

A Conceptual Review of Arabic Vowel Typology

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ABSTRACT

Mastery of the sound system, including the vowel system, is a fundamental aspect of language learning; however, it has often received limited attention in terms of detailed phonetic analysis. This study discusses the conceptual foundations for understanding the typology of Arabic vowels, specifically from a comprehensive phonetic and phonological perspective, in order to address the lack of systematic descriptions of Arabic vowel characteristics. Accordingly, this study aims to elaborate and conceptually describe the classification of Arabic vowels, encompassing vowel quantity (short and long vowels), vowel quality, their articulatory features from a scientific perspective, and their linguistic functions, while also highlighting the concept of Arabic vowel typology based on previous studies, in addition to identifying an appropriate theoretical framework to clarify the structure of these vowels. This study adopts a fully qualitative approach in the form of library research, through document analysis and literature reviews of modern Arabic phonetic books, journal articles, and previous linguistic studies related to the Arabic vowel system. Content analysis utilized to categorize and synthesize scholarly perspectives on vowel typology. Data are collected from primary classical Arabic linguistic sources and modern phonetic theories to construct a comprehensive typological framework. The findings indicate that Arabic vowel typology can be described through several main dimensions, namely vowel quantity, articulatory quality, and phonemic function. The study also reveals differences in approach between classical Arabic scholars and modern linguists in describing this vowel system. The analysis demonstrates that Arabic vowel distinctions are not merely a matter of duration; rather, vowels also function as integral components of syllable structure. This study contributes to a clearer and more systematic conceptual framework for Arabic vowel typology by providing a theoretical foundation that can be utilized, particularly in phonetics instruction and the development of more structured teaching materials. Furthermore, it offers a comprehensive and explicit theoretical reference for future research in Arabic linguistics.

Keywords: Vowel Typology, Arabic Language, Conceptual Review, Phonetics, Arabic Linguistics.

INTRODUCTION

The mastery of a language's sound system, including its vowel system, constitutes a fundamental aspect and a central pillar in the process of language acquisition and proficiency development. The phoneme, allophone, and grapheme concepts occupy a central position in contemporary phonetics and phonology due to their critical role in explaining the organization and distribution of speech sounds, especially phonemes, which are realized through consonant and vowel segments in a language (Md Isa et al., 2024). Nevertheless, the phonetic details of the Arabic vowel system have not been comprehensively addressed in previous studies. Existing research has generally examined the Arabic vowel system from a broad perspective, without providing a detailed discussion of its classification and linguistic functions. Accordingly, the present study investigates Arabic vowel typology from both phonetic and phonological perspectives. The analysis encompasses vowel quantity, namely the distinction between short and long vowels, vowel quality, and articulatory features related to vowel production, as well as their linguistic functions, particularly the role of vowels as integral components of syllable structure.

In addition, this study places particular emphasis on the phonotactic properties of Arabic vowels. This aspect warrants attention because sound sequences that violate the phonotactic constraints of Arabic frequently trigger phonological adjustments or monophthongization processes in order to conform to the word-formation patterns and phonological structure of the language.

Using a qualitative approach based on document analysis and an extensive literature review, this study synthesizes the perspectives of classical Arabic linguists with contemporary theories of phonetics and phonology. This endeavour seeks to clarify the structure of the Arabic vowel system while providing a more systematic, comprehensive, and coherent conceptual framework. The findings of this study are expected to contribute foundational insights to the teaching of phonetics and phonology, as well as to the development of more structured Arabic language teaching materials, particularly those relating to vowel segments.

LITERATURE REVIEW

Vowel sounds

Vowels play a crucial role in word structure. In Arabic, vowels serve a morphological function within word structures, whereby variations in vowel patterns can result in changes in lexical meaning (Md Isa et al., 2024). They serve to animate and support the functioning of consonants, as consonants cannot operate independently without the presence of vowels (Abd. Rahman & Mezah, 2010). A vowel can be defined as a voiced speech sound produced with a free and unobstructed airflow during articulation ('Abdullāh, 2004; Al-Bakkūsy, 1992). Vowels are generated by an airstream that flows freely from the lungs through the oral cavity without encountering any constriction or obstruction within the vocal tract (Hassan, 2007). The production of vowel sounds involves only an egressive airstream mechanism, whereby air is expelled from the lungs during articulation (Jalaluddin, 2007). According to Syāhīn (1980), vowel sounds are produced through the vibration of the vocal folds as air passes through the larynx. Thus, vowels may be described as voiced speech sounds produced with an unobstructed airflow from the lungs through the oral cavity and articulated through an egressive pulmonic airstream.

Previous studies

Numerous studies have examined the Arabic vowel system from various phonetic and phonological perspectives. Among these is the study conducted by Addow et al. (2025) entitled "*An Analysis of Phonetic and Phonological Systems in Classical Arabic and English: A Contrastive Study*," which specifically addresses aspects of Arabic vowels. The study focuses on a contrastive analysis of the phonetic and phonological systems of Classical Arabic and English with respect to stress patterns, syllable weight, and vowel duration, as well as the role of acoustic features such as vowel formants and consonant duration in distinguishing phonetic characteristics between the two languages. Primary data were collected through structured interviews with twenty-five native speakers of Classical Arabic and English. Secondary data were obtained from phonetic databases, linguistic research publications, and Classical Arabic literary texts, particularly the works of Ibn Shaddad (525–608 C.E). Data analysis was conducted using the Moraic Theory, CV Tier Theory, and Optimality Theory. The findings indicate significant differences between Classical Arabic and English. Classical Arabic is characterized by the presence of pharyngeal consonants, gemination, and stress assignment based on syllable weight, whereas English permits complex consonant clusters and exhibits stress patterns influenced by lexical and morphological factors.

Another study entitled "*Variable Phonetic Phenomena in Arabic: A Historical-Phonological Analysis*" by Mavlanov (2025) also addresses vowel variation and change. The study investigates several phonetic phenomena in Arabic, including vowel change, consonant assimilation, the articulation of emphatic consonants, and dialectal variation resulting from the evolution of Arabic from the pre-Islamic period to the present day. It further highlights phonetic developments driven by both internal linguistic processes and external influences. The findings demonstrate that vowel changes, consonant assimilation, the articulation of emphatic consonants, and dialectal variation are dynamically shaped by historical, cultural, and linguistic factors.

A subsequent study by Md Isa et al. (2024) entitled "*Arabic Phonemes, Allophones, and Graphemes in the Context of Modern Phonetics and Phonology*" discusses the phonetic principles governing Arabic from the

perspective of contemporary phonetic and phonological theory. The study also provides a detailed explanation of Arabic phonemes, including vowels. Employing a descriptive qualitative methodology, the researchers examined modern phonetic and phonological concepts as interpreted by Arab scholars. The primary focus of the study is the investigation of contemporary phonetic aspects of Arabic speech sounds and their application in both written and spoken contexts. The study was undertaken with the aim of contributing to educational and scientific field.

Furthermore, the study by Rahmatan et al. (2023) entitled "*The Role and Function of Phonemes in Phonology for Arabic Communication*" was conducted to clarify the role and function of Arabic phonemes, with the premise that such knowledge can help prevent communication errors. The phonemic categories examined include both consonants and vowels. The study adopted a descriptive qualitative approach based on library research, with data collected through a literature review. The findings reveal that Arabic long and short vowels perform distinct linguistic roles and functions and are influenced by various phonetic environments.

Based on the studies reviewed above, the discussions encompass a wide range of phonetic and phonological aspects of Arabic, rather than focusing specifically on the Arabic vowel system. Consequently, there remains a need for a conceptual typology of Arabic vowels that provides a systematic and dedicated account of Arabic vowel phenomena without extending the discussion to the phonetic characteristics of other speech segments. This study seeks to address that gap by offering a comprehensive conceptual framework for understanding Arabic vowel typology.

RESEARCH METHODOLOGY

This study was conducted using a qualitative research method based on library research and a systematic literature review using the document analysis method.

The reference materials consulted in this study involve classical Arabic phonetics and phonology books, modern Arabic phonetics and phonology books, journal articles, and modern phonetics and phonology proceedings. These references are publications ranging from the year 1980 to 2025. The selected content focuses only on the characteristics and the vowel phoneme system of the Arabic language. In addition, the adapted references consist of studies that apply linear generative phonology and nonlinear (autosegmental phonology). Reference materials that do not discuss the vowel typology dimension or general discussions are excluded from this study.

Primary data sources, especially journal articles and proceedings, were obtained from Google Scholar, which is one of the main academic databases, by using keywords such as "Arabic vowel", "Arabic phonology", "Arabic phonetic representation", and "autosegmental representation". Core reference books from classical linguists such as Ibn Jinnī titled *Sirr šinā'ah al-i'rāb* and works by Al-Farāhīdī titled *Kitāb al-'Ayn* serve as core classical Arabic primary data sources.

The data were synthesized from the selected documents using qualitative content analysis. The extracted data are categorized according to the divisions established in this study, namely vowel quantity, articulatory quality, distinctive features, and phonotactic constraints of the Arabic language. The approaches of both classical and modern linguists are highlighted critically. This aims to synthesize a systematic and comprehensive Arabic vowel typology framework.

DISCUSSION

Arabic vowel inventory

The Arabic vowel system consists of short vowels and long vowels. Arabic has three short vowels and three corresponding long vowels ('Abd Al-Jalīl, 1998; Al-Bakkūsy, 1992; Mavlanov, 2025). In total, the Arabic vowel inventory comprises six vowel phonemes (Al-Ghāmidīy, 2001; Addow et al., 2025). These six vowels represent the combination of both short and long vowel categories. This classification reflects the quantitative dimension of Arabic vowels, namely vowel length (duration contrast between short and long vowels).

In addition to being classified according to vowel quantity (short and long), Arabic vowels may also be analysed in terms of active and passive vowel categories (Abd. Rahman & Mezah, 2010). Active vowels correspond to vowel diacritics (*ḥarakāt* / الحَرَكَاتُ), whereas passive vowels refer to *sukūn* (السُّكُونُ), which indicates the absence of a vowel. Active vowels are further subdivided into two categories. The first involves the six Arabic vowel phonemes arranged in three long short pairs.

The short vowel /i/ is paired with the long vowel /i:/. For example, the short vowel /i/ appears in the word *بَرَحَ* [ba.ri.ha], whereas the long vowel /i:/ occurs in *بَعِيدَ* [ba.ʕi:d]. The short vowel /a/ is paired with the long vowel /a:/. The short vowel /a/ is found in *دَخَلَ* [da.xa.la], while the long vowel /a:/ appears in *خَاتَمَ* [xa:.tam]. Similarly, the short vowel /u/ is paired with the long vowel /u:/. The short vowel /u/ occurs in *سَلَّمَ* [sul.lam], whereas the long vowel /u:/ is found in *جُلُوسَ* [dʒu.lu:s]. All of the vowels mentioned above are classified as monophthongs.

The second category consists of vowel doubling (*tanwīn* / التَّنْوِينُ). This vowel type comprises three forms and is represented as a doubled realization of active vowels, which correspond to Arabic short vowels. *Tanwīn* occurs exclusively in nominal categories (nouns) and appears only in word-final position. The first type is the vowel /i)n/, as seen at the end of the second syllable in *دَاءٍ* [da:..ʔi)n]. The second is /a)n/, as in *شَرًّا* [ʃar.ra)n]. The third is /u)n/, as in *دَرْءٍ* [dar.ʔu)n].

The presence of *tanwīn* is clearly manifested in Standard Arabic pronunciation and in Qur'anic recitation. However, it is not a priority in colloquial dialects, as dialectal speech typically omits final short vowel inflections. Since *tanwīn* occurs only in word final position, it is generally not realized in everyday spoken varieties of Arabic. They are only found as inflectional markers in written Standard Arabic within texts.

Articulation of Arabic vowels

The point of articulation for paired monophthongs in Arabic is located within the same general articulatory region. Nevertheless, Arabic vowels can still be distinguished based on two primary parameters: quantity (الْكَمِّيَّةُ) and quality (الْكَيفِيَّةُ). Vowel quantity is determined by duration, namely whether the vowel is long or short (Al-Tawwāb, 1997). Long vowels require a greater duration of articulation compared to short vowels. According to Addow et al. (2025), long vowels measured around 250-300 ms, while short vowels averaged 100 ms. Vowel quality, on the other hand, refers to the configuration of the oral cavity as determined by the position of the tongue during vowel production (Al-Ghāmīdī, 2001). The tongue position and lip configuration for Arabic vowel pairs can be represented as follows:

Table 1 Tongue position of Arabic vowels

	Tongue part	Front	Central	Back
	Lip shape	Spread (الْمُنْبَسِطُ)	Neutral (وَضْعُ الْجَيَادِ)	Rounded (الْمُدَوَّرُ)
Tongue height	High (الْمُسْتَعْلِي)	i, i:		u, u:
	Low (الْمُنْخَفِضُ)		a, a:	

(Source adapted from Al-Bakkūsy, 1992; El-Hassan, 1994; Al-Ghāmīdī, 2001; Alfozan, 1989)

The table above illustrates differences in vowel production in terms of tongue position, lip shape, and articulatory placement. The short vowel /i/ and its long counterpart /i:/ are articulated in the front high vowel space, with the tongue raised during production. The short vowel /a/ and long vowel /a:/ are classified as central low vowels, with the tongue in a relatively neutral position and the mouth more open during articulation. The short vowel /u/ and long vowel /u:/ are back high vowels, produced with the tongue raised toward the back of the oral cavity.

From a phonetic perspective, Arabic vowel pairs exhibit clear contrasts in articulatory space, particularly in terms of tongue placement, across the three vowel sets, these spatial differences are also reflected acoustically (Ahmad & Teoh, 2006). The articulatory space described here corresponds to the vowel quadrilateral as proposed by

Daniel Jones (1956). The acoustic aspect (السَّمْعِيّ) refers to spectrographic representations of each vowel, which can be readily distinguished due to their clearly differentiated formant patterns.

Distinctive features of Arabic vowels

In addition, vowel sounds can be distinguished through a set of distinctive features inherent in each segment, similar to consonantal sounds. The inventory of distinctive features for Arabic vowels can be presented as follows:

Table 2 Distinctive features of Arabic vowels

	Vowel	a	a:	i	i:	u	u:
Feature							
Syllabic		+	+	+	+	+	+
Sonorant		+	+	+	+	+	+
Back		-	-	-	-	+	+
Front		-	-	+	+	-	-
High		-	-	+	+	+	+
Low		+	+	-	-	-	-
Rounded		-	-	-	-	+	+
Long		-	+	-	+	-	+

(Source adapted from Alfozan, 1989; Safa'ie, 2008)

The table above presents the set of distinctive features associated with each Arabic vowel phoneme. The vowel *ḍammah* [u] is distinguished from other vowels by the feature bundle [+syllabic], [+high], [+back]. The vowel *kasrah* [i] is characterized by the features [+syllabic], [+high], [-back]. In contrast, the vowel *fathah* [a] is identified by the features [+syllabic], [+low].

The distinction between short and long vowels is represented by the feature [-long] for short vowels and [+long] for long vowels. This feature matrix for each speech segment is essential for phonological analysis, particularly when applied in the study of sound change phenomena within the framework of Transformational Generative Theory.

Allophones and vowel typology variation

The quality of a vowel sound may vary depending on its position within a word. This phenomenon is conditioned by the type of segment that precedes the vowel in the sound sequence. For instance, when a nasal consonant precedes a vowel, the feature of nasality may spread to the following vowel through regressive assimilation. Similarly, when an emphatic consonant occurs before a vowel, such as [s^ʕ] ص, [d^ʕ] ض, [t^ʕ] ط, or [ð^ʕ] ظ it alters the quality of the vowel. Vowel quality is also affected when it is preceded by consonants such as [x] خ, [s^ʕ] ص, [d^ʕ] ض, [ɣ] غ, [ð^ʕ] ظ, [q] ق, and [t^ʕ] ط (‘Abdullāh, 2004; Syāhīn, 1980). These consonants are classified as emphatic (iṭbāq / الإطباق) or velarized/ pharyngealized (isti‘lāʾ / الاستعلاء) sounds in the Arabic consonantal system.

Vowel harmony is also observed in Arabic lexical items. This concept is discussed by Al-Syāyib (2004) under the phenomenon of assimilation, specifically vowel to vowel assimilation. One example of this phenomenon is the phonetic realization of the word مُنْذُ /minḏu/, which is pronounced as مُنْذُ [munḏu].

This temporal adverb is historically a compound of مِنْ and ذُو, which would yield the phonetic representation [minḏu]. However, a vowel change occurs due to an assimilatory process between vowels, particularly within the Sulaym dialect. This phenomenon can be more precisely explained by examining the feature composition of each involved segment through a modern phonetic and phonological feature-based analysis.

Classical and Modern Arabic vowel system

According to ‘Abdullāh (2004), one of the earliest Arabic linguists to give attention to vowels was Khalīl ibn Aḥmad Al-Farāhīdī. He discussed the relationship between long and short vowels in terms of quantity, referring specifically to the duration required for the articulation of these sounds. This is evident in his approach to the study of poetic meters (‘arūd - Arabic prosody), which involves syllabic structures in poetic rhythm, such as the classification of *sabab khafīf*, *sabab thaqīl*, *watad majmū‘*, and others. This syllabification implicitly distinguishes between consonants and vowels.

In addition, Arabic linguists have classified vowels as part of the phonemes of ‘illah (ḥurūf al-‘illah). According to Ibn Jinnī (1993), *alif*, *yā’*, and *wāw* are considered ‘illah phonemes, while all other phonemes are consonants. Ḥasan (1974) provides a more detailed account. He explains that when these phonemes occur in specific phonological environments within a word namely when *alif*, *yā’*, and *wāw* are unvocalised and preceded by a corresponding vowel they are classified as ‘illah phonemes, *madd* (lengthening vowels), or *līn* (glides/ long vowels). However, when the preceding vowel does not correspond, they are classified as ‘illah or *līn* in the sense of diphthongs. When these three phonemes carry vowel markings, they are simply treated as ‘illah in the sense of glide sounds. Notably, *alif* consistently functions as a ‘illah phoneme, whether as *madd* or *līn*.

Based on the discussion that has been highlighted, it clearly shows that there is a significant gap between classical and modern linguists. Al-Farāhīdī views the difference between short and long vowels from the aspect of quantity, which is specifically confined to the scope of poetry and discussed within the ‘arūd (Arabic prosody). Conversely, modern linguistic scholars state that this difference also involves syllable structure and articulatory quality.

Al-Khudaṛī (1998) further extends this definition by stating that ‘illah phonemes are of a general category similar to *līn* phonemes. Meanwhile, Syāhīn (1980) argues that there are three basic vowels that occur in two phonological states identified by classical linguists: the short vowels *fathah*, *kasrah*, and *ḍammah*, and their long counterparts *alif*, *wāw*, and *yā’*. These two states reflect vowel quantity, namely length versus shortness. However, from a modern linguistic perspective, he explains that *alif* corresponds to long /a:/, *yā’* corresponds to long /i:/, and *wāw* corresponds to long /u:/.

In contemporary linguistic analysis, ‘Abduh (n.d.) specifically argues that ‘illah phonemes are essentially vowels. These phonemes include both short and long vowels, since they may be classified into short ‘illah and long ‘illah categories (‘Abduh, n.d.). Thus, his position does not fundamentally differ from that of classical linguists, except in terms of terminological labelling: classical scholars tend to name phonemes based on letter identity, whereas modern linguists classify them as vowels or consonants based on phonological features. Al-Syā‘ir (2015) supports this view, stating that *alif*, *yā’*, and *wāw*, when unable to function independently and when substitutable by other phonemes in the same position, are classified as ‘illah phonemes.

An issue that is frequently highlighted in Arabic phonological debates is the phonemic status of the glide consonants [w] and [j] in relation to the long vowels [u:] and [i:]. From a modern linguistic perspective, this issue merely involves orthographic confusion of these phonemes within words in Arabic writing. If these phonemes are transcribed into phonetic symbols (IPA) in a modern phonological analysis, the glide consonants and long vowels can be clearly distinguished.

Furthermore, the Arabic vowel system has two distinctive characteristics. First, vowels do not occur in word initial position (Addow et al., 2025); if they appear to do so, they are always preceded by a *hamzah* (glottal stop). Second, each vowel exhibits contextual phonetic uniformity depending on its phonological environment within the word, particularly in relation to adjacent consonants.

When vowels occur near emphatic (pharyngealized/ uvularized) consonants, they tend to be retracted or centralized. Conversely, when adjacent to non-emphatic consonants, vowels are influenced by their surrounding phonetic context (El-Hassan, 1994). This second property describes the allophonic variation (البَدِيلُ الصَّوْتِيّ) of Arabic vowels, whereby vowel quality changes systematically depending on the consonantal environment preceding them.

Phonotactics of Arabic vowels

Arabic vowels are divided into two categories: short vowels and long vowels. These vowels occur within lexical structures in order to complete syllable formation. This is because every Arabic syllable must contain at least one vowel; otherwise, it violates the phonotactic constraints of Arabic. When consonant clusters appear in loanwords borrowed into Arabic, these clusters are typically broken up through epenthesis, i.e., the insertion of a vowel between adjacent consonants. Consonant clusters are only permitted in specific phonological contexts, such as word-final position in pause or stop (waqf). This phenomenon is frequently observed in English loanwords, which allow complex consonant clusters in their syllable structure. This demonstrates that vowels play a central role in the formation of Arabic syllable structure.

The rule prohibiting word-initial consonant clusters highlighted in this study is exclusively confined to the Standard Arabic system. Violations of this rule are permitted to occur in dialects; for instance, the short vowel /a/ in the word-initial position is often dropped in Arabic dialects, subsequently producing complex consonant clusters.

One of the phonotactic constraints involving vowels in Arabic word formation is the prohibition of sequences of three consecutive vowels. When such a sequence occurs, a phonological repair process is applied. This is supported by Syāhīn (1980), who states that phonological change aims to avoid sequences of three vowels, as in the word /diwa:r/ دِوَار, which becomes [di.ja:r] دِيَار in its phonetic representation. This change serves to produce a syllable structure that conforms to Arabic phonotactic rules.

Furthermore, according to Al-Syāyib (1989), the diphthong sequence /iw/ in which the glide /w/ is preceded by the vowel /i/ is not permitted in Arabic. Similarly, the sequence /uj/, involving the vowel /u/ followed by the glide /j/, is not recognized as a valid Arabic diphthong. When such sequences occur, a process of monophthongization is applied. The only diphthongs recognized in Arabic phonology are /aw/ and /aj/. However, even these permitted diphthongs may be restricted in certain morphological environments, triggering phonological alternations such as vowel lengthening. For example, سَنَوُ /sanaw/ becomes سَنَا [sanā:], and أَخْفَى /ʔaxfaj/ becomes أَخْفَى [ʔaxfa:].

The sequence of a long vowel /a:/ followed by the glides /w/ and /j/ may also violate Arabic phonotactic constraints in specific lexical environments. According to Ibn Jinnī (1993), the glide /w/ is not permitted in the final radical positions (fā' or lām positions) of a word, as it is considered phonologically "heavy". To satisfy Arabic phonotactic requirements, a default process of glottal stop epenthesis is applied. For example, بِنَايَ /bina:j/ becomes بِنَاءَ [binā:ʔ], and دُعَاوُ /duʕa:w/ becomes دُعَاءَ [duʕa:ʔ].

This demonstrates that vowel related segmental sequences in Arabic are highly systematic. When these sequences violate phonotactic rules, phonological repair processes are obligatorily triggered to ensure conformity with the structural constraints of the Arabic sound system.

Interaction of vowels with non-concatenative morphology

The transition from linear generative phonology to non-linear phonological theory was driven by several phonological phenomena that are difficult to account for within linear frameworks, particularly in languages with non-concatenative morphological systems, such as Arabic and other Semitic languages. The Arabic morphological system is based on a root-and-pattern (templatic) structure, in which the root segments within a lexical item cannot be segmented according to straightforward morpheme boundaries (Ahmad & Teoh, 2006).

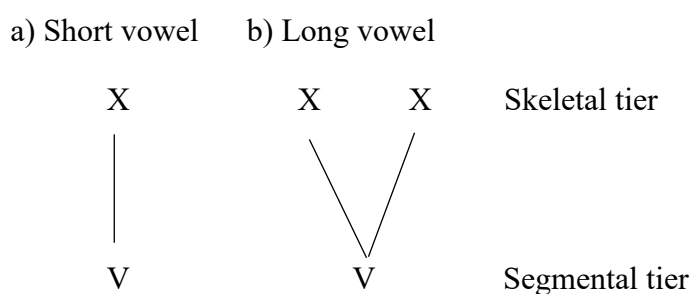
Phonological processes in non-concatenative morphology can be more adequately explained using an autosegmental phonological approach (McCarthy, 1981), in which syllabic structure plays a central role in analysis. Vowels that form syllables are not merely phonetic segments; they also perform morphological functions when they are intercalated between root consonants. The insertion of vowels into consonantal roots results in the formation of syllable structure.

According to McCarthy (1982), vowel association occurs on a separate representational tier known as the vocalic melody tier in the phonological representation of Arabic words. This is consistent with the requirement that syllable structure must contain a nucleus, which is exclusively represented by vowel segments (Addow et al., 2025). McCarthy (1982) further proposes that the word-level representation of Arabic should be divided into distinct tiers: a vocalic tier, a prosodic tier, and a root tier, while an additional morpheme tier is required when dealing with bound morphemes.

Thus, the vocalic tier in non-linear phonological representation demonstrates a strong interaction between vowels and the non-concatenative morphological system, particularly in Arabic, where morphological structure is fundamentally shaped by the interplay between consonantal roots and vocalic patterns.

Representation of Arabic vowels

In non-linear phonological representation, also known as autosegmental theory, long vowels can be distinguished from short vowels through their representation on two timing slots (skeletal tier units), whereas short vowels are associated with a single slot. This can be illustrated as follows:



(Source adapted from Rakhieh, 2009)

Figure 1 Timing-slot representation of short and long vowels

Figure 1 illustrates the difference in timing-slot representation between short and long vowels across two levels: the skeletal tier and the segmental (or melodic) tier. The association between the skeletal tier and the segmental tier for a short vowel involves a one-to-one linking, whereas a long vowel is represented through a one-to-two branching association.

From the perspective of syllable structure theory, a long vowel, which involves a dual association, must be dominated by a single syllable node (Ahmad & Teoh, 2006). This is because vowel length is a prosodic or suprasegmental feature that cannot be segmented into discrete units. Consequently, long vowels necessarily occupy a single syllable domain.

Therefore, in the analysis of various Arabic phonological phenomena whether involving vowel or consonant alternations the non-linear phonological representation framework is particularly appropriate for application.

CONCLUSION

This study does not only highlight the six already known Arabic vowels, but it also contributes to synthesizing the Arabic letter-labelling system with the mapping of distinctive features proposed in modern linguistic discussions. This study highlights a typological model which proves that Arabic phonotactic constraints are not merely phonetic rules; rather, they also involve the Arabic *non-concatenative* morphological structure, which is influenced by syllable structure.

Overall, the classical and modern Arabic vowel system reflects a dynamic and systematic linguistic structure that is firmly governed by specific phonotactic constraints. The discussion presented demonstrates that the evolution of Arabic linguistic thought from the classical approach of Al-Farāhīdī, which is based on temporal

quantity, to modern phonetic analysis consistently recognizes the role of the 'illah phonemes, namely *alif*, *yā*, and *wāw*, whether as long vowels, short vowels, or diphthongs.

This study also shows that Arabic vowel quality is not static; rather, it is significantly influenced by the surrounding phonetic environment. This includes the spreading of nasal features as well as the effect of emphatic consonant articulation (iṭbāq and isti'lā') on adjacent vowels, illustrating the interaction between consonantal and vocalic segments. Moreover, the presence of vowel harmony, resulting from assimilatory processes in certain dialects, highlights the flexibility of Arabic in actual speech production.

Finally, the phonotactic dimension demonstrates that vowels are essential elements in the formation of Arabic syllable structure. Constraints prohibiting consonant clusters without intervening vowels, as well as the restriction against sequences of three consecutive vowels, reflect a highly regulated phonological system, particularly in relation to the integration of loanwords.

The implication is that a deeper understanding of the vowel system is not only important for preserving the phonetic integrity of Classical Arabic, such as in Qur'anic recitation and poetry, but also contributes to a more comprehensive understanding of Modern Arabic phonology.

Therefore, further research is recommended to investigate the effects of these vowel-based phonotactic constraints across different Arabic dialects, in order to determine the extent to which the classical phonological system is maintained amid ongoing linguistic change.

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