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Whispering Sounds in Arabic Language: An Analytical Study

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Abstract—**The study aims to investigate the phenomenon of whispering sounds in Arabic, emphasizing the impact of phonetic harmony and sound proximity within words on their articulation and pronunciation. The research examines how consonants and vowels influence each other, leading to modifications such as voicing and devoicing, which facilitate or complicate pronunciation. Through analytical methodologies, including spectral graph analysis of short vowels, the study highlights the role of whispering sounds in interpreting meanings and enhancing communication in Arabic. Finally, one of the key findings is that the benefit of whispering for movements lies in the desire to keep the vocal cords' stoppage from vibrating to conserve muscular effort by using a single place of articulation.**

Index Terms—**Arabic language, whispering sounds, analytical study, spectral graph**

I. Introduction

Vocal sounds are influenced by their proximity within a single word or between two adjacent words due to the natural inclination of languages towards phonetic harmony. Upon examining sounds when they merge and neighbor each other, Al-Khalil ibn Ahmad observed a mutual attraction, with the tongue launching into an easy flow with some combinations and stumbling with others. He noted that the eloquence of a word is partly determined by the absence of discord among its sounds, which makes articulation difficult (Al-Mukhzumi, 1989, pp. 42-43). When adjacent sounds match in articulation and quality, their pronunciation becomes easier.

The degree to which sounds are affected by their neighbors varies, and this influence can occur between consonants and vowels. For example, the consonant sound t, a voiceless sound, in the word *tuʾminu*, is influenced by the preceding dhamma, a voiced sound, leading to a modification in the articulation of the consonant from the front to the back of the mouth as much as its pronunciation allows, resulting in a labialized consonant (Omar, 1997, p. 382). The position of a sound can also influence some of its features; for instance, a short vowel situated between two consonants, like the kasra in *min*, is affected by them. Another degree of influence is the redirection of the airstream from the oral to the nasal cavity or vice versa, commonly observed in the sounds /m/ and /n/. This transition in articulation is another level of influence, as seen when *min baʿdu* becomes *mimbaʿdu*, where the qualities of the sounds play a significant role in the phonetic change, with indicators of influence being either pronounced or diminished depending on the strength and dominance of the characteristic involved (ʻAbd al-Jalil, 2009, p. 290).

Linguistic sounds undergo several modifications due to the surrounding phonetic environment, leading to phenomena such as voicing and devoicing. These modifications aim to achieve phonetic harmony, facilitating pronunciation and reducing the muscular effort required during speech (Maslouh, 2000, p. 213). Voicing involves the vibration of the vocal cords during the articulation of a sound and gaining the characteristic of voicing due to the influence of neighboring sounds within the word, as in the pronunciation of /s/ as /z/ in dogs due to the voiced /g/, and indoors due to the voiced /r/. In Arabic, the voicing of /t/ in the form *iftaʿala* occurs when it follows a voiced sound, as in *izdahara*, originally *iztahara*.

Conversely, devoicing is the process by which an initially voiced sound becomes voiceless due to its environment, as when pronouncing /d/ in *ḥads*, losing its voicing characteristic and acquiring a whispery quality. In this context, the glottis remains open, the vocal cords do not meet or vibrate, and there is no constriction in the larynx, contrasting with a faster airstream (Bishr, 2000, pp. 87-88). Another example is the devoicing of /l/ in *milk* influenced by the voiceless /k/. It has been observed that devoicing can lead to the phonetic transformation of a phoneme into another, as in the Egyptian dialect transformation of /d/ to its voiceless counterpart /t/ in *ʿadas* (Al-Khuli, 1990). Considering short vowels in Arabic and other languages, they are phonetically voiced. Still, some may lose this property in specific contexts (Malmberg, 1984, pp. 109-110), becoming allophones rather than phonemes due to the influence of adjacent voiceless sounds resulting in a whispered (sibilant) quality (Istetiyyah, 2003, p. 285). The study aimed to explain the phenomenon of whispering sounds in the Arabic language, their linguistic importance, and their role in interpreting meanings and enhancing the communicative aspect of the language for Arabic speakers. Therefore, the study addresses the following questions:

1. What are the whispering sounds in the Arabic language?
2. What are the phonological characteristics of the whispering sounds in the Arabic language?

3. What is the significant role of short vowel sounds in the correct pronunciation of words in the Arabic language and in clarifying their meanings?

II. Methodology

Through an analytical and applied methodology, the study sought to clarify the whispering sounds in the Arabic language. This was achieved by collecting information and data related to these sounds from various sources and references, categorizing and analyzing them, and then conducting a phonetic analysis of the short vowels using spectral graphs to ensure the accuracy of the data analysis.

III. Theoretical Background

A. Definition of Whispering

Whispering, from the root *sh w sh*, denotes speech in a state of the mixture, and it has been related by some with the use of the disregarded letter 's,' intending the meaning of the covert speech or secretive word (Ibn Manzūr, n.d., Entry *sh w sh*). Webster's Dictionary defines whispering as speaking in a low, unclear voice, where the whispered sound does not involve the vibration of the vocal cords during its production, and the whispered speech is articulated without resonance (Webster's Dictionary, Whispering).

Whispering implies the loss of voicing, which concerns both voiced consonants and vowels. An example of whispering in a voiced consonant can be observed in the word *ḥabs*, where /b/ exhibits some whispering due to the vocal cords drawing close without touching. /b/ is close to a whisper position but retains a hint of voicing. This contradicts Al-Khouli's belief that /b/ in this word assumes a whisper position. This can similarly be applied to the phrase *ḥads*. However, whispering is most evident in vowels, where a voiced initially short vowel turns into a whispered one due to the influence of the adjacent phonetic environment. Whispered vowels are accompanied by noisy air, which undergoes turbulence in the passages it flows through (Istetiyyah, 2003, p. 102). Al-Khuli considers this phenomenon a type of phonetic assimilation, arguing that the short vowel tends to assimilate to its neighboring sounds (Al-Khuli, 1990, *washwasha*). However, from the researcher's perspective, vowel assimilation occurs to adjacent whispered consonants, suggesting that these vowels are influenced by the neighboring whispered consonants.

A whispered sound is produced by approximating vocal cords towards each other without contact, as opposed to a reduction in airstream velocity in this phenomenon. The respiratory effort involved in whispering is more significant than that in everyday conversation, requiring a longer duration for sound production due to the increased air volume. This leads to a prolonged period of rising air pressure, causing a kind of turbulent flow that enhances audibility in the phenomenon of whispering (Ayyūb, 1984, pp. 64-65). An example of whispering is the short vowel in the word *ḥalaba*, where the vowel loses its voicing and becomes whispered due to the influence of the whispered /h/ sound.

B. Whispering Phenomenon in Other Languages

This phonetic phenomenon is found in several languages, including Arabic, French, and Japanese. Jakobson mentioned that this phenomenon exists in the Comanche language, which is one of the Native American languages spoken in the southern regions of the United States, particularly in the northern plains of Texas, as well as in the Chemehuevi language, a Native American language of the Mojave Desert (Ayyūb, 1984, p. 102).

C. Whispered Vowels in Arabic

The influence of one phonetic unit upon another does not occur in isolation but in combination with other units within the context of words. Whispered vowels in Arabic can appear if preceded by, and sometimes if followed by, a voiceless consonant enclosed by voiceless consonants within the same syllable. Examples of whispered vowels preceded by a voiceless consonant include the words *silmun, khurjun,* and *ḥasmun*. An example where voiceless consonants enclose a short vowel is the word *fikr*. In the phrase *silmun*, the kasra vowel weakens due to the preceding voiceless /s/. Similarly, the damma in *khurjun* diminishes in resonance because it follows the voiceless /kh/, and the fatḥa loses its voicing and becomes whispered due to being enclosed between the voiceless sounds /h/ and /s/ in *ḥasmun* (Ramadan, 1979, p. 179).

A sound may also undergo a posterior shift, transforming from voiced to whispered, as in the phrase *arbaʿatu shuhadāʾ al-yawm* (four martyrs today), in some utterances like *ḥaythu shiʾtumā* (wherever you wish), and in the sentence *ishtaʿala al-raʾsu shaybā* (the head turned gray); in each, the /sh/ in *shuhadāʾ,* /s/ in *al-raʾsu*, and /th/ in *ḥaythu* are voiceless sounds followed by the voiced damma vowel, which, however, turns into whispered through the context (Anis, 1975, p. 204).

IV. Discussion

The Mechanics of Short Vowel Fatḥa and Kasra Articulation in Arabic

The duration of voicing and whispering for the short vowel /a/ (fatḥa) changes with different phonological positions of this short vowel. If this movement is confined between two voiced sounds, the time required to produce its sound

frequencies is 87 m/sec, as in the word *lamaʿa* (Figure 1). This figure represents the voiced state of the fatḥa movement. However, if a voiceless consonant precedes the fatḥa, and a voiced consonant follows it, as in the fatḥa between /ṣ/ and /n/ in the word *ṣanʿa* (Figure 2), Spectral analysis has found that the time required to produce the fatḥa in this position is 61 m/sec. Meanwhile, the time needed to make the fatḥa sound is 58 m/sec if it is confined between two voiceless sounds, as revealed through the spectral analysis of the word *ṣakhra* (Figure 3) where the fatḥa is confined between two voiceless sounds: /ṣ/ and /kh/.

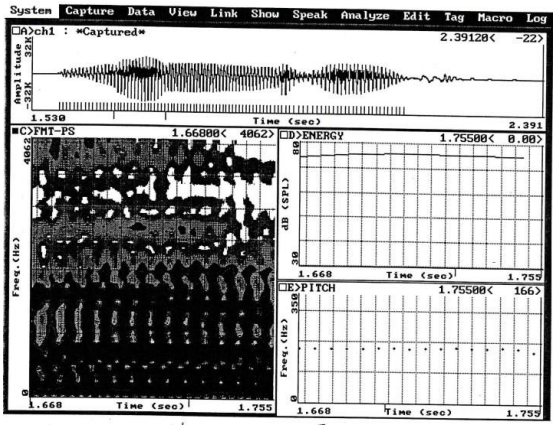

Figure1. Spectral Analysis of the Word *lamaʿa*

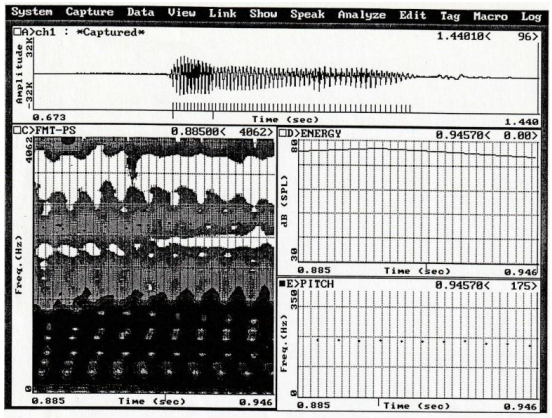

Figure 2. Spectral Analysis of the Word *ṣanʿa*

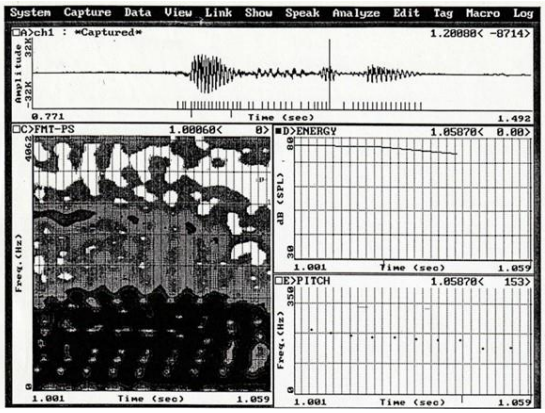

Figure3. Spectral Analysis of the Word *ṣakhra*

This analysis shows some modifications to the articulation forms of the sounds composing the syllable. If a voiced consonant precedes the voiced vowel /a/, such as /l/ in the word *lamaʿa* (Figure 1), followed by another voiced sound: /m/, the voicing of the movement between two voiced sounds increases. The sound frequencies in f1 are 521 Hz, in f2, the sound frequencies increase to 1355 Hz, and rise to their highest in f3 at 2256 Hz. Moreover, suppose a voiceless consonant precedes the fatḥa within the same syllable of the word. In that case, the fatḥa transitions from voiced to colored by voicing, and its onset is influenced by its proximity to the voiceless sound. The spectral analysis of the word *ṣanʿa* (Figure 2) and through spectral graphs shows a difference in sound frequencies. In the first layer of sound waves f1, the frequency reached 520 Hz; in f2, it reached 1025 Hz, and the sound frequencies in f3 rose to 1642 Hz. Following

the fatḥa confined between two voiceless sounds in the same syllable, as in the spectral graph for the word *ṣakhra* (Figure 3), *we* notice that the fatḥa, confined between /ṣ/ and /kh/, loses its essence and becomes whispered. The sound frequencies varied, appearing in f1 at 685 Hz, while the frequencies in f2 rose to 1169 Hz, reaching their highest in f3 at 2413 Hz.

As the spectral graph shows, the darkness indicates that the air passes through the vocal cords without their meeting. Looking at the three cases of sound frequencies in the spectral graphs for Figures 1, 2, and 3, we find that the highest sound frequencies in f1 occur in the case of the fatḥa confined between two voiceless sounds, reaching 685 Hz per second. Meanwhile, the sound frequencies for moving to stage f2 are highest when the fatḥa is confined between two voiced sounds, reaching 1355 Hz per second. In stage f3, the highest sound frequencies for the fatḥa confined between two voiceless sounds reached 2413 Hz per second. The presence of darkness in the spectral graph, widespread in Figure 3, indicates a quantity of air penetrating the vocal cords without contact, suggesting a whispering condition.

Regarding the duration of these frequencies for the fatḥa movement, the most extended duration occurs when the movement is confined between two voiced sounds, reaching 87 m/sec. The duration decreases for the fatḥa preceded by a voiceless sound to 61 m/sec, and it is the shortest when the sound is confined between two voiceless sounds, reaching 58 m/sec. The effort exerted is most significant in the fatḥa between two voiceless sounds, reaching an energy level of 75.93 decibels. In contrast, the effort in the short fatḥa movement preceded by a voiceless sound is 75.57 decibels, and the lowest effort is for the movement confined between two voiced sounds, reaching 75.63 decibels. The tone of the fatḥa between two voiced sounds reached 176.5 Hz, and for the fatḥa preceded by a voiceless sound in the same syllable, it reached 184.5 Hz, the highest tone ratio. Meanwhile, the tone of the fatḥa confined between voiceless sounds slightly decreased, reaching 181 Hz per second.

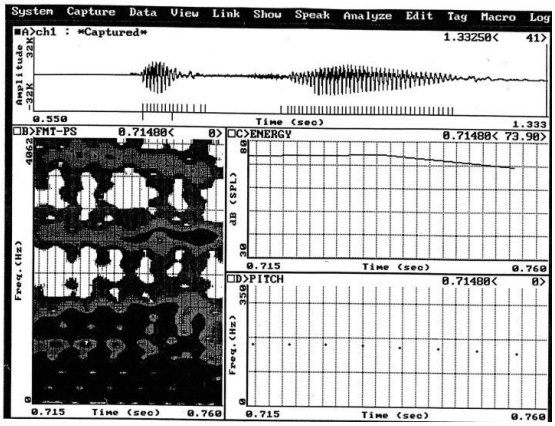

Figure 4. Spectral Analysis of the Word *ṭiflān*

Following the kasra movement in Figure 4, where it was confined between the voiceless /ṭ/ and/f/ voiceless sound in the word *ṭiflān,* we see that the duration for the sound frequencies was 45 m/sec (Figure 4), meaning the duration for producing the kasra sound is less than that for making the fatḥa sound confined between voiceless sounds as in *ṣakhra*, which was 58 m/sec (Figure 3). Additionally, the duration for the sound frequencies and the production of the kasra movement preceded by a voiceless sound (Figure 5) is less than that for the fatḥa preceded by a voiceless sound (Figure 2), being 55 m/sec for the kasra. In contrast, for the fatḥa, it was 61 m/sec. Moreover, the kasra between two voiced sounds in the word *ʿilmān* (Figure 6) has a shorter duration than the fatḥa between voiced sounds (Figure 1), being 66 m/sec for the former and 87 m/sec for the latter, indicating a change between the fatḥa and kasra movements acoustically, whether in terms of time, sound frequencies, or sound waves.

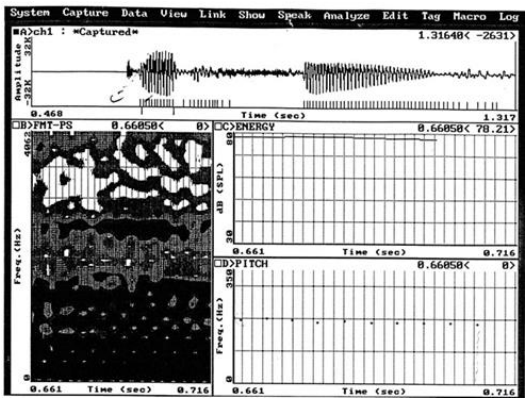

Figure 5. Spectral Analysis of the Word *qirshān*

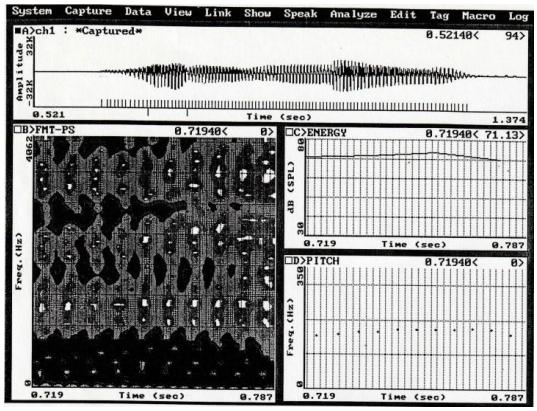

Figure 6. Spectral Analysis of the Word *ʿilmān*

To clarify the acoustic changes that occurred to this type of movement, we look at the wave spectrum, which shows the sound waveform, frequency height, and the temporal extension of the segment. Figure 3 represents the waveform of each sound in the word when the fatḥa is preceded and followed by a voiceless sound Figure 2, as well as the sound waveform for the word when the fatḥa is preceded only by a voiceless sound. These two forms represent the movement in a whispering condition. In contrast, Figure 1 shows the sound of the fatḥa between two voiced sounds. In Figure 3, we note the frequency height of the sound waves and the temporal extension from 685 in f1 to 2413 in f3, while the temporal extension for the kasra is less.

Understanding the sound frequencies of the fatḥa movement in the words ṣakhra (Figure 3), ṣanʿa (Figure 2), and lamaʿa (Figure 1) allows us to deduce how the fatḥa movement is influenced by its neighboring sounds.

The previous analysis provides insights into the whispering movement confined between two voiceless sounds or preceded by a voiceless consonant. It also shows the difference in effort between the two conditions and generally indicates a change in the characteristic of the movement in Figures 1, 2, 3, 4, 5, and 6. This is because the sound frequencies of a voiceless consonant are more robust than those of the fatḥa or kasra movements, causing the short vowel sounds, either fatḥa or kasra, to be influenced by the preceding voiceless consonant. Consequently, the vocal cords adopt a different position, the whispering position. Similarly, suppose a voiceless sound followed by another precedes the fatḥa or kasra. What matters in this context is how the voiceless sound's wave affects the short vowel's wave. This leads to adjusting both the voiceless consonant and the short vowel. The critical aspect of this study is the change that occurs to the short vowel; both the onset of the fatḥa and kasra waves undergo modification.

V. Findings

From the previous analysis, we can deduce the following:

- If a short vowel movement occurs in a syllable between two voiced sounds, the degree of voicing that the short vowel movement acquires after its new position is higher due to its adjacency to two voiced sounds.
- If a short vowel movement is preceded by a whispered vowel sound, the subsequent movement is influenced by its proximity to that whispered sound, as proven by the attached spectral graphs, indicating a whispering condition.
- If the movement is confined within the same syllable between two whispered sounds or in two adjacent words, like the /t/ sound in the sentence *coming to tea* affecting the /o/ movement, the movement loses its voicing and becomes whispered. This is seen in the kasra movement confined within the same word between two whispered sounds in the word *ṭiflān* طِفْلان (Figure 4), confined between /ṭ/ and /f/, as well as the voiced fatḥa in *ṣakhra* (Figure 3) confined between two whispered sounds: /ṣ/ and /kh/, which constitutes the whispering condition. In this position, the vocal cords adopt a position where the space between them on one side is wider than on the other, showing tension and rigidity. Air passes through, causing disturbance and noise without the vocal cords vibrating, with the airspeed in this case ranging from 25 to 30 m/s. Looking at the fatḥa and kasra movements preceded by a whispered sound, as in *qirshān* (Figure 5) and *ṣanʿa* (Figure 2), we notice that the effort of whispering differs from the voicing condition of the movement when isolated.
- The study also reveals that the sound of the faith movement is longer and more audible than that of the kasra in a non-nasal syllable.
- We also conclude that the characteristics of movements in context differ from when they are isolated; they are voiced when isolated, while they may be voiced or in a whispering condition within context, as illustrated by the attached spectral graphs.
- The position of the vocal cords in a whispered breathy sound is open, whereas a voiced sound is produced in the case of vocal cord contact. If the vocal cords approach each other without touching, this is called the whispering position. This contrasts with Abdel Rahman Ayoub's opinion on sound, that it may be described as voiced or whispered, and Ayoub considers it inaccurate to describe it between these two states (Ayyūb, 1984, pp. 183-184).

It seems that Abdel Rahman Ayoub overlooked or ignored the existence of sounds in a language called whispered sounds. Abercrombie states that a whispered sound, if pronounced in this manner, retains the whispering characteristic, whereas another replaces a voiced sound, the whispered sound (Abercrombie, 1967, p. 26). In the whispering condition, the vocal cords are in a position close to that of voicing but with a significant difference: they are stiffened and frozen, preventing vibration (Bishr, 1980, p. 68).

- We also found that language movements differ from one linguistic environment to another. For instance, when spoken by Moroccan, Arabic movements differ from those pronounced by an Egyptian or a Syrian, revealing variations in these movements upon pronunciation. This is influenced by local pronunciation habits or the specific dialect of each linguistic environment. For example, a Moroccan might pronounce a non-nasal segment nasally, as in *maqāsak*, elongating the short fatḥa in pronunciation to become *maqāsā ka*, leading to a transformation of the segment from non-nasal to nasal, making the fatḥa in the nasal segment voiced (Istetiyyah, 2003, p. 286).

VI. Conclusion

Among the critical characteristics of whispering sound production are:

- There is a relative constriction in the larynx.
- The airflow speed is lower than in whispering mode.
- The vocal cords come close together in a whispering mode without touching.
- The effort exerted in this phenomenon is greater than in everyday conversation.
- In whispered movements, the flow and quantity of air increase, along with the pressure in the oral cavity space.
- The time required to produce the sound extends due to the increased breathing air and the time needed to increase air pressure.
- Whispering is not limited to a short vowel movement confined between two whispered sounds but fundamentally relies on the movement if preceded by a whispered sound. This is accompanied by a difference in effort between the two conditions. If we consider groups for the variety of short vowel movements, for example:
  - Group 1, fatḥa movement: examples include *takbir, taʿẓīm, fahīm*
  - Group 2, kasra movement: examples include *ṣinwān*, *ṣifrān, ṭiflān*
  - Each of these groups contains a fatḥa, kasra, that is whispered, all preceded by a whispered consonant sound. In the first group, the fatḥa is preceded by /t/ and /f/ sounds. In the second group, the kasra is preceded by /ṭ/ and /ṣ/ sounds. This proves that the essential condition for a short vowel movement to become whispered is that a whispered consonant sound precedes it.
- Finally, the benefit of whispering for movements lies in the desire to continue stopping the vocal cords from vibrating and conserving muscular effort using a single place of articulation.

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