

# The Historical Changes of /k/ and /q/ in Najdi Arabic: A Phonological Analysis

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**Abstract**—This paper seeks to explore the potential phonological reasons for the historical change of /k/ and /q/ in Najdi Arabic and the influence of these two consonants on the frequency and duration of vowels, such as /i/ sound through the prism of acoustic analysis. The /k/ phoneme transforms into [ts] and /q/ transforms into [g] and [dz] in many Najdi Arabic words. This transformational process is called ‘palatalization’. Although it is a universal phenomenon, palatalization in Najdi Arabic has specific characteristic features. The main reason for this specificity is that the Najdi dialect had not been in contact with any other foreign languages in Najd region (the region of Najdi speakers) to create the affrication. This historical change is thus attributable to phonological reasons motivated by specific phonological features. Data were extracted from two recordings by two native speakers of the Najdi dialect who produced 217 words. They were phonologically transcribed and analyzed by the researcher to understand the motivation for the phonological change of these two consonants. Additionally, Pratt software was used to analyze the data to explore the influence of consonants on the /i/ sound frequency and duration. The results revealed that the palatalization of [ts] and [dz] does not occur in all the Najdi Arabic words, but only in some due to specific phonological features. The phonological patterns of /k/ and /q/ rely on the place of vocalic articulation preceding and following them.

**Index Terms**—Najdi Arabic, /k/ and /q/, phonetic features, historical change, palatalization

## I. INTRODUCTION

Palatalization is a universal phonological phenomenon in languages. Many factors can affect sound patterns as they change from one status to another, particularly when a community is bilingual or multilingual. Therefore, they lead to changes in phonemes over a long time. Bateman (2007) defines palatalization as “any instance where a consonant changes its place features to palatal-like, regardless of the nature of the trigger” (p. 5). Moreover, she provides another definition that palatalization is “any instance of a consonant acquiring a secondary palatal articulation” (p. 5). Palatalization occurs mainly as a result of the interaction of consonants with vowels: front and high vowels and the palatal glide j. Furthermore, it occurs as a result of rapid speech (Guion, 1996; Syrika et al., 2011).

The palatalization of /k/ and /q/ features [ts] and [dz] as the major characteristics of Najdi Arabic. They occur in most words with front vowels. The most significant point about affrication in this dialect is that it has not undergone exposure to foreign influences in other communities (Al-Essa, 2009; Ingham, 1986; Johnstone, 1964). The motivation behind changing /k/ to [ts] is less clear (Kaye, 1998). On the other hand, Al-Essa (2009) points out that the motivation can be for phonetic simplification and ease. Therefore, this study aims to identify the phonological reasons for the change of /k/ to [ts] and /g/ to [dz] and to explain why they do not change in other words. Additionally, it seeks to explore the influence of consonants on the frequency and duration of the vowel /i/.

## II. BACKGROUND

### A. Arabic

Ryding (2005) describes Arabic as a member of the Semitic language group, which is the native language of seventeen countries. It extends from Morocco in the northwest part of Africa to the United Arab Emirates and Oman in the east of Arabian Gulf. Arabic embodies different structures from English and other European languages. For instance, it is a rich inventory of consonants. Arabic has two main varieties: Classical Arabic (CA, the language of the Holy Quran) and Modern Standard Arabic (MSA). The second one (i.e., MSA) has not changed its syntactic components, but rather its lexicons. Modern Standard Arabic is the official and formal language of seventeen Arab countries. For example, it is employed in political speech, sermons, lectures, news broadcasts, conferential discussions, and written activities (newspapers and magazines). Moreover, Modern Standard Arabic is officially taught to school students. Colloquial Arabic, on the other side, is the dialect that is most often used in daily life to communicate and interact with others in informal situations and on the Internet. Colloquial Arabic differs not only from one country to another but also from one province to another within these countries. Differences in sociolects can be observed in phonology, morphology, syntax, and lexicon (Watson, 2002).

### B. Phonological System of Arabic

Modern Standard Arabic has twenty-eight consonants (see Table 1), three short vowels, such as a, i, o (see Figure 1) and three long vowels (ā, ī, ū). Standard Arabic is rich in inventory of guttural consonants, such as laryngeals (ʔ and ʕ), pharyngeals (ħ and ʕ), and uvular affricatives (χ, ʁ) as shown in Table 1. In Arabic, short vowels are not written, for example, /kataba/ becomes “ktb.” Additionally, Modern Standard Arabic has complex structures and systems of nouns and verbs. The structure of Colloquial Arabic, in contrast, differs from Modern Standard Arabic, but both have the inflectional system in common. In Arabic dialects, there are thirty-one consonants, and not all the consonants of Modern Standard Arabic are used in Arabic dialects (Watson, 2002).

TABLE 1  
THE CONSONANTAL PHONEME INVENTORY OF THE STANDARD ARABIC (WATSON, 2002)

	Labial	Labio-dental	Inter-dental	Dental-alveolar	Palatal	Velar	Uvular	Pharyngeal	Laryngeal
<b>Plosive emphatic</b>	b			t, d t̤, d̤	g <sup>j</sup>	k	q		ʔ
<b>Fricative Emphatic</b>		f	t̤, d̤ d̤̥	s, z s̤, z̤	ʃ		χ, ʁ	ħ, ʕ	h
<b>Nasal</b>	m			n					
<b>Lateral Emphatic</b>				l, d̤̥					
<b>Tap</b>				r					
<b>Glide</b>					j	w			

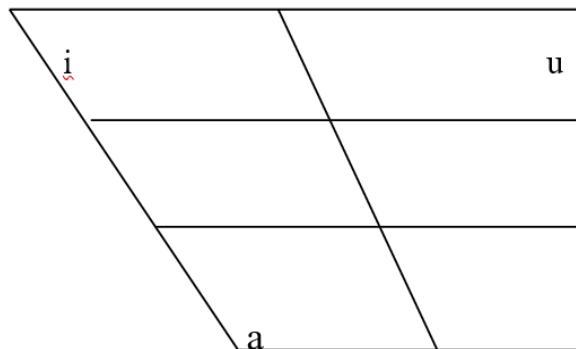


Figure 1 The Phonemes of a Standard Arabic Vowel

### C. Najd and Najdi Speakers

The Arabian Peninsula is divided into Hijaz, Yemen, Oman, Eastern Arabia, and Najd. Najd is in the central part of Arabian Peninsula (see the map in Figure 2 below). People who live in that area are from various tribes, such as Anizah, Mutair, Ghatan, and Utaibah. They have lived in Central Najd since the 19<sup>th</sup> century. Moreover, they are Bedouins, who utilize sheep and camels. Najdi Arabic is spoken not only in the central part, but also by groups who live around it. The first area is the dialect of Jabal Shammar in Northern Najd. The second area is the dialect of Qasim and of Dhafir tribes in the Northern-Central region. The third is the dialect of Najran and Ghatan tribe in Southern Najdi. The fourth area is the dialect of Al-Murrah and Ajman tribes in the East. They share the same dialect and culture. Although they speak the same dialect (Najdi Arabic), they differ in phonology and morphology. The last group (Al-Murrah and Ajman) differs from the other groups in syntax and lexical features because they live near the Yemeni border in the South (Ingham, 1994).

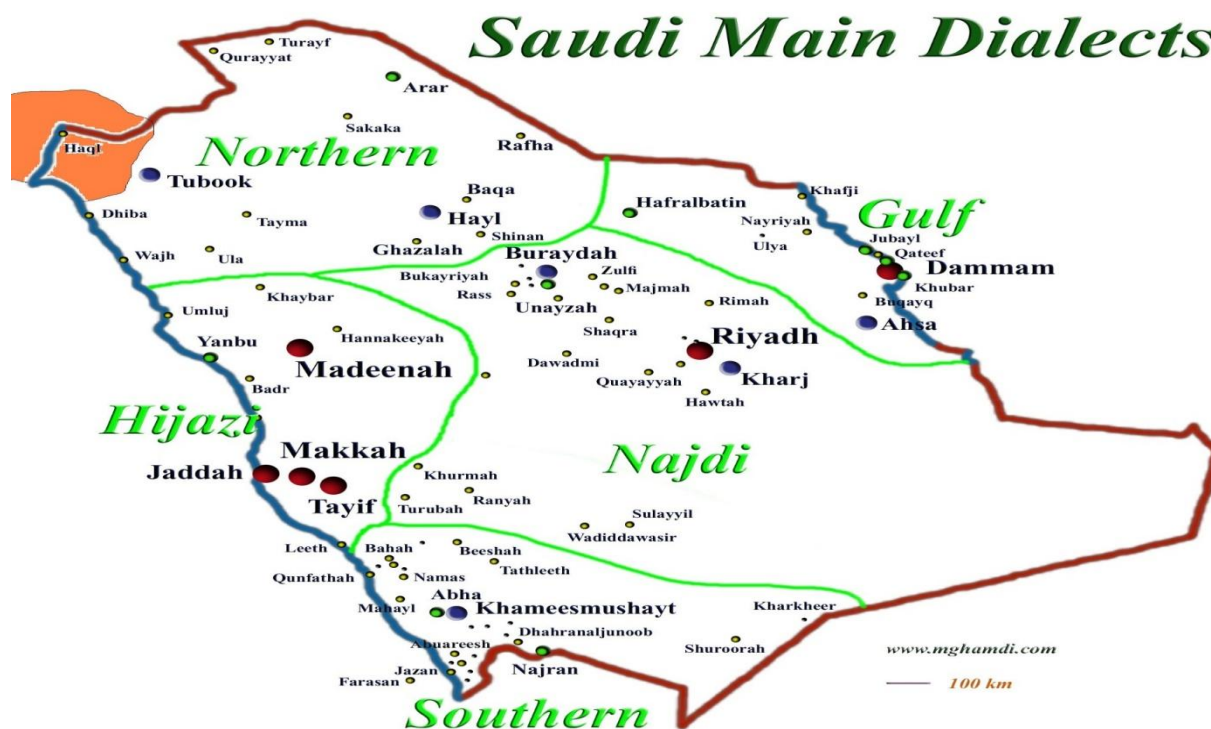


Figure 2 [The Map of Saudi Dialects]

#### D. Phonological System of Najdi Arabic

According to Ingham (1994), Al-Ani (1970), Al-Sweel (1987), and Alsager (2019), Najdi Arabic has some features which distinguish it from other dialects. Therefore, its features indicate the old system and the pure dialect in that area. It came up as a result of the isolation of the area and absence of foreign immigration. In Najdi Arabic, there are four main features which distinguish this dialect from others. First, the sound /ḡ/, which is a pharyngealized voiced plosive, has changed into the sound /ḡ/, which is a pharyngealized voiced interdental fricative. For instance, in Modern Arabic, ḡarab “to hit” changed to “ḡarab.” This means that the sound /ḡ/ is hidden in Najdi Arabic. The second feature is the absence of glottal hamzah except the words that have been borrowed from Standard Arabic. This absence is observed in medial hamzah, which is replaced by long vowels, such as ra:s “head” rather than ra’s. The third feature is that i and u overlap in distribution. When u and r are the environment of the vowel, u tends to occur in the environment of bilabial or pharyngealized consonants. The last feature, which is the topic of this study, is the affrication of /k/ and /q/ in Najdi Arabic. They have become [ts] and [dz], and they are widely investigated in the following section. Regarding the vowels, Najdi Arabic has five main vowels: i, u, ē, ō, a (see Figure 3).

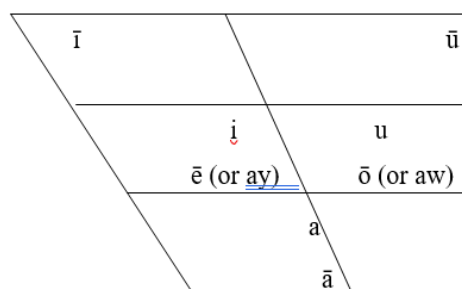


Figure 3 The Phonemes of Najdi Arabic Vowel

#### E. The Phonemes /k/ and /q/ in Standard Arabic and Najdi Arabic

There are phonemes which exist in Modern Standard Arabic, but they have not been retained in almost all the words of Najdi Arabic. Sometimes the phoneme of standard Arabic can be merged with other sounds to constitute a new phoneme like what occurs in Najdi Arabic. The pronunciations of these two consonants /k/ and /q/ are not the same in all Arabic words. For example, the phoneme /k/ is a voiceless velar stop in Modern Standard Arabic whereas in Najdi Arabic, it is merged with /s/ to be [ts] (voiceless alveolar affricate). The affrication of /k/ does not occur in all words, but it appears only with front vowels (Ingham, 1994; Watson, 2002).

Additionally, the phoneme /q/ is a voiced uvular plosive in Modern Arabic. It can be observed in Syrian, Yemeni, and Northern African dialects. In Najdi, in contrast, it occurs only with words borrowed from standard Arabic, foreign languages, and religious terminology. Phonologically, they appear with back vowels. In Najdi Arabic, /q/ changed to [g] (voiced velar plosive) in most of the words. Furthermore, the phoneme /q/ is merged with /z/ as [dz] (voiced alveolar affricate). The affrication of /q/ also occurs only with front vowels (Ingham, 1994; Wright, 1964; Watson, 2002).

#### F. The Names and Processes of Palatalization

Palatalization consists of five different processes under different names (Bateman, 2007). The first process is palatalization, which refers to a consonant acquiring a secondary palatal articulation. For example, /t/ becomes [tʲ] in its production. The second is coronalization or fronting, which means that a velar stop changes to a coronal affricate, such as k → tʃ. The third is raising, which indicates the raising of a consonant, such as t → tʃ. The fourth is spirantization, which means that “a consonant is spirantized in a palatalizing environment, such as r → s” (p. 1). Finally, assibilation, which means a dental stop /t/ changes to [ts] before the front vowel /i/.

In general, palatalization comprises two main types. The first type is that the consonant changes the primary place of articulation and sometimes the manner to the palatal region of the vocal tract, such as k, t → tʃ (full palatalization). In English, for instance, we say /dɒntʃju/ for /dɒnt ju/. The second is that it is “co-articulated with the following palatal off-glide”, such as t, d → tʲ, dʲ (secondary palatalization).

The velar consonant /k/ tends to shift to [ts] when it comes with front vowels whereas /k/ does not change when it comes with back vowels. In terms of articulation, the tongue position and effect of the front tongue position on a particular class of consonants play important roles in this respect.

### III. LITERATURE REVIEW

In fact, Bateman (2007) compared the influence of triggers on the palatalization phenomenon among 117 languages and pointed out the following results that are considered as evidence for the effect of the vowels. The triggers have no significant influence on partial or full palatalizations. In consonants, the type of palatalization does not depend on the trigger type; rather, it is a result of the nature of the target. Therefore, palatalization triggers differ among languages. The palatalization triggers, such as the front vowels /i/ and /e/ and the palatal glide, are common in a great majority of languages. Chen (1973), Bhat (1978), and Hall (2000) came with the same common triggers. Regarding features of vowels, Bateman (2007) pointed out that the length of vowel, rounding, and nasality exhibit no differences in terms of the ability of vowels to trigger palatalization. It means that the features of vowels, such as short and long vowels, oral or nasalized, rounded or unrounded, and high or front, can trigger palatalization, depending on the language. Therefore, Bateman (2007) has stated that “palatalization is common but not automatic” (p. 84).

Al-Rojaie (2013) found that affrication occurred significantly in the phonological context of high front vowels in the Najdi dialect in Qassim. Also, he found that affrication was strongly correlated with three social variables, such as the age, educational level, and gender of the speaker. Additionally, Alrashed (2018) conducted a descriptive analysis of three phonological topics, including affrication, in Qassimi Arabic, a subdialect of Najdi Arabic spoken in Qassim, Saudi Arabia. He found that the affrication process was triggered by front vowels, and the alveolar affricates /ts/ and /dz/ occur in the environment of almost all vowels either before or after [i, e, a, ə, o]. The researcher suggested that Najdi varieties need to be examined individually because they may have specific features that might not be shared with other varieties.

### IV. METHODOLOGY

#### A. Data Collection and Analysis

Data were collected from two recordings by two male native speakers of Najdi dialect who were born in Riyadh located in the middle of Saudi Arabia; it may be noted that as of the date of this paper, they are still living there. The participants were in their twenties, and each of them holds a Master of Arts in linguistics. They were given an hour to list the words that change from /k/ to [ts] and from /q/ or /g/ to [dz]. Additionally, they were asked to list the words that do not change with the previous consonants. They produced 217 words from Standard Arabic, together with their pronunciations in both Saudi and Najdi dialects. The researcher asked each of them to read the words in the list for the purpose of recording. They were accordingly recorded and transcribed by the researcher. Additionally, the data were analyzed not only phonologically but also acoustically with Pratt.

#### B. Research Questions

- 1- What are the vowels that affect the palatalization of /k/ and /q/ in Najdi Arabic?
- 2- What are the phonological reasons for the historical change of /k/ to [ts] and /q/ to [dz] in the dialect?
- 3- What are the phonological barriers to their palatalization and why?
- 4- What is the change that occurs to the /i/ vowel when it is preceded by /k/, /ts/, /g/, and /dz/ in terms of the frequency and duration?

## V. RESULTS AND DISCUSSION

In Najdi Arabic, the analysis of the phonological features of /k/ and /q/ phonemes revealed significant reasons for the historical change of these two phonemes. The dialect aims to simplify /k/ and /q/ in its lexicons. The dialect, on the other side, faces some barriers to particular features which simplify the phonemes into other allophones in different positions. Therefore, the following tables show the positions of /k/ and /q/ changes and their barriers to the phonological features in order to identify the changes and provide explanations of the reasons for such changes.

TABLE 2  
THE CHANGE OF /k/ IN ARABIC LEXICONS FROM STANDARD ARABIC TO [TS] IN NAJDI ARABIC

/k/ → [ts]					
	Arabic Words	Translation of Arabic Words	Under Representation (Standard Arabic)	Surface Representation (In Saudi dialect)	Surface Representation (In Najdi Arabic)
1.	هكذا	Like this	/ka ða/	/ki ða/	[tsi ða]
2.	كبير	Big	/kabi:r/	/kibi:r/	[tsibi:r]
3.	سكين	Knife	/sikki:n/	/sakki:n/ or /sikki:n/	[sitssti:n]
4.	ركب	Rode	/rakiba/	/rakab/	[ritsab]
5.	كيس	Bag		/kiis/	[tsiis]
6.	كأنه	Like	/kaʔnnah/	/kannah/	[tsinnah]
7.	مكان	Place	/makan/	/makan/	[mitsan]
8.	حكى	Talk	/haki/	/haki/	[hatsi]
9.	بركة	Blessing	/barakah/	/barakah/	[britsah]
10.	يعلك	Chew	/yaʕlik/	/yiʕlik/ or /yaʕlik/	[yʕalits]
11.	كلاب	Dogs	/kila:b/	/kla:b/	[tsila:b]
12.	بواكير/عصي	Stick (dialect)	/bawaki:r/	/bawaki:r/ or /bu:waki:r/	[bu:atsi:r]
13.	كنا	We were	/kunna/	/kunna/ or /kinna/	[tsinna]
14.	كان	Was	/kan/	/kan/	[tsan]
15.	كافي	Enough	/kafi/	/kafi/	[tsafi]

Table 2 shows the lexicons in standard Arabic, and how they changed in the dominant Saudi dialect in general and in Najdi Arabic in particular. Obviously, the consonant /k/ in the lexicons of both Standard Arabic and the Saudi dialect changed to [ts] in Najdi Arabic.

According to Table 4, the phoneme /k/ is a voiceless velar stop in Standard Arabic (under representation). On the other hand, it changed to the [ts] allophone, which is a voiceless alveolar affricate in Najdi Arabic (surface representation). The production of /k/ as [ts] does not occur in all lexicons; it happens only with the front vowel /i/ and the central vowel /a/. The phoneme /k/ is [+back and + high] whereas the phoneme /i/ is [-back and + high] (see Example 1).

**Example (1):**

(The phonological features of [ts] and the vowels /i/ and /a/ in Najdi Arabic)

[kiða] (It means 'like this' in the Saudi dialect)

[tsiða] (It means 'like this' in Najdi Arabic)

/k/	/i/
+ con	-con
+ dor	-back
+ high	+ high
+ back	

[ts]	/i/
+ con	-con
+ cor	-back
+ ant	+ high

Possibly, these features, especially [+back, -back], facilitate the /ts/ palatalization. Therefore, the phoneme /k/ changed to [ts] due to the latent assimilation between [ts] allophone and /i/ phoneme in terms of phonetic features. The allophone [ts] is [+ant] and the phoneme /i/ is [-back and +high]. They are adjacent in the place of articulation and thus support the change, based on the features. The allophone [ts] occurs when it is followed or preceded by the /i/ phoneme. Additionally, [ts] occurs with the phoneme /a/ because it is [+low, -back], i.e., it is produced in the middle of the tongue to support the production of [ts] (see Example 2).

**Example (2):**

[kan] (It means 'was' in the Saudi dialect)

/k/	/a/
+ con	-con
+ dor	-high
+ high	+low
+ back	-back

[tsan] (It means 'was' in Najdi Arabic)

[ts]	/a/
+ con	-con
+ cor	-high
+ ant	+low
	-back

It is obvious that the vowels /i/ and /a/ share the feature [-back], which plays an important role in the change. The allophone [ts] is an affrication of the /k/ phoneme which aims to simplify producing the sound when /k/ occurs with different places of articulation of vowels.

The sound change of velar palatalization from [k] to [ts] with front vowels is natural in languages, but it is also rare (Guion, 1996). The velar palatalization occurs as a result of rapid speech (Guion, 1996; Syrika et al., 2011). Although the researcher attempts to investigate the reasons for this by analyzing the phonetic features of the vowels i and a and the consonants k and ts. As Guion (1996) states, there is "no consensus view on how the articulation change is accomplished." At the same time, there are many attempts from researchers to identify the physical reasons for the articulation change. In 1922, Johnson (cited in Guion, 1996) noted that the velar [k] makes an imprint on a palatogram when it is produced before front vowels on one hand. On the other hand, [k] makes no imprint on palatogram when it is produced before back vowels. Another explanation of the change of the velar sound is proposed by Anttila (1989, cited in Guion, 1996). Anttila (1989) mentions that shifting [k] to a coronal place of articulation is a result of the narrow shape of the vocal tract. Velar palatalization is produced only with front vowels, not with back vowels. However, there were certain vowels that trigger the palatalization more than any other vowels. From an articulatory view, they are front and high vowels (Zygis et al., 2008).

Based on physical explanation, people pronounce /k/ using the tongue body. It was found that the velar closure is achieved at the velar region. At the palatal region of the vocal tract, it was observed that the vowel /i/ is pronounced by a narrow constriction of the tongue body directed to the palatal region when the vowel follows the consonant to change into [ts] (see Figure 4).

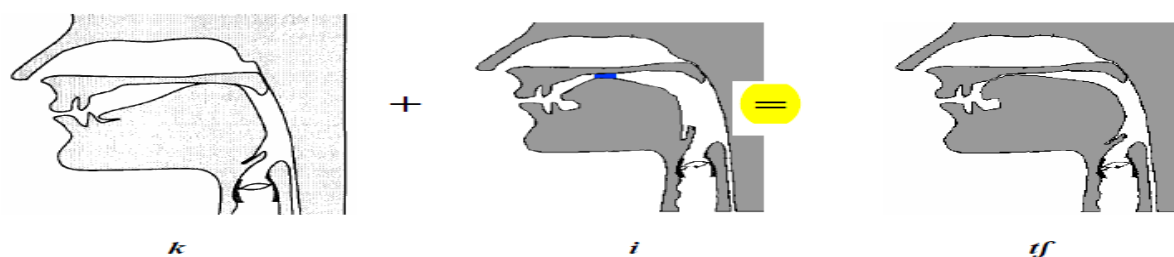


Figure 4 (as found in Bateman, 2007, p.9)

As can be seen in Figure 4, the result is [tʃ], but focus on the beginning of the result, i.e. the consonant /t/, is needed to show the process of articulation. In the articulation of /k/ with the vowel /i/, it was found that the back consonant, i.e., /k/ → [ts] in Figure 4, was fronted and both the consonant and the vowel use the tongue articulator (Bateman, 2007). This means that front vowel /i/ and coronal consonant /ts/ are members of the class [coronal] (Hume, 1996). Moreover, both the front vowel /i/ and the consonant /k/ are [+High].

One interesting observation is that the same vowel /i/ does not trigger palatalization of /k/ in Navajon, but /e/ does (Bateman, 2007). According to Bhat (1978), velar consonants are influenced more by front vowels whereas the labial and coronal consonants are affected more by high vowels.

Table 3 shows in standard Arabic some lexical items that have a little or no change in both Saudi and Najdi Arabic. Also some lexicons in the Saudi dialect, but not in Standard Arabic, do not change in Najdi Arabic. In addition, the borrowed words do not change in both Saudi and Najdi Arabic.

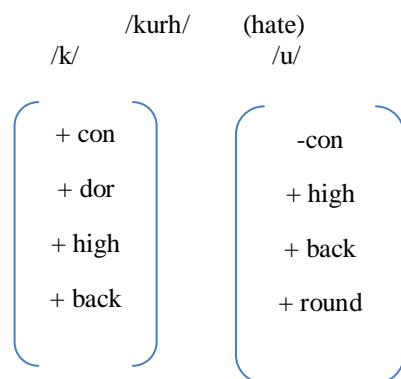
TABLE 3  
THE UNCHANGED ARABIC LEXICONS WITH /k/ IN STANDARD ARABIC AND NAJDI ARABIC

/ k /					
	Arabic words	Translation of Arabic words	Under Representation (In Standard Arabic)	Surface Representation (in Saudi dialect)	Surface Representation (in Najdi Arabic)
1	كرسي	Chair	/kursi/	/kursi/	/kirsi/
2	كراث	Leek	/kurraθ/	/kurraθ/	/kirraθ/
3	كلية	College	/kulliah/	/kulliah/	/killiah/
4	كحل	Eyeliner	/kuhl/	/kihl/	kihl
5	كوريا	Korea	/ku:ria/	/ku:ria/	/ku:ria/ country name
6	كفر	Unbelieving	/kufri/	/kufri/ or /kufur/	/kufur/
7	كحة	Cough	/kuhhah/	/kahhah/	/ kahhah /
8	كتلة	mass	/kutlah/	/kutlah/	/kutlah/
9	كسوف	Eclipse	/kusu:f/	/ kusu:f /	/kusu:f/
10	ضوء	Light	-	/ kubs /	/ kibs / borrowing
11	كف	Palms	/kufu:f/	/kufu:f/	/kufu:f/
12	كوابيس	Nightmares	/kawabiis/	/kawabiis/	/kuabiis/
13	كره	Hate (N)	/kurh/	/kurh/	/kurh/
14	الكوفة	Al-ku:fah	/alkuufah/	/alkuufah/	/alkuufah/
15	باذنجان	Zucchini	/kuusah/	/kuusah/	/kuusah/
16	كرة	Ball	/kurah/	/kuurah/	/kuurah/
17	كوري	Korean	/kuuri/	/kuuri/	/kuuri/
18	كوخ	Cottage	/kuux/	/kuux/	/kuux/
19	كوفة	Pile	/kawmah/	/kawmah/	/kawmah/
20	كوب	Cup	/ku:b/	/Kawb/	/Ku:b/
21	معطف	Coat	-	/kawt/	/kawt/ borrowing

According to Table 3, the phoneme /k/ (a voiceless velar stop) in Standard Arabic does not change to any other phonemes or allophones in the Saudi dialect in general or Najdi Arabic in particular. The most important observation here is the occurrence of phoneme /k/ with the phoneme /i/ without any change, i.e., the consonant /k/ has not changed to [ts]. However, it may change in the future as long as most of the words change their cases.

In the case of consonant /k/, which is pronounced as it is in Standard Arabic, does not change with the vowels /u/ and /o/. The main reason is that the vowels are [+ round]. This means that they prevent the phoneme /k/ from changing into any other position (see Example 3).

**Example (3):**



In Figure 4, the tongue position of /k/ with the front vowel /i/ which leads to the palatalization [ts] physically is explained. In this paragraph, the discussion concentrates on the back vowel /u/ with the consonant /k/. Regarding the articulation of /k/, it has been clarified that it is articulated by the tongue body at the velar region with a velar closure on one hand (see Figure 5).

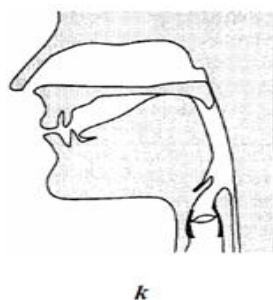


Figure 5 (as found in Bateman, 2007, p.8)



In the articulation of the vowel /u/, on the other hand, the tongue is positioned towards the back of the mouth and the lips are rounded (see Figure 6).



Figure 6 (as found in Bateman, 2007, p.8)

The two similar places of articulation and distinctive features between the back vowel /u/ and the dorsal consonant /k/, which are [+high, +back], enforce the two remaining sounds without change. Furthermore, the vowel is bilabial whereas the consonant is dorsal. Therefore, the researcher assumes that the roundness of /u/ blocks the change of the consonant. In addition, the consonant /k/ tends to remain with the vowel /u/. Finally, the back vowel /u/ and the dorsal consonant /k/ are not members of one class, like the front vowel /i/ and the coronal consonant [ts], so that they get palatalized.

With regard to the back vowels, they are not common enough to trigger palatalization generally. Therefore, it has been found that high back vowels do not trigger palatalization of dorsal consonants, but they trigger palatalization of coronal ones (Bateman, 2007).

Table 4 shows some lexical items from Standard Arabic and dialects that have changed in both Saudi and Najdi Arabic. In the Saudi dialect, the phoneme /q/ changed to /g/, and the phoneme /g/ changed to [dz] in Najdi Arabic.

TABLE 4  
THE LEVELS OF CHANGING OF PRODUCING /g/ IN ARABIC LEXICONS AS /Q/ IN STANDARD ARABIC TO [TS] IN NAJDI ARABIC

	Arabic words	Translation of Arabic Words	Under Representation (In Standard Arabic)	Surface Representation (In Saudi dialect)	Surface Representation (In Najdi Arabic)
1	قدر	Pot	/qidr/	/qidir/	[dzidir]
2	شرقي	Eastern	/ʃarqi/	/ʃargi/	[ʃardzi]
3	اذهب بعيدا	Get out (insulting meaning)	-	/ingiliʃ/	[indziliʃ]
4	راقب	Watch	/irqub/	/irgub/	[irdzib]
5	غادر	Leave	-	/fariq/	[faridz]
6	علق	Hang	/ʕalliḡ/	/ʕallig/	[ʕallidz]
7	مستيقظ	Awake	-	/fa:jiḡ/	[fa:jidz]
8	تنفس	Breath	-	-	[ifhidz]
9	صديق	True	/ʕidq/	/ʕidg/	[ʕidz]
10	سيقان	Legs	-	/siḡan/	[siidzan]
11	حساء	Broth	/maraqah/	/maragah/	[mridzah]
12	حلقة	Ring	/ḡalaḡah/	/ḡalagah/	[ḡlidzah]
13	رقبة	Neck	/raqabah/	/ragabah/	[rdzibah]
14	إقلب	Flip over	/iqlibhu/	/iglibah/	[idzlibah]
15	قبلة	Direction of prayer	/qiblah/	/giblah/	[dziblah]
16	رفيق	Companion	/rafi:q/	/rafi:g/	[rifi:dz]
17	بهارات	spice	-	/swa:hi:q/	[swa:hi:dz]
18	عائد	Returned	-	/miḡifi/	[midzfi]
19	عتيق	Ancient	/ʕati:q/	/ʕati:g/	[ʕati:dz]

According to Table 4, the phoneme /g/ is a voiced velar plosive in Standard Arabic. In contrast, it changed to a [dz] allophone which is a voiced alveolar affricate in Najdi Arabic. The phoneme /g/ had undergone two stages until it became [dz] in Najdi Arabic. At the beginning of producing the sound, the allophone [g] was /q/ phoneme (a voiceless uvular plosive), but then it changed to /g/. Finally, the phoneme /g/ has become a [dz] allophone with the high front vowel /i/. The phoneme /i/ is [-back] whereas /q/ phoneme is [+back]. Hence there is an obvious reason, based on the features, why the /i/ phoneme triggered the palatalization. It is similar to the case of /k/ phoneme that changed to /ts/ phoneme. The [dz] allophone is a palatalization whose purpose is to simplify the production of /g/ with the high front vowel to become [dz]. Therefore, [dz] shares the phoneme /i/ vowel with assimilatory features to support the result of change (see Example 4).



**Example 4:**

/rifi:g/ (friend)

[rifidz] (it means friend in Najd dialect)

/i/	/g/	or	/q/	/i/	[dz]
-con	+con		+con	-con	+con
+high	+dor		+dor	+high	+cor
-back	+back		+back	-back	+ant
	+high				

The /g/ phoneme is [+high and +back] and /i/ is [+high and -back], both of which facilitate palatalization. It sheds light on producing the sound in comparison with the /q/ phoneme which has a heavy articulation. The phoneme /g/ has changed to a [dz] allophone. It is observed that /i/ is [-back] and [dz] is [+ant], which means that the /i/ phoneme affects /g/ so that it becomes [dz]. The vowel /i/ can have an effect when it follows or precedes the /g/ phoneme. Table 5 shows some lexical items from Standard Arabic in which /q/ has changed to /g/ in both Saudi and Najdi Arabic.

TABLE 5  
THE CHANGE OF PRODUCING /Q/ IN ARABIC LEXICONS IN STANDARD ARABIC TO [g] IN NAJDI ARABIC

	Arabic words	Translation of Arabic words	Under Representation (In Standard Arabic)	Surface Representation (In Saudi dialect)	Surface Representation (In Najdi Arabic)
1	قتل	Kill	/qatil/	[qatil]	[qatil]
2	قشر	Peels	/qiʃr/	[giʃr]	[giʃr]
3	قصيدة	Poem	/qaSi:dah/	[qiSi:dah]	[qiSi:dah]
4	قرية	Village	/qaryah/	[garyah]	[garyah]
5	قصر	Palace	/qaSr/	[qaSr]	[qaSr]
6	قصة	Haircut	/qaSah/	[qaSah]	[qaSah]
7	قبر	Grave	/qabr/	[qabr]	[qabr]
8	قرن	Horn	/qarn/	[qarn]	[qarn]
9	قحط	Drought	/qahāT/	[qahT]	[qahT]
10	مكانة	Position	/qadr/	[qadr]	[qadr]
11	وسخ	Dirt	/qaraf/	[qaraf]	[qaraf]
12	قمل	Louse	/qaml/	[qaml]	[qaml]
13	قلم	Pen	/qalam/	[qalam]	[qalam]
14	قاضي	Judge	/qaDi/	[qaḍi]	[qaḍi]
15	أقارب	Relatives	/ʔaqarib/	[ʔaqarib]	[ʔaqarib]
16	قارة	Continent	/qarrah/	[qarrah]	[qarrah]
17	قارورة	Bottle	/qaru:rah/	[garu:rah]	[garu:rah]
18	قاسي/صارم	Strict	/qasi/	[qasi]	[qasi]

According to Table 5, the phoneme /q/ is a voiceless uvular plosive in Standard Arabic. On the other hand, /q/ changed to the [g] allophone which is a voiced velar plosive in Najdi Arabic. Additionally, [g] indicates the second stage of change for the /q/ phoneme in Table 4. Therefore, in this section, it can be said that it is possible for the allophone [g] to change to [dz] in Najdi Arabic in the future due to the existence of vocalic triggers, such as the vowels /i/ and /a/. In fact, based on the features of both q and g, the researcher could not identify any possible reason for why q changed to g (see Example 5).

**Example 5:**

/qabr/ (it means grave in Standard Arabic)

[qabr] (in Najdi Arabic)

/q/	/a/	/g/	/a/
+ con	-con	+ con	-con
+ dor	-high	+ dor	-high
+ back	+ low	+ high	+ low
-high	-front	+ back	-front
	-back		-back
	-round		-round

However, a simple answer is because of the difficulty of pronouncing /q/. As a result, the change is to the light consonant /g/. Table 6 shows some lexical items from standard Arabic that have not changed in both Saudi and Najdi

Arabic. The consonant /q/ is followed by the vowel /u/, similar to what is said in Table 3 about the consonant /k/ with the phoneme /u/.

TABLE 6  
THE UNCHANGED /q/ IN ARABIC LEXICONS IN STANDARD ARABIC AND NAJDI ARABIC

/q/			
	Arabic Words	Translation of Arabic words	Under Representation (In Standard Arabic and Najdi Arabic)
1	قرآن	The Holy Quran	/qurʔan/
2	قبرص	Cyprus	/qubruʃ/
3	قرحة	Ulcer	/qurḥah/
4	قرنفل	clove	/qurunful/
5	قمع	Funnel	/qumʕ/
6	قنوت	Pray	/qunu:t/
7	قبلة	Kiss	/qublah/
8	قولون	colon	/qawlawɪn/

According to Table 6, the phoneme /q/ (a voiceless uvular plosive) in Standard Arabic has not changed to any other phonemes or allophones in all the data. It means that the /q/ phoneme is pronounced as it is in Standard Arabic and Najdi Arabic. The main reason is that the phoneme /q/ is [+back] and the phoneme /u/ is [+back], i.e., they share backness. Additionally, the phoneme /u/, which is [+round], stops the phoneme /q/ from changing into any other one. It is similar to the case of the /k/ phoneme. Moreover, the phoneme /q/ may change in Najdi Arabic in the future if the vowel changes from [+back] to [-back] (see Example 6). It is heard in borrowed words and religious terminologies.

**Example 6:**

/qurʔan /	(It means the Holy Quran)
/q/	/u/
<div> <div>+ con</div> <div>+ dor</div> <div>+ back</div> </div>	<div> <div>-con</div> <div>+ high</div> <div>+ back</div> <div>+ round</div> </div>

In the example above, the phoneme /q/ has not changed to any other allophones in Najdi Arabic. The phoneme /q/ is [+back] and the phoneme /u/ is [+back]. They share the feature [+back]. On the other side, the /u/ phoneme is [+round] and stands as a barrier to changing the phoneme /q/ to other allophones.

In Najdi Arabic, the researcher argues that not only the vowels cause the consonants to be palatalized but also the consonants affect the vowels in terms of frequency and duration. In this section, the focus is particularly on the consonantal effect on the vowels. Also, it has been found that there is a need to mention the velar /k/ because the [ts] palatalization occurs a result of it. Therefore, the following table and charts clarify the influence of them on the high front vowel /i/ in terms of frequency and duration.

TABLE 7  
THE AVERAGE OF THE FREQUENCY AND DURATION OF [i] SOUND WHEN IT IS PRECEDED BY [k] AND [ts]

	F1	F2	Duration
ki	368.1933 Hz	2120.439 Hz	0.085581
tsi	359.4198 Hz	1968.166 Hz	0.082363

According to Table 7, the [i] sound has different frequencies and durations when it is preceded by [k] or [ts]. It means that the velar [k] and the palatalization [ts] have an influence on the frequency of vowels. Therefore, it has been observed that there is a difference in the frequency of F1 in [i] sound when it is preceded by [k] and [ts]. The difference is not very high between [ki] and [tsi], but they still exhibit a difference. The F1 frequency of [i] in [k] is 368.1933 Hz; whereas, the F1 frequency of [i] in [ts] is 359.4198 Hz. This difference displays that the [i] sound appears in different positions in the place of articulation in the front. As a result, it has been found that [i] with [k] is lower than [i] with [ts] in the place of articulation. Moreover, the frequency of F2 shows that there is a difference between [i] sound with [ki] and [ts] in terms of front and backness. The vowel sound in [ki] is 2120. 439 Hz whereas [i] sound in [tsi] is 1968. 166 Hz. It is obvious that the F1 frequency of [ki] is higher than [i] in [ts]. Thus, the [i] sound with [k] is more front than [i] sound in [ts]. It may infer that the features of [k], i.e. [+ high and +back], can cause [i] which is [+high] to be more front than [i] with [ts] in the place of articulation. Finally, there is no significant result in the duration; therefore, it has not been discussed in this study.

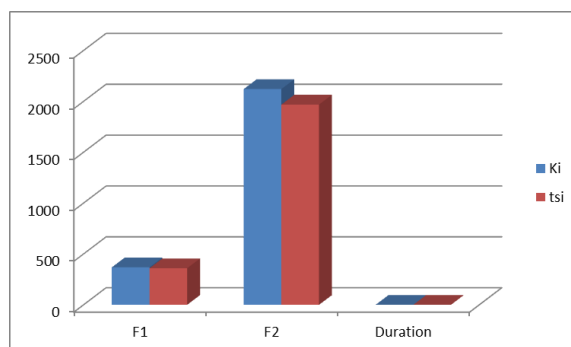


Figure 7 The Difference of Frequency of [i] Sound When It Is Preceded by [k] and [ts]

Figure 7 shows difference in the frequency of [i] sound when it is preceded by [k] and [ts]. As seen in the chart, there is no obvious difference in the frequency of F1 between [i] with [k] and [i] with [tsi] in terms of high and low level in the place of articulation on one side. On the other side, the difference in F2 frequency is obvious and relates to [i] sound in terms of front and backness. There is no clear difference in duration.

TABLE 8  
THE INFLUENCE OF CONSONANTS ON THE FREQUENCY OF THE VOWEL

	[gi]	[dzi]
<b>F1</b>	313.68 Hz	328.82 Hz
<b>F2</b>	2218.74 Hz	1941.994 Hz

According to Table 8, the frequency of the high front vowels with [g] and [dz] show results different from those of the influence of /k/ and [ts] on the vowel /i/. Regarding F1, it is observed that the high front vowel with the dorsal consonant [g] is higher than the vowel /i/ with the coronal consonant [dz]. For F2, the vowel, in the dorsal consonant [g], is more front than the vowel in the coronal consonant [dz]. The influence of palatalized [ts] on the vowel /i/ is completely different from the effect of palatalized [dz] on the same vowel (i.e., /i/).

In summary, it has been found that the dorsal consonant [g] is fronting the coronal consonant [dz] because of the existence of high front vowel /i/. Moreover, both the coronal consonant and vowel /i/ are members of the class of coronal sounds. The dorsal consonant [g] causes the vowel to be higher and fronter than the effect of coronal consonant [dz] on the vowel. This means that the vowel /i/ in [dz] is lower and backer than /i/ in [g].

## VI. CONCLUSION

This study identified the reasons for the historical change of the /k/ and /q/ phonemes in Najdi dialect, based on an analysis of their phonetic features. The /k/ phoneme changes to [ts] with the front vowels /i/ and /a/. The reason is that the vowel /i/ and the consonant /ts/ are members of class [coronal]. Although there are some words that include /k/ and are followed or preceded by the vowel /e/ with no change, it can be stated that they may be vulnerable to change in this dialect in the future. In the case of /k/ when it is followed or preceded by /u/ or /o/ vowel, it does not change because of the roundness that works as a barrier to change. The same reason occurs with the consonant /g/. It changes to /dz/ with front vowels, e.g. /i/, but not with back vowels. The /g/ phoneme has changed from /q/ for simplifying pronunciation. Similarly to the case of /k/ phoneme, the researcher found some words that have not changed /g/ to /dz/ although it is followed or preceded by /i/ or /a/ phoneme. However, they may change in the future. In this dialect, there are some words pronounced with /q/, not /g/, because they are borrowed words or religious terminologies. Regarding the acoustic analysis, it was found that the [i] sound appears in different positions in the place of articulation. For instance, the [i] with [k] is lower than [i] with [ts] in the place of articulation. Additionally, the frequency of F2 shows that there was a difference between [i] sound with [ki] and [ts] in terms of front and backness. In contrast, duration showed no significant influence. Regarding [gi] and [dzi], the frequency of high front vowels with [g] and [dz] indicated results different from those of the influence of /k/ and [ts] on the vowel /i/. The findings of this study recommend including more participants together with a different method of data collection to enlarge the number of words that exhibit this change. Furthermore, the researcher recommends comparing affrication across other Arabic varieties in Saudi Arabia.

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