization and enhance our theoretical knowledge of phonological opacity.

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REFERENCES

- [1] Alahmari, M. (2018). *An optimality-theoretic analysis of some aspects of the phonology and morphology of a Southwestern Saudi Arabian Arabic dialect* (PhD dissertation, Indiana University).
- [2] Al-Essa, A. (2009). When Najd meets Hijaz: Dialect contact in Jeddah. *Arabic Dialectology*, 53(2), 203-222. <https://doi.org/10.1163/ej.9789004172128.i-298.76>
- [3] Alghamdi, A. (2009). *The phonology of Saudi Arabic: A comparative study*. University of Manchester PhD dissertation.
- [4] Alghamdi, M. (2020). *Saudi dialect map*. Available at: <http://www.mghamdi.me/> (accessed on 9/112/ 2024).
- [5] Alfai, A., & Davis, S. (2021). Dialect variation in Saudi Arabia: Phonological and morphological aspects. *Journal of Arabic Linguistics*, 24(2), 213-230.

- [6] Alkhonini, O. A., & Kwon, H. (2023). Temporal organization of word-initial consonant sequences in Najdi Arabic. In: R. Skarnitzl & J. Volín (Eds.), *Proceedings of the 20th International Congress of Phonetic Sciences* (pp. 2005-2009). Guarant International.
- [7] Almbark, R., Hellmuth, S. (2015). Acoustic analysis of the Syrian vowel system. *Proc. 18th ICPHS*. Glasgow.
- [8] Al-Rojaie, Y. (2013). Regional dialect leveling in Najdi Arabic: The case of the deaffrication of [k] in the Qašimī dialect. *Language Variation and Change*, 25(1), 43-63. <https://doi.org/10.1017/S0954394512000245>
- [9] Al-Shehri, A. (2016). Palatalization and its typology in Gulf Arabic dialects. *Journal of Arabic Linguistics*, 4(2), 29-47.
- [10] Al-Wer, E., & Al-Qahtani, M. (2016). The dialects of Arabia. In: E. Al-Wer & R. de Jong (Eds.), *Arabic dialectology: In honour of Clive Holes on the occasion of his sixtieth birthday* (pp. 49-70). Brill. <https://doi.org/10.1002/9781118827628.ch32>
- [11] Bateman, N. (2007). *A cross-linguistic investigation of palatalization*. San Diego, CA: University of California doctoral dissertation.
- [12] Behnstedt, P. (2016). *Sprachgeographie des Arabischen: Dialektatlas von Saudi-Arabien (Linguistic Geography of Arabic: Dialect Atlas of Saudi Arabia)*. Harrassowitz Verlag.
- [13] Boersma, P. (2004). A stochastic OT account of paralinguistic tasks such as grammaticality and prototypicality judgments. In: *Proceedings of the 6th international conference on spoken language processing (ICSLP)* (pp. 1-18). Amsterdam: Amsterdam University Press.
- [14] Bokhari, H. A. (2020). *A comprehensive analysis of coda clusters in Hijazi Arabic: An Optimality-theoretic perspective*. A PhD Thesis, Indiana University.
- [15] Bousabaa, N. A., Metwally, A. A., & Alabdaly, A. H. (2021). “/j/” or “/dʒ/”: A comparative study of Hadhrami-Southern Saudi Arabian dialectal variations of “/dʒ/” and its implications on the phonological structure of the verb form. *International Journal of Language and Linguistics*, 8(4), 48-53.
- [16] Davis, S., Alshammari, W., Alahmari, M., & Alhuwaykim, M. (2024). Aspects of the phonology and morphology of Saudi varieties of Arabic. In: Fabio, G; Russel, K; & Janet, C.E.W. (Eds.). *Diversity across the Arabian Peninsula: Language, culture, nature*. Oxford: Oxford University Press. <https://doi.org/10.11647/obp.0411.04>
- [17] Hall, T.A. (2000). Typological generalizations concerning secondary palatalization. *Lingua*, 110, 1-25. [https://doi.org/10.1016/S0024-3841\(99\)00017-0](https://doi.org/10.1016/S0024-3841(99)00017-0)
- [18] Holes, C. (2004). *Modern Arabic: Structures, functions, and varieties*. Georgetown University Press.
- [19] Ingham, B. (1982). *North east Arabian dialects: Monograph 3* (1st edn.). Routledge.
- [20] Ingham, B. (1994). *Najdi Arabic: Central Arabian*. Amsterdam, Philadelphia: John Benjamin. <https://doi.org/10.1075/loall.1>
- [21] Kager, R. (2004). *Optimality theory*. Cambridge: Cambridge University Press.
- [22] Kisseberth, C. W. (1970). On the functional unity of phonological rules. *Linguistic Inquiry*, 1, 291-306.
- [23] Legendre, G., Grimshaw, J., & Vikner, S. (Eds.) (2001). *Optimality-theoretic syntax*. Cambridge, MA: MIT Press. <https://doi.org/10.7551/mitpress/5161.001.0001>
- [24] Mahzari, M. (2023). The historical changes of /k/ and /q/ in Najdi Arabic: A phonological analysis. *Theory and Practice in Language Studies*, 13(3), 796-807. <https://doi.org/10.17507/tpls.1303.30>
- [25] McCarthy, J. (2001). *A thematic guide to optimality theory*. Cambridge: Cambridge University Press. <https://doi.org/10.1017/CBO9780511613333>
- [26] McCarthy, J., & Prince, A. (1995). Faithfulness and reduplicative identity. In: J. Beckman, L. W. Dickey, & S. Urbanczyk (Eds.), *University of Massachusetts occasional papers in linguistics* (Vol. 18, pp. 249-384). GLSA Publications.
- [27] Melissa, B., Al-Tamimi, J., Benkirane, T. (2003). Phonetic variation in production and perception of speech: a comparative study of two Arabic dialects. *Proceedings, 15th ICPHS*. Barcelona.
- [28] Padgett, J. (2003a). The emergence of contrastive palatalization in Russian. In: D. Eric Holt (Ed.), *Optimality theory and language change* (pp. 307-335). Netherlands: Kluwer Academic Publishers. https://doi.org/10.1007/978-94-010-0195-3_12
- [29] Padgett, J. (2003b). Contrast and post-velar fronting in Russian. *Natural Language & Linguistic Theory*, 21, 39-87. <https://doi.org/10.1023/A:1021879906505>
- [30] Prince, A., & Smolensky, P. (1997). Optimality: From neural networks to universal grammar. *Science*, 275, 1604-1610. <https://doi.org/10.1126/science.275.5306.1604>
- [31] Prince, A., & Smolensky, P. (1993). *Optimality theory: Constraint interaction in generative grammar*. Rutgers University & University of Colorado at Boulder.
- [32] Rasul, G. (2017). Palatalization in Arabic dialects: A comparative approach. *Linguistic Inquiry*, 48(4), 535-562.
- [33] Rubach, J. (2002). An overview of palatalization-i. *Studies in Phonetics, Phonology and Morphology*, 8(2), 169-186.
- [34] Ruthan, M. (2024). An optimality-theoretic analysis of syllable structure in Najdi Arabic. *Theory and Practice in Language Studies*, 14(6), 1688-1696. <https://doi.org/10.17507/tpls.1406.09>
- [35] Ruthan, M., Durvasula, K., Lin, Y., & Heidenreich, S. (2021). Probing syllable structure through acoustic measurements: Case-studies on American English and Jazani Arabic. *Phonology*, 38(2), 173-202. <https://doi.org/10.1017/S0952675721000142>
- [36] Ryding, K. (2005). *A reference grammar of modern standard Arabic*. Cambridge: Cambridge University Press. <https://doi.org/10.1017/CBO9780511486975>
- [37] Syrika, A., Kong, E. J., & Edwards, J. (2011). Velar softening: An acoustic study in Modern Greek. In *Proceedings of the 17th International Congress of Phonetic Sciences*, Hong Kong, 1926-1929.
- [38] Zuraw, K. (2002). Optimality theory in linguistics. In Arbib, M (Ed.). *Handbook of brain theory and neural networks*, (2nd edition: MIT Press.
- [39] Watson, J. (2002). *The phonology and morphology of Arabic*. New York: Oxford. <https://doi.org/10.1093/oso/9780199257591.001.0001>
- [40] Watson, J. C. E., & Al-Azraqi, M. (2011). Segmental and prosodic aspects of speech rhythm in Arabic dialects. *Speech Prosody Proceedings*, 115-118.



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