Macrothink Institute™

International Journal of Linguistics
ISSN 1948-5425
2016, Vol. 8, No. 4

The Behavior of Noon Sakinah and Nunation in Quranic Recitation: An Optimality Account

Albatool Mohammed Abalkheel

Linguistics Program, Tulane University, 6823 St Charles Ave, New Orleans, LA 70118, USA

Tel: 1-504-432-3412 E-mail: albatool.abalkheel@hotmail.com

Received: July 21, 2016 Accepted: August 3, 2016 Published: August 16, 2016

doi:10.5296/ijl.v8i4.9761 URL: http://dx.doi.org/10.5296/ijl.v8i4.9761

Abstract

"Natural classes" refer to the set of sound patterns that go together in phonological processes. This paper provides an analysis of the phonological behavior of noon sakinah and nunation /n/ in Quranic recitation based on natural class generalization within the framework of Optimality Theory (OT). In some instances, the OT account may be accurate than traditional analysis. It provides evidence that natural classes derive from the nature of the set of markedness constraints, and that gutturals must constitute a natural class. The principal source of evidence for these proposals is that gutturals, unlike other places of articulation, do not induce nasal assimilation.

Keywords: Noon sakinah, nunation, Optimality Theory, Quranic recitation, gutturals, natural classes

1. Introduction

Reading the Qur'an appropriately and accurately requires applying several phonological processes. An example of these processes is the behavior of noon sakinah and nunation when they are followed by another sound within and across word boundaries. Noon sakinah and nunation are phonetically the same. They are pronounced as /n/; however they have different functions morphologically and syntactically (Alfozan, 1989). Among the differences between them is that noon sakinah comes in the middle, as in *ʔinjaaz* "accomplishment," and at the end of a word, as in *muslimeen* "Muslims". Nunation comes only at the end of words, as in *ʕaljmun* "knower". Unlike nunation, that can only be in nouns and pronounced just while speaking or reciting continuously, noon sakinah can be in verbs, nouns, and prepositions and may be pronounced at a stop or during speaking or reciting continuously.

Among the processes that /n/ undergoes is assimilation. This is a process that results in a phoneme realized differently as a result of being near to some other phoneme so the two (or more) sounds become more similar to each other (Roach, 1998). Therefore, feature(s) of two neighboring segments are transferred. It may occur at the beginning, in the middle, or at the end of words and can be complete or partial. Regarding direction, it can be progressive, regressive, reciprocal or coalescence. In progressive assimilation, feature(s) of the first sound passes to the second, whereas in regressive assimilation feature(s) of the second sound passes backwards to the first. In reciprocal assimilation each sound affects the other, whereas in the coalescent assimilation both sounds work together to produce a different sound. Assimilation is not restricted to Arabic, but it is common for nasal sounds in several languages (Ohala, Ohala, 2002).

Several Arab linguists have described nasal assimilation in Arabic (e.g. Abu-Abbas et al., 2010; Youssef, 2013). Using Optimality Theory (OT) as a framework, Abu-Abbas found coronal sonorant /n/ undergoes total assimilation to a following /r/ but not to any other continuant in Irbid Urban Jordaniam Arabic. Youssef (2013) found that /n/ in both the Cairene and Baghdadi Arabic dialects assimilates in place to a following /b, m, f, k, g, q, ʃ, ʒ/ consonant and none of his informants noted that it assimilates to a following /x, ɣ/. However, findings of these studies about nasal assimilation do not necessarily apply to the *Qur'anic* recitation.

Alfozan (1989) analyzed the nasal phonological processes in Quranic recitation and Standard Arabic using the descriptive features theory that is developed by Chomsky and Halle (1968). He argued that sonorants induce different types of nasal assimilation: complete regressive assimilation of /n/ to liquids and nasals, and partial regressive assimilation to glides. This argument led him to state that the coronal nasal loses place of articulation if the following consonant is a bilabial nasal. He also argued that the glides, namely /w, y/ behave like other obstruents, except gutturals and bilabials.

However, it is argued in this paper that analyzing the phonological behavior of /n/ in Quranic recitation within the framework of OT (Prince & Smolensky, 1993) is more accurate than the traditional analysis and the descriptive features theory. It is shown that the general behavior of /n/ can be captured through classifying following sounds in terms of natural classes that

derive from the nature of the set of markedness constraints, a proposal that Flemming (2005) calls for. Furthermore, evidence of McCarthy's (1994) proposal that gutturals must constitute a natural class is shown in this paper. Before providing the new analysis, a brief review of natural classes will be provided, followed by an exploration of the traditional analysis of /n/ in Quranic recitation.

2. Literature Review

2.1 Natural Classes

Phonologically, there are certain sets of sound patterns that go together in phonological processes. These sets are referred to as natural classes. An active natural class is composed of "sounds in an inventory which do at least one of the following, to the exclusion of all other sounds in the inventory: undergo a phonological process, trigger a phonological process, or exemplify a static distributional relation" (Mielke, 2008, p. 13).

Sounds in a certain natural class undergo the same phonological behavior when they appear in the same environments. For instance, voiceless plosives in English form a natural class because they have the same effect on voicing a following fricative (i.e., pronounced as [s]), and voiced plosives form a natural class because they have the same effect on a following fricative (i.e., pronounced as [z]) (Burquest & Payne, 1993). Examples are given in (1):

(1) Examples of the Effect of Voiceless and Voiced Plosives

a. map[s] tab[z]

b. cup[s] cub[z]

c. mat[s] fad[z]

McCarthy (1994) claimed that the post-velar consonants, which include the uvulars, pharyngeals, and glottals, form a universal guttural natural class. Arabic gutturals, /ʔ, h, x, ħ, ɣ, ʕ/, are produced at different places of articulation. Specifically, /ʔ/ and/h/ are glottals, /ʕ/ and /ħ/ are pharyngeals, and /x/ and /ɣ/ are uvulars. McCarthy (1994) stated that gutturals' natural class is defined by their place of articulation, [pharyngeal], and "directly represented within distinctive feature theory" (p. 2).

Phonetically, McCarthy stated that all gutturals have a relatively high F1, a high resonating frequency of the vocal tract. Pharyngeals and uvulars are characterized by high F1 values because they have a clear constriction in the pharyngeal cavity, while glottals have this value because of the shortening of the vocal tract through a raised larynx that occurs when they are produced (Shar, 2012).

Root co-occurrence is one piece of evidence that McCarthy provided to support his claim. Consonants of the same place of articulation, such as uvular fricatives, pharyngeals, and glottals, are prohibited from co-occurring together in a root, as in **ɣmʕ* (McCarthy, 1994). Furthermore, vowels are lowered when they are adjacent to a triggering post-velar consonant

in Arabic, Maltese, and Tiberian Hebrew (Hayward & Hayward 1989; McCarthy 1994).

In his explanation of the generalization that roots cannot contain two gutturals, McCarthy (1994) stated that this is prohibited by the Obligatory Contour Principle (OCP) and the Anti-Spreading Rule. He defines them in the following way:

> The OCP says that no root can contain more than one instance of the feature [pharyngeal], under the assumption that all instances of [pharyngeal] within a root are adjacent on some autosegmental tier, whether the root consonants α and β are adjacent or not. The Anti-Spreading Rule says that [pharyngeal] cannot spread, in the sense that a single instance of the feature [pharyngeal] cannot mark a distinction in more than one segment (p. 67).

This applies also to gemination in Tiberian Hebrew and "ghawa syndrome" in Bedouin Hijazi Arabic dialects (McCarthy, 1994). The prohibition of guttural gemination in Tiberian Hebrew results in lengthening the preceding vowel, a process called "compensatory lengthening". In Bedouin Hijazi, the presence of a guttural causes vowel deletion with a subsequent stress shift, such as *basʿala* "onion" that becomes *bsʿala* (Hetzron, 2013). This paper presents another evidence that gutturals form a natural class. This is based on the Quranic recitation where the only natural class that blocks the effect of /n/ in the Quranic recitation is gutturals.

2.2 Quranic Recitation and Nasal Assimilation

Arabic is the liturgical language of Islam since the *Quran* is composed of it. In Quranic recitation, noon sakinah and nunation undergo different processes within and across words boundaries, depending on the following sound. Ibn Al-Jazari (1927) stated that there are some slight differences in the characteristics of nasal assimilation between the ten *qiraa'aat* (i.e., Quranic readings), such as retaining the nasality of /n/ when it assimilates to a following liquid. This paper focuses on Hafs ʕan Asim reading because it is used by the vast majority of Muslims and because it is the nearest reading to Classical Arabic (Noldeke, Schwally & Bergstrasse, 2013).

Obligatory assimilation in Arabic has some conditions. In everyday Arabic speech, there are two environments where assimilation is obligatory:

A. When the /l/ of the Arabic definite article *al* is followed by a coronal consonant, as in (3)

(3) Underlying form	Surface form	Gloss
a. /ʔal/ + /šams/	[ʔaš-šams]	The sun
b. /ʔal/ +/daar/	[ʔad-daar]	The house

B. When /t/ is "infixed after the first radical in the /ʔiftaʕala/ form and its derivatives" (Alfozan, 1989, p. 69) where it is replaced by the emphatic sound /tˤ/ after /sˤ/, /dˤ/, /ðˤ/ or

/tˤ/, as in (4).

(4) Underlying form	Surface form	Gloss
a. /ʔisˤtabara/	[ʔisˤtˤ abara]	To be patient
b. /ʔidˤtaraba/	[ʔidˤtˤaraba]	To be shaken or disturbed
c. /ʔiðˤtalama/	[ʔiðˤtˤalama]	To act unjustly
d. /ʔitˤtalaʕa/	[ʔitˤtˤalaʕa]	To inspect

And it is replaced by /d/ after /d/, /ð/ or /z/, as in (5).

(5) Underlying form	Surface form	Gloss
a. /ʔidtaʕā/	[ʔiddaʕā]	To claim
b. /ʔi ðtakara/	[ʔi ðdakara]	To remember
c. /ʔiztāna/	[ʔizdāna]	To become beautiful

Assimilation in any other environment is optional, as in (6).

(6) Underlying form	Surface form	Gloss
a. /min lībjā/	[mil lībjā]	From Libya

However, in Quranic recitation, all assimilation types of noon sakinah and nunation are obligatory, even those that are optional in everyday speech, unless a pause takes place.

2.3 The Traditional Analysis of Nasal Assimilation

Based on traditional analysis, noon sakinah and nunation in the Quaranic recitation undergo the following phonological processes:

2.3.1 Idhaar in which /n/ does not induce any assimilation when the following sound is a guttural, namely /ʔ, h, x, ħ, ɣ, ʕ/. In this distinct pronunciation, the nasal /n/ is articulated fully and clearly (Gouda, 1988). Examples are given in (7) and (8).

(7) Examples of Noon Sakinah

Underlying form	Surface form	Gloss
a. /man ʔāmana/	[manʔāmana]	Who believes

b. /min hād/	[minhād]	None can guide
c. /min xajr/	[minxajr]	Of good
d. /man ħādd/	[manħādd]	Anyone that opposes
e. /min ɣil/	[minɣil]	Of malevolence
f. /man ʕamila/	[manʕamila]	Who worked

(8) Examples of Nunation

Underlying form	Surface form	Gloss
a. /kullun ʔāmana/	[kullunʔāmana]	Everyone believed
b. /dʒūrfin hār/	[dʒūrfinhār]	The brink of a crumbling edge
c. /ʕalīmun xabīr/	[ʕalīmunxabīr]	The knower, The aware
d. /ʕalīmun ħakīm/	[ʕalīmunħakīm]	The knower, The wise
e. /qawlan ɣajr/	[qawlanɣajr]	Another speech
f. /ħaqīqun ʕalā/	[ħaqīqunʕalā]	Approved upon

2.3.2 Idghaam, “assimilation” which can be of two types: complete regressive assimilation and partial regressive assimilation. Complete regressive assimilation occurs when /n/ is followed by a liquid, namely /l/ or /r/. Examples are given in (9) and (10):

(9) Examples of Noon Sakinah

Underlying form	Surface form	Gloss
a. /min laban/	[millaban]	Of milk
b. /min rabbihim/	[mirrabbihim]	From their lord’

(10) Examples of Nunation

Underlying form	Surface form	Gloss
a. /fa salāmun laka/	[fa salamullaka]	Peace be unto you

b. /raʔūfun raħīm/	[raʔūfurraħīm]	Kind and compassionate

Partial regressive assimilation occurs when /n/ is followed by /y, m, n, w/. The place feature of the following sounds aligns to the left and nasality is retained in the pronunciation. Examples are given in (11) and (12):

(11) Examples of Noon Sakinah

Underlying form	Surface form	Gloss
a. /man jaʕmal/	[majjaʕmal]	Who works
b. /min niʕmah/	[minniʕmah]	Of a blessing
c. /min māl/	[mimmāl]	Of money
d. /min wāl/	[miw̃w̃āl]	Of a sponsor

(12) Examples of Nunation

Underlying form	Surface form	Gloss
a. /qawmin juʔminūn/	[qawmiʲjuʔminūn]	Believer people
b. /šajʔun nukur/	[šajʔunnukur]	A thing most terrible
c. /ʔājātin mobajjināt/	[ʔajātimmobajjināt]	Revelations clearly showing the truth
d. /raħīmun wadūd/	[raħīmuw̃w̃adūd]	Compassionate and Loving

2.3.3 Iqlaab in which /n/ is changed to another nasal sound, namely /m/, when it is followed by the bilabial stop /b/. Examples are given in (13) and (14):

(13) Example of Noon Sakinah

Underlying form	Surface form	Gloss
a. /min baʕd/	[mimbaʕd]	From after

(14) Example of Nunation

Underlying form	Surface form	Gloss

a. /samīʕun basˁīr/ [samīʕumbasˁīr] Hearer and Seer

2.3.4. Ikhfaa' "hiding" occurs when /n/ is followed by one of following fifteen sounds /sˁ, ð, θ, k, dʒ, ʃ, q, s, d, tˁ, z, f, t, dˁ, ðˁ/. This is a partial regressive assimilation where the place of articulation of /n/ moves to be homorganic with the following sound, while nasality is retained. It is important to note that there is a lack of IPA symbols for some of the resulting sounds (Youssef, 2013). A glossary of these sounds is provided in (15) to make examples in (16) and (17) clear.

(15) A Glossary of the Resulting Sounds of *Ikhfa'*

Symbol	Description
a. /n̈/	Palatoalveolar nasal (Youssef, 2013)
b. /ɲ/	Interdental nasal

(16) Examples of Noon Sakinah

Underlying form	Surface form	Gloss
a. /ʔafaman šaraħ/	[ʔafamanšaraħ]	He whose (chest Allah) has expanded
b. /man dʒāʔ/	[mandʒāʔ]	Whosoever does (a good deed)
c. /ʔan taðbaħū/	[ʔaṇtaðbaħū]	To kill
d. /ʕan dīnikum/	[ʕaṇdīnikum]	To (renounce) your religion
e. /min tˁajjibāti/	[miṇtˁajjibāti]	Of the good things
f. /man dˁall/	[maṇdˁall]	Whosoever goes astray
g. /min sedʒdʒīl/	[miṇsedʒdʒīl]	Of (baked) clay
h. /faʔin zalaltum/	[faʔiṇzalaltum]	If you lapse back
i. /ʔan sˁaddūkum/	[ʔaṇsˁaddūkum]	Would bar you
j. /min ðikr/	[miɲðikr]	No recent revival of the remembrance
k. /faman θaqulat/	[famaɲθaqulat]	He whose scales are heavy

l. /min ðʃahīr/	[miƉðˤahīr]	Have supporters
m. /man fī ʔalʔardˤi/	[maŋfī ʔalʔardˤi]	All the people of the earth
n. /min qabl/	[miɲqabl]	From after
o. /ʔan kāna/	[ʔaɳ̊kāna]	That he was

(17) Examples of Nunation

Underlying form	Surface form	Gloss
a. /ʕaljmun šaraʕ/	[ʕaljmuñšaraʕ]	The All-Knower of everything. He (Allah)
b. /dʒannātin tadʒrī/	[dʒannātiɳ̊tadʒrī]	Gardens underneath (which rivers) flow
c. /hadʒran dʒamīlā/	[hadʒrañdʒamīlā]	A fine abandonment
d. /likullin daradʒāt/	[likulliɳ̊daradʒāt]	Each shall have their degrees
e. /sˤaʕīdan tˤajjiba/	[sˤaʕīdaɳ̊tˤajjiba]	The clean surface of the earth
f. /musfiratun dˤāħikah/	[musfiratuɳ̊dˤāħikah]	Shine laughing
g. /qawlan sadīda/	[qawlaɳ̊sadīda]	Speak right words
h. /nafsan zakjjatan/	[nafsaɳ̊zakjjatan]	A pure soul
i. /rīħin sˤarsˤarin/	[rīħiɳ̊sˤarsˤarin]	Howling wind
j. /watˤaʕāman ðā/	[watˤaʕāmaƉðā]	And a food that (chokes)
k. /dʒamīʕan θumma/	[dʒamīʕaƉθumma]	Them all together we shall
l. /ðillan ðalīlā/	[ðillaƉðˤalīlā]	Plenteous shade
m. /ʕumjun fahum/	[ʕumjuŋfahum]	Blind, so they (return not to the Right Path)
n. /samīʕun qarīb/	[samīʕuñ̊qarīb]	The Hearer, the Near
o. /ʕuluwwan kabīrā/	[ʕuluwwaɳ̊kabīrā]	Exceedingly high

All of *Idhaar, Iqlaab* and *Ikhfaa',* take place within and across word boundaries. However, *Idghaam* just takes place across word boundaries for semantic and morphological reasons where the meaning of a word can be lost if *Idghaam* takes place within words. This is seen in the Quran in only four cases; "Al-dunya" [dunīā], "qinwan" [qinwān], "sinwan" [sˁinwān], and "bunyan" [bunīān]. These words are good candidates for *Idghaam*, but there are pronounced completely without any assimilation (i.e., *Idhaar*).

It is obvious that this traditional analysis of the behavior of /n/ and nunation is systematic, but it exhibits some drawbacks. First, there is no clear explanation of what makes the bilabial stop /b/ behave in a unique manner. Second, it does not give a general description of each set of sounds that triggers a certain behavior of /n/, or those that block–effects. Traditionally, learners of Tajweed (i.e., rules of the Quranic recitation) memorize the sounds that trigger the same phonological processes. Third, it does not explain why glides, namely /w/ and /j/, trigger the same phonological behavior as nasals, namely /m/ and /n/, while liquids, namely /l/ and /r/, do not. In the next section, an analysis of the behavior of noon sakinah and nunation is presented within the framework of OT.

3. An Optimality Theoretical Analysis of /n/

Considering the assimilation of noon sakinah and nunation in the Quranic recitation within the framework of OT shows that the phenomena can be accounted in terms of some ranked violable constraints. OT is based on using a set of minimally violable constraints, and ranking the constraints on a language-specific basis to have constraint hierarchy that evaluates a set of candidates. A faithfulness constraint is violated by any difference between the input and the output. The optimal candidate is the output that does not incur any fatal violation of any of the high ranked constraints. Assimilation is accounted for within OT through the interaction of faithfulness and markedness constraints.

Before providing the relevant constraints in the case of noon sakinah and nunation assimilation in the Quranic recitation, some of the previously mentioned data were regrouped based on the patterns that /n/ exhibits. This regrouping supports Flemming's (2005) proposal that natural classes derive from the nature of the set of markedness constraints, and provides evidence of McCarthy's (1994) proposal that gutturals must constitute a natural class.

3.1 Gutturals

Gutturals do not trigger any phonological process when they follow /n/. The coronal nasal is pronounced without any changes. Some examples are repeated in (18) and (19).

(18) Examples of Noon Sakinah

Underlying form	Surface form	Gloss
a. /man ʔāmana/	[manʔāmana]	Who believes
b. /min hād/	[minhād]	None can guide

c. /min xajr/	[minxajr]	Of good

(19) Examples of Nunation

Underlying form	Surface form	Gloss
a. /kullun ʔāmana/	[kullunʔāmana]	Everyone believed
b. /dʒūrfin hār/	[dʒūrfinhār]	The brink of a crumbling edge
c. /ʕalīmun xabīr/	[ʕalīmunxabīr]	The knower, the aware

This provides evidence supporting McCarthy's (1994) proposal that gutturals must constitute a natural class. In Quranic recitation, the only natural class that does not induce nasal assimilation is gutturals. One might think that it is possible to analyze the phenomenon of a sequence of /n/ and a guttural in Quranic recitation with the OCP and the Anti-Spreading Rule that are used to analyze the prohibition of co-occurring gutturals in a root, gemination in Tiberian and "ghawa syndrome" in Bedouin Hijazi Arabic dialects.

This phenomenon does not just occur within words, but also across word boundaries and so the OCP cannot be used. Otherwise, the OCP needs to be modified. The Anti-Spreading Rule can be used here, but the natural class generalization is about processes (i.e., mappings between input and output in a language) rather than individual rules. A phonological pattern is derived by a complete phonological grammar, and "processes that cannot be characterized by a single rule may still be formulated in terms of a set of rules" (Flemming, 2005, p. 7). Therefore, it should be analyzed in terms of the constraint shown in (20):

(20) N-[+Guttural] Given an output C1C2 sequence where C1 is /n/ and C2 is a guttural, C2 does not trigger any phonological process.

3.2 Obstruent

When an obstruent, but not a guttural, follows /n/, it causes partial regressive assimilation. The place feature of the obstruent aligns to the target nasal. The coronal nasal /n/ changes into the homorganic nasal of the trigger where the nasality of /n/ is retained while its place feature is deleted and replaced by the place feature of the obstruent. Some languages, such as Yoruba, exhibit a similar process where nasal consonants tend to be homorganic with a following obstruent (Padgett, 1995). Some examples are given in (21) and (22).

(21) Examples of Noon Sakinah

Underlying form	Surface form	Gloss
a. /ʔafaman šaraħ/	[ʔafamañšaraħ]	He whose (chest Allah) has expanded

b. /min ðˤahīr/	[miŊðˤahīr]	Have supporters
c. /manfī ʔalʔardˤi/	[maɱfī ʔalʔardˤi]	All the people of the earth

(22) Examples of Nunation

Underlying form	Surface form	Gloss
a. /rasūlan šāhidan/	[rasūlañšāhidan]	A messenger as a witness
b. /watˤaʕāman ðā/	[watˤaʕāmaŊðā]	And a food that (chokes)
c. /dʒamīʕan θumma/	[dʒamīʕaŊθumma]	Them all together we shall

It is natural to find the stop bilabial /b/ in this group. When the coronal nasal /n/ occurs before the bilabial stop /b/, the coronal loses its place of articulation and becomes bilabial /m/. Examples are given in (23) and (24).

(23) Examples of Noon Sakinah

Underlying form	Surface form	Gloss
a. /min baʕd/	[mimbaʕd]	From after

(24) Examples of Nunation

Underlying form	Surface form	Gloss
a. /samīʕun basˤīr/	[samīʕumbasˤīr]	Hearer and Seer

This pattern can be analyzed in terms of the constraint shown in (25).

(25) N-[+Obstruent] Given an output C1C2 sequence where C1 is /n/ and C2 is an obstruent, place feature of C2 aligns to the left.

3.3 Sonorants

The main issue with sonorants is that nasals and liquids cause complete regressive assimilation, while glides cause reciprocal assimilation. This can be accounted for through having two different natural classes: [+Sonorant, +Consonantal] for nasals and liquids, and [+Sonorant, -Consonantal] for glides.

3.3.1 [+Sonorant, +Consonantal]

When one of the sonorant consonantal segments, namely /n, m, l, r/, follows /n/, the coronal nasal induces a complete regressive assimilation, resulting in a cluster of two identical

sonorant consonantal segments. Examples are given in (26) and (27).

(26) Examples of Noon Sakinah

Underlying form	Surface form	Gloss
a. /min niʕmah/	[minniʕmah]	Of a blessing
b. /min māl/	[mimmāl]	Of money
c. /min laban/	[millaban]	Of milk
d. /min rabbihim/	[mirrabbihim]	From their lord

(27) Examples of Nunation

Underlying form	Surface form	Gloss
a. /šajʔun nukur/	[šajʔunnukur]	A thing most terrible
b. /ʔājātin mobayyināt/	[ʔajātimmobajjināt]	Revelations clearly showing the truth
c. /fa salāmun laka/	[fa salamullaka]	Peace be unto you
d. /raʔūfun raħīm/	[raʔūfurraħīm]	Kind and compassionate

This pattern can be analyzed in terms of the constraint shown in (28).

(28) N-[+Sonorant, +Consonantal] Given an output C1C2 sequence where C1 is /n/ and C2 is a sonorant consonantal, place and nasality of C2 align to the left.

3.3. 2 [+Sonorant, -Consonantal]

When a sonorant non-consonantal segment, namely /w/ or /j/, follows /n/, its place of articulation aligns to the left, causing the coronal nasal to lose its place feature, and the nasality feature of the coronal nasal aligns to the right. This is a partial reciprocal assimilation. Examples are given in (29) and (30).

(29) Examples of Noon Sakinah

Underlying form	Surface form	Gloss
a. /man jaʕmal/	[maj̃j̃aʕmal]	Who works

b. /min wāl/	[miw̃w̃āl]	Of a sponsor

(30) Examples of Nunation

Underlying form	Surface form	Gloss
a. /qawmin juʔminūn/	[qawmiĵĵuʔminūn]	Believer people
b. /raħīmun wadūd/	[raħīmuw̃w̃adūd]	Compassionate and Loving

This pattern can be analyzed in terms of the constraint shown in (31).

(31) N-[+Sonorant, -Consonantal] Given an output C1C2 sequence where C1 is /n/ and C2 is a glide, place feature of C2 aligns to the left and nasality of C1 aligns to the right.

In OT, constraints are violable. In each sequence of /n/ and a sound of a natural class, one violation mark is assigned for each unmotivated alignment. Another violation mark is assigned for the un-alignment of each motivated alignment. These constraints interact with faithfulness constraints. They are given in the following set.

(32) MAX(C) All consonants of the input are presented in the output

(33) DEP(V) No vowel epenthesis is allowed

(34) FAITH [NASAL]$_{+CorNas}$ In a sequence of C1C2 where C1 is a nasal and C2 is not, C1 retains its nasality.

(35) FAITH [VOICE]$_{+CorNas}$ In a sequence of C1C2 where C1 is voiced and C2 is not, C1 retains its voicing.

(36) FAITH [PLACE]$_{+CorNas}$ In a sequence of C1C2 where C1 is a coronal and C2 is not, C1 retains its coronal place.

One of the reviewers of this paper provided another suggested proposal of the behavior of /n/ through adopting a set of certain constraints that account for basic phonological aspects not accounted for in the provided analysis in this paper, such as Pulleyblank (1997)'s IDENTICAL CLUSTER CONSTRAINTS (ICC) and AGREE. Generally speaking, any of these constraints can trigger the process of [n] assimilation.

Keeping nasality of [n] when assimilating to certain consonants can be accounted for in this analysis through grouping [m, n, l, r] together as a set of consonants that trigger assimilation when following [n]. The preceding [n] completely assimilates the following consonant and loses its nasality. In this case, AGREE can be splitted into AGREE-[m, ,n ,l, r] and AGREE-[all other consonants].

In the case of glides, [n] resembles glides except in nasality, and the glides gain nasality to

resemble the preceding nasal. This behavior can be accounted for through proposing a set constraints that reflects that retaining the nasality status of /n/ and place of articulation of glides are more important than maintaining the place of articulation of /n/ and the glide feature of the glides in this assimilation, such as IDENTITY-(w, y)[NASAL] and IDENTITY-(w, y)[Other features/place].

Gutturals' blocking of assimilation also can be accounted for through the exclusion of gutturals from the constraint AGREE-NC, to have AGREE-N[gutturals]. In this way, AGREE-N[m, ,n ,l, r] is ranked high to force complete assimilation, dominating AGREE-NC and input-output faithfulness constraints which in turn are ranking higher than AGREE-N[gutturals].

However, the set of constraints that are proposed in this paper are used for making the analysis more economic, easier and clearer. Besides, since the argument in this new paper is based on "natural classes" and how they derive from the nature of the set of markedness constraints, an argument that was proposed by Flemming (2005). The other suggested proposal would not support this argument in an obvious way. The constraint N-[+Guttural] is proposed to block /n/ assimilation, while N-[+Obstruent], N-[+Sonorant, +Consonantal] and N-[+Sonorant, -Consonantal] are proposed to trigger different types of /n/ assimilation.

4. Interaction of Constraints

4.1 N-[+Guttural]

It has been argued so far that the gutturals form a natural class. Data in (18) and (19) prove that /n/ surfaces unchanged when followed by a guttural in Quranic recitation. This can be straightforwardly accounted for with the high ranking of all the faithfulness constraints and N-[+Guttural]. N-[+Obstruent], N-[+Sonorant, +Consonantal], and N-[+Sonorant, -Consonantal] are all irrelevant. This is given in (37) and tested in Tableau (38).

(37) MAX(C), DEP(V), N-[+Guttural], FAITH $[NASAL]_{+CorNas}$, FAITH $[VOICE]_{+CorNas}$ FAITH $[PLACE]_{+CorNas}$

In Tableau (38) below, candidate (a) is the optimal candidate because it satisfies all the constraints. Candidates (b) and (c) are ruled out for triggering a change through violating N-[+Guttural]. This alignment also causes violation of the FAITH $[NASAL]_{+CorN}$, FAITH $[VOICE]_{+CorNas}$, and FAITH $[PLACE]_{+CorNas}$. Candidate (d) incurs a fatal violation of MAX(C) because /n/ is lost, while candidate (e) incurs a fatal violation of DEP(V) because /i/ is inserted between /n/ and the following guttural.

Tableau (38). The Interaction of N-[+Guttural] with Other Constraints

/ʕalīmun ħakīm/	MAX(C)	DEP(V)	N-[+Guttural]	FAITH [NASAL]$_{+CorNas}$,	FAITH [VOICE]$_{+CorNas}$	FAITH [PLACE]$_{+CorNas}$
a. ☞ [ʕalīmunħakīm]						
b. [ʕalīmunnakīm]			*!**			
c. [ʕalīmuħħakīm]			*!**	*	*	*
d. [ʕalīmuħakīm]	*!			*	*	*
e. [ʕalīmuniħakīm]		*!				

4. 2 N-[+Obstruent]

The active constraint N-[+Obstruent] dominates FAITH [PLACE]$_{+CorNas,}$ whereas N-[+Guttural], N-[+Sonorant, +Consonantal], and N-[+Sonorant, -Consonantal] are irrelevant. The ranking is shown below in (39).

(39) MAX(C), DEP(V), N-[+Obstruent], FAITH [NASAL]$_{+CorNas}$, FAITH [VOICE]$_{+CorNas}$ » FAITH [PLACE]$_{+CorNas}$

In the case of a sequence of /n/ and a /b/, they both are voiced. Therefore, FAITH [VOICE]$_{+CorNas}$ is irrelevant. The set of constraints is given in (40), and their interaction is shown in Tableau (41).

(40) MAX(C), DEP(V), N-[+Obstruent], FAITH [NASAL]$_{+CorNas}$ »FAITH [PLACE]$_{+CorNas}$

In Tableau (41) below, candidate (a) is ruled out for violating N-[+Obstruent] where the placefeature of the obstruent does not align to the left. Candidate (b) loses also for violating N-[+Obstruent] where the nasality and place feature /n/ aligns to the left, and the place feature of the obstruent does not align to the left. Candidate (c) also loses for violating N-[+Obstruent] as well as FAITH [NASAL]$_{+CorNas}$ where the nasality feature of the obstruent (i.e., -nasal) aligns to the left. Candidate (e) loses for violating N-[+Obstruent] where the nasality feature of /n/ aligns to the right. Candidates (f) and (g) are ruled out for violating MAX(C) and DEP(V), respectively. Candidate (c) is the optimal choice because it does not incur any fatal violation.

Tableau (41): The Interaction of N-[+Obstruent] with Other Constraints

/min baʕd/	MAX(C)	DEP(V)	N-[+Obstruent]	FAITH [NASAL]$_{+CorNas}$	FAITH [PLACE]$_{+CorNas}$
a. [minbaʕd]			*!		
b. [minnaʕd]			*!**		
c. [mibbaʕd]			*!	*	*
d. ☞ [mimbaʕd]					*
e. [mimmaʕd]			*!		*
f. [mibaʕd]	*!				
g. [minibaʕd]		*!			

Now, let's consider the sequence of /n/ and a voiceless obstruent in which [VOICE]$_{+CorNas}$ becomes relevant. Tableau (42) below tests the interaction of these constraints with a voiceless obstruent where FAITH [VOICE]$_{+CorNas}$ becomes relevant.

In Tableau (42) below, candidate (a) is ruled out for violating N-[+Obstruent], where there is no left alignment of the place feature of the obstruent. Candidate (b) is also ruled out for the lack of the left alignment of the place feature of the obstruent and the right alignment of the nasality, voice and place features of /n/. Both candidate (c) and (d) are also ruled out for violating the same constraint where the nasality and voicing features of the obstruent align left in candidate (c), and the nasality feature of /n/ aligns right. Candidates (f) and (g) are ruled out for violating MAX(C) and DEP(V), respectively. Candidate (d) is the optimal candidate and in this ranking of constrains accounts well for the optimal candidate.

Tableau (42). The Interaction of N-[+Obstruent] with Other Constraints

/rasūlan šāhidan/	MAX(C)	DEP(V)	N-[+Obstruent]	FAITH [NASAL]$_{+CorNas}$	FAITH [VOICE]$_{+CorNas}$	FAITH [PLACE]$_{+CorNas}$
a. [rasūlanšāhidan]			*!			
b. [rasūlannāhidan]			*!***			
c. [rasūlaššāhidan]			*!*	*	*	*
d. ☞ [rasūlañšāhidan]						*
e. [rasūlañ̃nāhidan]			*!		*	*
f. [rasūlašāhidan]	*!					
g. [rasūlanišāhidan]		*!				

4. 3 N-[+Sonorant, +Consonantal]

When the following segment of /n/ is sonorant consonantal, N-[+Guttural], N-[+Obstruent] becomes irrelevant. FAITH [VOICE]$_{+CorNas}$ is also irrelevant because all nasals and liquids are voiced. The ranking of constraints is given in (43) and tested in Tableau (44).

(43) MAX(C), DEP(V), N-[+Sonorant, +Consonantal] » FAITH [NASAL]$_{+CorNas}$, FAITH [PLACE]$_{+CorNas}$

In Tableau (44), candidate (a) loses for violating N-[+NASAL] because the place feature of /m/ does not align to the left. However, because these two sounds are nasals, it is difficult to predict whether the nasality feature of /m/ aligns to the left or not. Candidate (b) loses for violating the same constraint where the nasality feature does not align to the left. Candidates (c) also loses for violating N-[+NASAL] where the place feature of /m/ does not align to the left and the place feature of /n/ aligns to the right. Candidate (e) loses for violating MAX(C), and candidate (f) loses for violating DEP(V). Candidate (d) is optimal because it does not incur any fatal violation.

Tableau (44). The Interaction of N-[+Sonorant, +Consonantal] with Other Constraints

/min māl/	MAX(C)	DEP(V)	N-[+Sonorant, +Consonantal]	FAITH [NASAL]$_{+CorNas}$	FAITH [PLACE]$_{+CorNas}$
a. [minmāl]			*!		
b. [mibmāl]			*!	*	*
c. [minnāl]			*!*		
d. ☞ [mimmāl]				*	*
e. [mimāl]	*!				
f. [minimāl]		*!			

Now, let's test the interaction of these constraints with another example in Tableau (45).

Tableau (45). The Interaction of N-[+Sonorant, +Consonantal] with Other Constraints

/min laban/	MAX(C)	DEP(V)	N-[+Sonorant, +Consonantal]	FAITH [NASAL]$_{+CorNas}$	FAITH [PLACE]$_{+CorNas}$
a. [minlaban]			*!		
b. [minnaban]			*!*	*	*
c. [miÎlaban]			*!	*	*
d. [milaban]	*!				
e. [minilaban]		*!			
f. ☞ [millaban]					

In Tableau (45), each candidate incurs at least one fatal violation, except candidate (f). All of the candidates (a), (b) and (c) violate N-[+Sonorant, +Consonantal]. The nasality feature of /l/ (i.e., –nasal) in candidate (a) does not align to the left. It also does not align in candidate (b) and the nasality feature of /n/ (i.e., +nasal) aligns to the right. In candidate (c), the nasality feature of /l/ (i.e., –nasal) does not align to the left. The optimal candidate is (f).

4.4 N-[+Sonorant, -Consonant]

Of the following sounds that are sonorant, but not consonantal, reciprocal assimilation takes place. The constraints N-[+Guttural], N-[+Obstruent], N-[+Nasal] and N-[+Liquid] are irrelevant. FAITH $[VOICE]_{+CorNas}$ is also irrelevant because the nasals and glides are voiced. Ranking is given in (46) and tested in (47).

(46) MAX(C), DEP(V), N-[+Sonorant, -Consonantal] »FAITH $[NASAL]_{+CorNas}$, $FAITH[PLACE]_{+CorNas}$

Tableau (47): The Interaction of N-[+Sonorant, -Consonantal] with Other Constraints

/min wāl/	MAX(C)	DEP(V)	N-[+Sonorant,-Consonantal]	FAITH $[NASAL]_{+CorNas}$	FAITH $[PLACE]_{+CorNas}$
a. [minwāl]			*!*		
. [miwwāl]			*!*	*	*
c. [minnāl]			*!	*	*
d. ☞ [miw̃w̃āl]					
e. [miniwāl]		*!			
f. [miwāl]	*!				

In the tableau above, the place feature of /w/ does not align to the left in candidate (a) and nasality of /n/ does not align to the right, making this candidate violate N-[+Sonorant, -Consonantal]. Candidate (b) loses for violating the same constrain where the nasality feature (-nasal) of /w/ aligns to the left and the nasality feature (+nasal) of /n/ does not align to the right. Candidate (c) also loses for violating N-[+Sonorant, -Consonantal] where the place feature of /w/ does not align to the left. Candidate (d) is the optimal candidate because it

satisfies all the high ranked constraints. Candidates (e) and (f) loses for violating DEP(V) and MAX(C), respectively.

5. Conclusion

It has been shown in this paper that the OT account may be accurate than traditional analysis of the phonological behavior of /n/ in Quranic recitation. It also has been found that this phonological behavior is an example of a process in which natural classes are derived from multiple markedness constraints. This supports Flemming's (2005) proposal of deriving natural classes in phonology. The final ranking of constraints in this case is:

(48) MAX(C), DEP(V), N-[+Guttural], N-[+Obstruent], N-[+Sonorant, +Consonantal], N-[+Sonorant, -Consonantal] »FAITH [NASAL]$_{+CorNas}$, FAITH [VOICE]$_{+CorNas}$, FAITH [PLACE]$_{+CorNas}$

The inability of gutturals to induce partial or complete nasal assimilation, as shown in this paper, also provides phonological evidence of McCarthy's (1994) proposal that the post-velar consonants, which include the uvulars, pharyngeals, and glottals, behave as a natural class in terms of place of articulation. However, further research is needed to analyze the behavior of gutturals in the other qira'aat (i.e., Quranic readings) since this paper focused only on Hafs-an-Asim reading. Semantic and morphological reasons that prevent assimilation of /n/ in "Al-dunya" [dunīā], "qinwan" [qinwān], "sinwan" [sˤinwān], and "bunyan" [bunīān] also need to be analyzed within the framework of OT.

References

Abu-Abbas, K. H., Zuraiq, W. M., & Al-Tamimi, F. Y. (2010). Assimilation and Local Conjunction in Arabic. *SKASE Journal of Theoretical Linguistics*, 7(3), 64-83.

Alfozan, A. I. (1989). *Assimilation in Classical Arabic: A phonological Study.* PhD dissertation, University of Glasgow.

Burquest, D. A., & Payne, D. L. (1993). *Phonological Analysis: A Functional Approach.* Dallas, TX: Summer Institute of Linguistics

Chomsky, N., & Halle, M. (1968). *The Sound Pattern of English*. Harpet & Row Publishers, NY: New York.

Flemming, E. (2005). Deriving natural classes in phonology. *Lingua, 115*(3), 287-309. http://dx.doi.org/10.1016/j.lingua.2003.10.005

Gouda, A. S. (1988). *Quraanic Recitation: Phonological Analysis.* Ph.D. Dissertation, Washington, DC: Georgetown University.

Hayward, K. M., & Hayward, R. J. (1989). Guttural: Arguments for a New Distinctive Feature. *Transactions of the Philological Societ*, 87(2), 179–193. http://dx.doi.org/10.1111/j.1467-968X.1989.tb00626.x

Hetzron, R. (2013). *The Semitic Languages*. Routledge, London

Ibn Al-Jazari, M. (1927). In Ali Muhammad Al-Dabba' (ed.) 2009. *Al-Nashr fi'l-qira'at Al-'ashr.* Beirut: Dar al-Fikr

McCarthy, J. (1994). The Phonetics and Phonology of Semitic Pharyngeals. In Patricia Keating (Ed.), *Phonological Structure and Phonetic Form: Papers in Laboratory Phonology III*, 191-233. Cambridge: Cambridge University Press.

Mielke, J. (2008). *The Emergence of Distinctive Features.* Oxford: Oxford University Press

Noldeke, T., Schwally, F., & Bergstrasse, G. (2013). *The History of the Quran*. In Wolfgang H. Behn, (tran.) Leiden. Netherlands: Brill.

Ohala, J., & Ohala, M. (2014). The phonetics of nasal phonology: theorems and data. *Phonetics and phonology, 5,* 225-249. http://dx.doi.org/10.1016/B978-0-12-360380-7.50013-2

Padgett, J. (2011). Consonant-Vowel Place Feature Interactions. In Van Oostendorp, Marc, Colin J. Ewen, Elizabeth V. Hume, & Keren Rice (Eds.), *The Blackwell Companion to Phonology*, (3), 1761-1786. Malden, MA: Wiley-Blackwell.

Prince, A., & Smolensky, P. (1993). *Optimality Theory: Constraint Interaction in Generative Grammar.* Malden, MA: Blackwell.

Pulleyblank, D. (1997). Optimality Theory and Features. In *Optimality Theory*, Diana Archangeli and D. Terence Langendoen (eds.), 59-101. Oxford: Blackwell.

Roach, P. (1998). *English Phonetics and Phonology*. Cambridge: Cambridge University Press.

Shar, S. A. M. (2012). *Arabic Emphatics and Gutturals: A Phonetic and Phonological Study*. PhD Dissertation, The University of Queensland: Australia.

Youssef, I. (2013). *Place Assimilation in Arabic: Contrasts, Features, and Constraints.* Ph.D Dissertation, University of Tromsø. Norway.

Copyright Disclaimer