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Syllabification in Najdi Arabic: A Constraint –Based Analysis

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Abstract
This paper seeks to show how the optimality theory regulates the syllabification of Standard Arabic, in general, and Najdi Arabic in particular. The arrangement of phonemes in the syllables is ruled by constraints. This paper shows how Najdi Arabic repairs the words adopted from Modern Standard Arabic to conform to Najdi Arabic constraints. The data is adopted from different sources such as previous studies, and the researcher's own data. Although a number of studies have been conducted on Arabic, this is the first study that implements the optimality theory to account for Najdi Arabic syllabic structure. Issues tackled here include epenthesis, syncope, the markedness of sonority hierarchy, vowel shortening, cluster tolerance and apocope. The analysis here is conducted at the word level.
Keywords: constraint, markedness, Najid dialect, optimal theory, sonority, syllabification

Introduction

Arabic language belongs to the Semitic group of languages. Arabic is the native language of over 150 million Arabs living in the area that extends from Morocco in the north western part of Africa to the United Arab Emirates and Oman in the eastern coast of the Arabian Gulf. Formally, Arabic has a morpho-syntactic structure that is unrelated to English or any of the Indo-European languages. For example, Arabic enjoys a rich inventory of consonants. Arabic has three varieties: Classical Arabic (the language of Islam's holy book), Modern Standard Arabic, and Arabic dialects. Modern Standard Arabic is the official language used in all seventeen Arab countries. It is used in formal situations which include political speeches, sermons, lectures, news broadcasts, conference discussions and most written activities. Colloquial Arabic, on the other hand, is the actual language of everyday activities, mainly spoken, and it varies not only from one Arab country to another, but also from one area to another within countries (Watson, 2007).

Modern Standard Arabic has twenty-eight consonants. It has also three short and three long vowels. Furthermore, it has a rich inflectional system of case for nouns and verbs, including plural forms for verbs, nouns and pronouns. It is endowed with a rich vocabulary characterized by a multiplicity of synonyms. In contrast, the phonological system of the colloquial varies extremely, but all of these share a simplified inflectional system of case and dual forms. Phonemically, when we consider the several colloquial dialects of Arabic that exist in the Arab countries, the number of consonants would be thirty one and here the reference is to the Arabic sounds as they are used orally. The sound system of Modern Standard Arabic is not very distinct from that of the colloquial. Very few sounds that exist in the Modern Standard Arabic are not used in the colloquial and vice versa (Brustad, 2000). Verbs and nouns are main word classes. Nouns are derived from verbs and verbs are sometimes derived from nouns. Therefore, Arabic language has a very distinct and complicated conjugated system.

There are three root types: strong, hallow and weak. The strong root does not contain glides (ktb "to write"). The hollow root has a glide as the second letter (nwm "to sleep"). The weak has a glide as the third letter (rmy "to throw") (Kabrah, 2004). In Arabic writing system, the short vowels are not written; only the long vowels are. For example, the word /kataba/ consisting of three consonants would be in Arabic system as follows: ktb.

The vowels in transcriptions will be short vowels a, i, u and the long vowels will be a: , i: , u: . Using English transliterations, we will use the Arabic writing system in most cases here (Aryan, 2001).

Najdi Arabic (spoken in the central part of Saudi Arabia) is similar to Modern Standard Arabic to some extent. However, there are some sounds that exist in Modern Standard Arabic, but are not found in Najdi Arabic. For instance, the phoneme /d/ which is a voiced dental fricative exists in Modern Standard Arabic, but is not there in Najdi Arabic. The phonemes /z/ and /d/ has been merged and pronounced as /z/. On the other hand, the voiceless affricate allophone [ts] of the phoneme /k/ is found in Najdi dialect, but does not exist in Modern Standard Arabic (e.g. the phrase " keef halak" meaning "how are you" in Modern Standard Arabic becomes " tseef al haal"). The inventory of vowels include three short vowels and three long vowels (i, a, u, i:, a:, u:). Look at appendix (a) for the inventory of the Najdi system (Ingham, 1994). In general, the morphology of Najdi Arabic is similar to that of Modern Standard Arabic with the exception that Najdi Arabic exhibits more elaborate morphology.

Theoretical Background

Prince and Smolensky (2004) introduced the optimality theory in 1993 as a model for linguistic analysis. The optimality theory states that there are no rules in the derivation of the surface forms, but a set of competing constraints that chooses the optimal form among possible set of candidates. The optimal form is the one that incurs minimal violations. Well-formedness constraints are ranked in a hierarchal pattern starting from the highest rank to the lowest rank.

The analysis of this study is based on the optimality theory. In this study, the researcher will work on different universal constraints or at least constraints that are employed in some languages. The focus will be on phonological phenomena such as epenthesis, syncope, vowel shortening, apocope, and sonority hierarchy. The following summarize the core principles of the optimality theory (Kager, 1999: 12; & Archangeli, 1999: 335)

1) Violability: "constraints are violable, but violation must be minimal"
2) Optimality: the surface form is the most harmonic if "it incurs the least serious violations".
3) Domination: Constraints are rankable and the higher ranked constraints have priority over the lower ranked constraint admitted by the well-formedness of the competing output.

Only few studies examined Arabic dialects within the optimality theory (Aquil, 2013). There seems to be a consensus among researchers that the framework of optimality theory can better account for the phonological phenomena. Exploring the phonological property of Madina Hijaz Arabic, Jarrah (2013) found out that the optimality theory is sufficient to explain the characteristics of Madina Arabic such as consonant clusters. Similarly, Aquil (2013) found out that no theory was able to capture the phonological phenomena of Cairene Arabic except the optimality theory. Compared to other generative phonological theories, the optimality theory provides a better analysis for epenthesis in Cairene Arabic.

Since the syllable structure is the most important component of phonological organization, and since it is the ground upon which the study is based, it will be a wise idea not to tackle the constraints in the optimality theory before having a clear idea about the syllable structure of Modern Standard Arabic and Najdi Arabic.

Modern Standard Arabic Syllables

Like English, Modern Standard Arabic has two kinds of syllables: an open syllable and a closed syllable. In Modern Standard Arabic, the open syllable consists of a consonant and a vowel (CV) or a consonant followed by two vowels (CVV). The closed syllable consists of a consonant followed by a vowel and a consonant (CVC) or a consonant followed by two vowels and a consonant (CVVC). The latter syllable (CVCC) occur word finally (Halpern, 2006). Additionally, Modern Standard Arabic does not allow initial consonant clusters (double onsets) and even if they appear close to each other, the first consonant of the cluster belongs to the coda of the first syllable and the second acts as a second of the second syllable (Mitchell, 1990). For example, mak.tab (desk) can be illustrated below to clearly show the point.

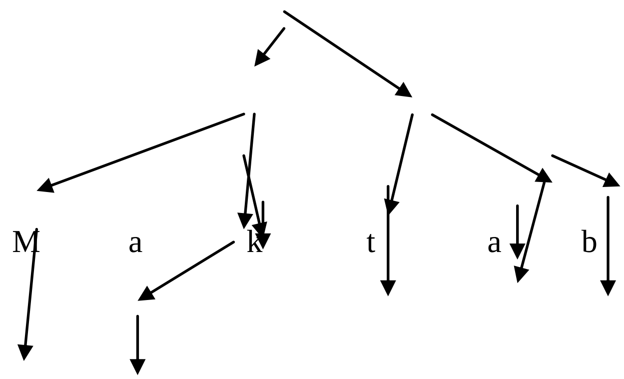

Figure 1. **Tree diagram of mak.tab**

The syllabic structure of Modern Standard Arabic has shown that the possible syllable types are as in the following:

a. Light syllable: CV (ka.ta.ba) (wrote). This syllable comes word initially, medially, and finally.
b. Heavy syllable: CVV. This occurs word initially (ka:.tɪb " writer"), medially (ka.lɪ.maa.tɪ " my words") and finally (ramaa "threw").
   CVC occurs in all positions (e.g yɪk.tub " he writes") and it is light word finally.
c. Superheavy syllable: The following super heavy syllables occur at word end.
   CV:C (nu:m) (sleeping).
   CVCC (barq) (lighter).
   CV:C (shaabb) (young).

Since speakers of Modern Standard Arabic delete short vowels in the word final position upon pausing, the final structure is CVCC. For example, ʔa.kaltu tufaha (I ate an apple).
Pausing on the word (ʔa.kaltu) would yield (ʔa.kalt). Here the word final short vowel /u/ is deleted/ apocopated (Halpern, 2006).

Syllabic Structure of Najdi Arabic

In general, the syllabic structure of Najdi Arabic is not much different from that of Modern Standard Arabic. In Najdi Arabic, there are three basic types of syllables:

a. Light syllable (CV). This syllable occurs word initially, medially and finally. For example, ʔɪk.ta.bu (they wrote). Here the syllable (CV) appears word initially, medially, and finally.
b. Heavy syllable (CVV). This syllable occurs word initially but usually comes word medially. It does not appear word finally. That means that Najdi Arabic diverges from Modern Standard Arabic in disallowing CVV word finally, as illustrated in ka:.tɪb 'writer'. Here it is word initially.

Like the light syllable, this syllable (CVC) occurs in all positions. This syllable, however, is regarded in the final position as a light syllable. For instance, the underlined is the CVC syllable.
<u>mak</u>.ta.<u>buh</u> (his office).

kɪ.tab.tuh (I wrote it).
Another heavy syllable is CCV (e.g. ktibat " she wrote").

C. Superheavy

In Najdi Arabic, as in Modern Standard Arabic and most Arabic dialects, superheavy syllables appear in the word final positions:
CV:C (nu:m) (sleeping).
CVCC (barq) (lighter).
CV:C (shabb) (young).

In Modern Standard Arabic, it is possible to obtain a string of five light syllables: ʃa.ga.ra.tu.hu.ma: "their (dual) tree". Such a form does not exist in Najdi Arabic. It can be observed that Najdi Arabic has a maximum of four syllables (e.g., ɪʃ.ga.rat.hum "their (dual) tree").

Methodology

The methodology used in this study is based on data collected from the previous studies and the researcher's data since he is a native speaker of Najdi Arabic. Care was taken to include words of different syllables, for example, initial consonant clusters and short vowels.

Najdi Arabic Syllable Structure within Optimality Theory

To account for the syllabic structure of Najdi Arabic within the optimality theory and to provide a better analysis of phonological phenomena such as consonant cluster, epenthesis, sonority hierarchy, vowel shortening, syncope and apocope, the following main constraints are used:

Markedness Constraints
a)*[□ V
Syllables must have onsets

b) *[□ CC
Onsets are simple

Faithfulness Constraints:

c) MAX-IO (no deletion)
d) DEP – IO (no insertion)

Consonant Clusters

Unlike Modern Standard Arabic, Najdi Arabic allows both simple onsets and initial consonant clusters (double onsets). For examples, **fl**a.mu.hum "their movies", **gl**a.mu.hum "their pens", **kt**ibat "she wrote", and **xd**ilat "she betrayed". Allowing both of these syllable structure CV and CCV is regarded to be "universally marked" compared to simple onsets (Kager, 1999). This fact can be accounted for by the following constraints of Najdi Arabic.
a)*[□ V
Syllables must have onsets

b) *[□ CC
Onsets are simple

Najdi Arabic behaves symmetrically according to theses constraints. The complex constraint *[CC is dominated by the other constraints. On the other hand, it is undominated in Modern Standard Arabic. In what follows the researcher shows how the ranking of the *complex onsets constraint accounts for the well-formedness of the syllable in Najdi Arabic.

Input / ktibat/	***[□ V**	**MAX-IO**	**DEP-IO**	***[□ CC**
a. katabat			*!	
→ b. ktibat				*

Tableau (1)

The optimal candidate, which is marked by the arrow, is (b). This candidate has no violation of the higher ranked constraint and it is the only one that incurs the least serious violations. Candidate (a) was fatally violated by the faithfulness constraint Dep-IO. If the ranking is reversed, the optimal candidate will be the incorrect form.

Input / **ktibat** /	***[□ V**	***[□ CC**	**Dep-IO**	**Max-IO**
→ a. katabat			*	
b. ktibat		*!		*

Tableau (2)

In tableau 2, ranking the markedness (the complex onset constraint) higher than the faithfulness constraint yields the incorrect form (katabat).

This is why the Najdi Arabic speaker would not encounter a problem in pronouncing an English word such as “street”. Other dialects in Saudi Arabia would face difficulty in pronouncing such clusters. To solve this dilemma, speakers of these dialects resort to epenthesis. They insert a vowel to resyllabify the English word to conform to the syllabic structure permitted in these dialects (Hassan, 2007). Applying the same example, they would utter (sitreet) instead of pronouncing (street).

Epenthesis :(Vowels)

This section analyzes epenthesis at the word level. In Najdi Arabic, epenthesis reduces the occurrence of the syllabic structure (CVCC). Najdi speakers insert a vowel to split the final cluster. For example, the word (gidr “pot”) is pronounced without inserting a vowel in Modern Standard Arabic whereas in Najdi dialect a vowel is epenthesized to break up the final cluster (gɪdɪr). Other examples include the following: (Abu- Mansour, 1991)

Table 1. ***Vowel epenthesis in Najdi Arabic***

Input	**Output**	**Gloss**
ʔism	ʔɪsɪm	Name
Tifl	Tifil	Child
ʃukr	ʃukur	Thanking
Sahl	Sahil	Simple
gɪdr	gɪdɪr	Pot

Deducting from the above examples (table 1), it could be claimed that complex codas are allowed only when they conform to the sonority sequencing principle which dictates that sonority level should drop as we move from C1 to C2 (Yavas, 2006). Based on this, only consonant clusters that agree with the sonority sequencing principle are accepted. We notice here that the consonant clusters do not conform to the sonority sequencing principle. To avoid a consonant cluster that violates this principle, typical avoidance strategy is used, namely, epenthesis. The consonant cluster, for instance, [dr] has a sonority peak, rather than a sonority fall which makes Najdi native speaker insert a vowel [dɪr].

If we look at the following examples (Abu- Mansour, 1991) (table 2), we notice that the coda clusters (e.g. kanz, harf) conform to the sonority sequencing principle and thus they do not undergo the rule of epenthesis. That is, a word can end with the sequence [rd] and [lt]] but cannot end up with the inverse sequence, [dr] and [tl] because the sonority level rises as we move for instance from /d/ to /r/.

Table 2. ***Sonority sequencing principle in Najdi Arabic***

Input	**Output**	**Gloss**
Harf	Harf	Letter
Katabt	Katabt	I wrote
gɪrd	gɪrd	Monkey
Kanz	Kanz	Treasure

These facts can be accounted for by the following constraints:
Markedness Constraint:
a)Son-SEQ (complex onsets rise in sonority and complex codas fall in sonority).
Faithfulness Constraints
b) MAX-IO (no deletion)
c) DEP – IO (no insertion)

To account for examples in table (1), SON-SEQ dominates the anti-epenthesis constraint DEP-IO. Put on a tableau, this will look as follows:

Input / tɪfl/	***[□ V**	**SON-SEQ**	**MAX-IO**	**DEP-IO**
→ a. tɪfɪl				*
b. tɪf			*!	
c. tɪfl		*!		

Tableau (3)

Epenthesis is chosen as a repair strategy over deletion and this shows that Max-IO dominates DEP-IO. The optimal form here is (a) tɪfɪl. Other forms are violated by either by MAX-IO or DEP-IO.

If we keep the same constraints, no epenthesis would occur since SON-SEQ is not violated, as is shown in tableau (4).

Input / harf/	***[□ V**	**SON-SEQ**	**MAX-IO**	**DEP-IO**

→ a. harf				
b. har			*!	
c. harif				*

Tableau (4)

The optimal output here is (a) harf. The two constraints SON-SEQ is ranked higher than MAX-IO and DEP-IO. Some Arabic dialects such as Syrian and Lebanese Arabic, insert a vowel (e.g. harif) which shows that their syllable structure is not sensitive to the sonority sequencing principle.

However, there is a need for a morphological constraint to account for some words shown in table (3) (Al-Mohanna, 1998).

Table 3. ***Morphological constraint in Najdi Arabic***

Input	**Output**	**Gloss**
ʔasr	ʔasr	Capturing
Madh	Madh	Praising
Lakm	Lakm	Punching
Fath	Fath	Opening
Dafn	Dafn	Burying

If we take ʔasr as an example, even though the cluster sr violates the sonority sequencing principle, epenthesis does not apply here. Applying the epenthesis to the word (noun) would produce an output that is identical to the verb (ʔasar "capture"), having the same forms of the verbs derived from. To solve this dilemma, this syllable structure presupposes the following faithfulness constraint.

IDENT-IO
Correspondent segments in input and output must have an identical form.

To yield a correct form, the IDENT-IO constraint must be ranked higher than the SON-SEQ constraint as the following tableau displays. However, this constraint might not be the optimal one due to the fact that it is difficult to advocate distinctions of verbs, nouns, adjectives within the optimality theory.

Input / ʔasr/	***[□ V**	**IDENT-IO**	**SON-SEQ**
a. ʔasar		*!	
b. ʔasr			*

Tableau (5)

In tableau (5), the optimal candidate is (b) because it does not violate the faithfulness constraint IDENT-IO.

Using the same example in tableau (3), how can we account for an incorrect hypothetical candidate: *tıflı? How can we discriminate between *tıflı and tıfıl in a manner favoring the latter?

This candidate is a competitor since it respects the constraints SON-SEQ and MAX-IO. Therefore, we also need a right edge aligning constraint:

ALIGN]stem =]
The right edge of a Grammatical Word coincides with the right edge of a syllable

Now let's us examine this constraint in the following tableau in which there is particular ranking between ALIGN-R and DEP-IO is required.

Input / tɪfl/	***[□ V**	**ALIGN]stem =]**	**DEP-IO**
→ a.tɪ.fɪl			*
b.tɪf.lɪ		*!	*

Tableau (6)

The constraint **ALIGN]stem =]**outranks the constraint DEP-IO. The candidate (b) is ruled out by **ALIGN]stem =]**. The stem is separated from the right edge of the prosodic word by the final element /ɪ/ and thus it is misaligned. The optimal form (a) is successfully aligned. The right edge of ti.fil. (the stem final element /l/) is in itself the right edge of both the prosodic word and the lexical word.

The quality of the inserted vowel is usually similar to the vowel of the preceding syllable. The phoneme / ɪ / is usually chosen as the epenthetic vowel. This is governed by the following constraint (Adra, 1999: 22):

Epenthesis Association
***V/u, *V/a >> *V/I (it is less harmonic to epenthesize /u/ or /a/ than i).**

This phenomenon is exemplified in the following tableau

Input / gɪdɪr/	***V/u**	***V/a**	***V/I**
→ a. gɪdɪr			*
b. gɪdur	*!		
c. gɪdar		*!	

Tableau (7)

Candidates (b) and (c) are eliminated by the constraints ***V/u** and ***V/a.** Candidate (a) is the optimal form since it is worse to epenthesize **/u/ or /a/** than to epenthesize /ɪ/.

Epenthesis in Superheavy

As it has been said, Modern Standard Arabic as well many Arabic dialects including Najdi Arabic do not allow superheavy syllables to occur word initially or medially. To avoid the occurrence of superheavy syllables in non-final positions is by employing epenthesis. For instance, when the word kɪ.taab 'book' is attached to the suffix ha 'her', an epenthetic vowel (a) is added to prevent the non-superheavy syllables (AlMahanna, 1999).

kɪ.taab-ha → kɪ.taa.ba.ha (her book)
kɪtabt-hum → kɪ.tab.tu.hum (I wrote them)
tiin-na → tii.na.na (our clay)
jaab-ha → jaa.ba.ha (bring it to me)

To account for this behavior within the optimality theory, there is a need for an alignment constraint that blocks superheavy in non-final position (AlMahanna, 1999: 24)

ALIGN(S.H.) □
Every superheavy syllable must have its right edge aligned with the right edge of some prosodic word.

Also, in order to succeed in accounting for the epenthesis pattern in Najdi dialect, we need a syllable alignment constraint (ALIGNR) which is evaluated in terms of mora violation (Davis and Zawaydeh, 1996).
ALIGNR
Align the right edge of each syllable with the right edge of some prosodic word.

Tableau (8) shows that ***[□ V, ALIGNR,** and **ALIGN (S.H.)** □□□□must be ranked higher than **DEP-IO** constraint to yield the optimal output. If the ranking is revered by allowing DEP-IO to outrank the constraints, candidate (b), would lose and consequently the superheavy would occupy the non-final position (Davis and Zawaydeh, 1996)

Input/ bint-na/ (our daughter)	*[□ V	ALIGN(S.H.) □	ALIGNR	DEP-IO
a. bint.na		*!	U	*
→ b. bin.ti.na			u, uu	
c. bi.nit.na			u, uuu*!	*

Tableau (8)

Candidate (b) has three violations and candidate (c) incurs more than three violations; thus, candidate (b) wins since it satisfies the ALIGN constraint. Candidate (a) is a fatal violation. However, if the suffix begins with a vowel, then there is no need to insert a vowel because this vowel serves as the nucleus of the last segment of the stem. For examples,
kɪ.taab-i ⟶ kɪ.taa.bi (my book)
In this case, the faithfulness constraint DEP-IO will be ranked higher than ALIGN (S.H).

Epenthesis (Consonants)

Similar to Modern Standard Arabic, Every syllable in Najdi Arabic begins with a consonant, not a vowel. And if the word begins with a vowel (the definite article *al*), it is recognized in Arabic as beginning with the glottal stop /ʔ/. Universally, the presence of an onset is unmarked compared to its absence. Consider the following examples (table 4) which show how onset is important in Najdi Arabic and it is never violated in Arabic in general (Abu-Mansour, 1991; & Adra, 1999).

Table 4. ***Consonant epenthesis in Najdi Arabic***

Input	**Output**	**gloss**
ak.tub	ʔak.tub	Write (imperative)
an.ka.tab	ʔan.ka.tab	written
al.ki.tab	ʔal.ki.tab	book

a.naa.ni	ʔa.naa.ni	selfish

The interaction between the Onset constraint and the faithfulness constraints (MAX-IO and DEP-IO) is illustrated in tableau (9).

Input / a.naa.ni/ (selfish)	***[□ V**	**MAX-IO**	**DEP-IO**
→ a. ʔa.naa.ni			*
b. a.naa.ni	*!		
c. naa.ni		*!	

Tableau (9)

Each candidate incurs a violation of one constraint. The optimal form is (a) since it satisfies the high ranking constraints (Onset and MAX-IO). The violation of the DEP-IO is irreverent, given its ranking in the tableau.

Turning to codas, Najdi speakers usually add /h/ to the final words. This insertion/addition makes Najdi Arabic remarkable among all Saudi dialects. It shows that Najdi speakers prefer Coda to No-Coda. Consider the following examples.
mak.ta.buh (his office).
kɪ.tab.tuh (I wrote it).
The syllable structure (CVC) presupposes the following constraint:

NO-OPEN *V/u]□□
Word finally syllables ending in /u/ are not open.

Put on a tableau, this will look like

Input / kɪ.tab.tu/ (I wrote it)	***V/u]□□**	**DEP-IO**
→ a. kɪ.tab.tuh		*
b. kɪ.tab.tu	*!	

Tableau (10)

The second candidate (b) is eliminated by undominated NO-Open constraint as it contains an open syllable. Although candidate (a) violates DEP-IO, it is selected since it violates the lowest ranking constraint.

Vowel Shortening

In this section, we are dealing with an internal change in the syllables. When a superheavy syllable occurs in non-final position, the usual remedy is to insert a vowel between the consonant initial suffix and the last consonant of the superheavy syllable. However, vowel shortening in Najdi Arabic is restricted to hollow verbs that are suffixed by a dative marker followed by an object marker. When this environment exists, no epenthesis takes place. Instead of epentheis, the two vowels preceding the two consonants get reduced to one vowel (ALMahanna, 1999). Consider the following examples:
jiib-l-i ⟶ jib.li (bring to me)

raah-l-hum ⟶ rahlahum (he went to them)
To account for such behaviour within the OT framework, we need a set of constraints that are introduced so far.

Input /jiib-l-i/		*[□ V	DEP-IO	ALIGN(S.H.) □	MAX-IO
a.	jiib.li			*!	
⟶ b.	jib.li				*
c.	jii.ba.li		*!		
d.	jii.baa.li		*!		

Tableau (11)

To produce the optimal form, the other constraints should be ranked higher than the MAX-IO. As for the ranking of other constraint, their mutual ranking is irrelevant. All candidates incur a fatal violation of one constraint except candidate (b) whose its violation is least expensive.

However, vowel shortening in not triggered in case a long vowel is followed by consonant-initial suffixes (other than the dative markers). Vowel shortening underapplies in accusatives. For instance, ʃaaf-na 'he saw us', baab-na 'our door'. In these examples, the failure of vowel shortening is due to the constraint **MAX-IO,** which is ranked higher than **DEP-IO** and **ALIGN(S.H.)** □

Looking at what have been said from a different angle, Najdi Arabic allows CVCC word finally which means that a syllable coda could have more than one consonant as long as the nucleus does not have a long vowel. Thus, the syllable structure CVVCC is prohibited in Najdi Arabic. Even loan words such as [ba:nk] "bank", and [tʃa:ns] " chance" are pronounced as [bank] and [tʃans] with a short vowel. To account for this, we need to introduce two constraints (Adra, 1999)

***uuu**
trimoraic syllables are prohibited

Such a constraint should be ranked lower than the following constraint to avoid deleting the consonant.

MAX-C-IO
(no deletion of consonants).
So let's evaluate some of the candidates based on the constraints introduced so far:

Input / ba:nk/	*[□ V	MAX-C-IO	*uuu
a.ba:nk			*!
⟶ b.bank			

Tableau (12)

The word ‘bank’ here is bimoraic and it is the optimal form (b). Candidate (a) is fatally violated by the constraint *uuu.

Syncope

In this section, the deletion of the high short unstressed vowel will be discussed. This syncope affects the internal structure of the syllable and it occurs when the last consonant is attached to a vowel initial suffix. In this case, the word final consonant is resyllabified as the onset of the following syllable and the preceding high front unstressed vowel is deleted. Let’s consider the following examples (AlMahanna, 1999).

a. /yis-talim-uuk/ ⟶ yis.tal.muuk. `they receive you'
b. /tis-talim-ak/ ⟶ tis.tal.mak. `she receives you'

To avoid the occurrence of superheavy syllables in nonfinal positions, the high front unstressed vowel is syncopated. To account for this behavior with the optimality theory, the constraint that determines the optimality of this behavior is the ranking of Max-IO and DEP-IO relative to each other.

/tis-talim-ak/	*[□ V	DEP-IO	ALIGN(S.H.) □	ALIGNR	MAX-IO
⟶ a. tis.tal.mak				uu,uuuu	*
b.ti.tal.mak				uu,uuuu	**
c. tis.tal. aki	*!	*!		uu,uuuu	**
d.tis.talim.ak	*!		*!	u,uuuu	
e.tis.ta.li.mak				uu,uuu, uuuu *!	

Tableau (14)

Both candidate (a) and (b) violate only MAX-IO. In order to make sure that only the unstressed vowel is deleted rather than a consonant, we need to incorporate another constraint to discriminate against deleting a consonant.

MAX-V-IO (no deletion of vowels).

The MAX-C-IO must be ranked higher than MAX-V-IO constraint because deleting a root consonant is more fatal than deleting an unstressed vowel. Thus, this will lead us to choose (a) as the optimal form.

/tis-talim-ak/	*[□ V	DEP-IO	ALIGN(S.H.) □	ALIGNR	MAX-C-IO	MAX-V-IO
⟶ a. tis.tal.mak				uu,uuuu		*
b.ti.tal.mak				uu,uuuu	*!	*
c. tis.tal. aki	*!			uu,uuuu	*!	*
d.tis.talim.ak	*!		*!	u,uuuu		*
e.tis.ta.li.mak				uu,uuu,		

				uuuu *!		

Tableau (15)

However, syncope does not take place in the following examples (AlMahanna, 1999).
a. /SaaHib-i/ → SaaH.bi. `my friend (ms.)
b. /SaaHib-kum/ → Saa.Hib.kum `your(pl.) friend(ms.)
c. /Taalib-na/ → Taa.lib.na. `our student (ms.)
The vowels are not deleted in the above examples because the added suffix is not a vowel initial one; it is a consonant initial suffix.

Glottal Deletion (apocope)

In Najdi Arabic, the word final consonant (glottal stop) is deleted (see table 5).

Table 5. ***Apocope in Najdi Arabic***

Modern Standard Arabic	Najdi
ʔal.ki:m.ya:ʔ " chemistry"	ʔal.ki:.mya " chemsirty"
ʔal.fi:z.ya:ʔ " physics"	ʔal.fi: zya " physics"
ʔal.ga.da:ʔ " lunch"	ʔal/ga.da " lunch"
ʔal.sa.ma:ʔ " sky"	ʔal.sa.ma

To account for this kind of behaviour, we have to introduce another constraint that deletes the glottal stop word finally.
*ʔ]□□

Glottal stop must be deleted word finally

The following tableau demonstrates that behaviour.

Input / ʔal.ki:m.ya:ʔ/	**DEP-IO**	***ʔ]□□**	**MAX-IO**
a. ʔal.ki:m.ya:ʔ		*!	
→ b. ʔal.ki:.mya			*

Tableau (16)
The optimal form is candidate (b). Preserving the same output in candidate (a) is blocked by the constraint *h which mitigates against the presence of the glottal stop /h/ word finally.

Conclusion

In this study, the researcher explores the optimality theory and how it accounts logically for the processes related to the syllable structure of Najdi Arabic. The optimality theory is helpful in explaining the syllabic structure of Najdi Arabic. This study points out the existence of consonant clusters, epenthesis, aopcope in Najdi Arabic and how they work within the optimality theory. However, optimality theory is still unexplored and much remains to be known about this theory and how it applied to other phonological phenomenoa.

About the Author

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The Inventory of the Najdi System (consonants)

B	Voiced bilabial plosive
W	Voiced labio-velar continuant
F	Voiceless labiodentals fricative
D	Voiced dental fricative
T	Voiced dental fricative
D	Voiced dental plosive
T	Voiced dental plosive

Z	Voiced alveolar fricative
S	Voiceless alveolar fricative
Dz	Voiced alveolar affricate
Ts	Voiceless alveolar affricate
T	Voiced dental plosive
S	Phraygealized voiceless alveolar fricative
Y	Voiced palatal continuant
J	Voiced palatal plosive
S	Voiceless palate-alveolar fricative
G	Voiced velar plosive
K	Voiceless velar plosive
G	Voiced uvular fricative
Q	Voiced uvular plosive
X	Voiceless uvular fricative
H	Voiceless pharyngeal fricative
H	Voiceless pharyngeal fricative