

Variation in the Production of Emphasis Among Children in Jordanian Arabic: Gender and Education

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Abstract:

This study investigates the effects of gender and education on the production of emphasis by children speaking Ajlouni Jordanian Arabic (AJA). Driven by the paucity of acoustic analyses in Jordanian Arabic (JA), this research engaged 20 schoolchildren, evenly distributed across gender and educational backgrounds. The acoustic measurements encompassed Voice Onset Time (VOT) and the first three formant frequencies (F1-F3) at the onset, midpoint, and offset of the vowel. The findings indicated that emphasis is characterized by shorter VOT, elevated F1 and F3, and reduced F2 frequencies. A notable interaction between emphasis and gender was identified for F1 and F2, with male participants exhibiting more pronounced emphatic-plain distinctions. No significant effects were identified for emphasis by education or emphasis by gender by education interactions.

Keywords: Emphasis, Ajlouni Jordanian Arabic, acoustic measurements, Voice Onset Time, formant frequencies.

1. Introduction:

Emphasis, the coarticulation of a primary and secondary feature in the anterior and posterior vocal tract, is a significant linguistic phenomenon that is inherent in almost all Arabic varieties, including Jordanian Arabic (henceforth JA) (Abudalbh, 2011; Omari and Jaber, 2019; Almomany, 2023a, Almomany, 2023b, Almomany, 2024), Syrian Arabic (Almbark, 2008), Algerian Arabic (Salem and Sebane, 2023), Iraqi Arabic (Salman, 2020), Saudi Arabic (Alarifi, 2010; Al Malwi, 2017), Libyan Arabic (Algryani, 2014), to mention a few. Although emphasis has been grossly defined as the simultaneous articulation of a coronal constriction and a dorsal constriction, the nature of the latter gesture has widely been disputed in different Arabic varieties, referring to it as uvularization, velarization, pharyngealization, and/or backing² (Davis, 1995; Lehn, 1963; McCarthy, 1994; Zawaydeh, 1998, inter alia).

More recent accounts of emphasis (see, e.g., Omari and Jaber, 2019) further divided emphasis into two subcategories: primary and secondary. The former set refers to the four primary emphatic sounds, namely /t^ʕ, d^ʕ, s^ʕ, ð^ʕ], in which the presence/ absence of the emphatic feature entails phonemic change. On the other hand, the latter set refers to allophonic or free-

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variational emphasis (for a review, see Al-Deaibes, Al-Shawashreh, and Jarrah, 2021: 2). Table 1 below provides some examples of primary emphatics.

	Emphatic	Gloss	Plain	Gloss
1.	[tʰax]	‘he shot’	[tæx]	‘stayed too long’
2.	[dʰab]	‘he packed’	[dæb]	‘he fell’
3.	[sʰad]	‘he fended off’	[sæd]	‘he closed’
4.	[ðʰam]	‘he hugged’	[ðæm]	‘he criticised’

Table (01): Examples on primary emphatic sounds from JA.

Given the fact that emphasis is realized differently in different Arabic varieties, it has been intensively examined from a phonological and/or phonetic perspective (Lehn, 1963, for Cairene Arabic; Davis, 1995, for Palestinian Arabic; Salman, 2020, for Iraqi Arabic; Jaradat, 2020, for JA, among others). More recently, the sociophonetics of emphasis has gained momentum in dialectal Arabic, with a keen interest in how social factors acoustically influence the production of emphasis (Al-Masri and Jongman, 2004; Abudalbuh, 2011; Alzoubi, 2017; Omari and Jaber, 2019; Omari and Jaber, 2020; Salem and Sebane, 2023; Almomany, 2023a; Almomany, 2023b; Almomany, 2024, to mention a few).

However, the vast majority of previous studies suffer from methodological shortcomings, as they often utilize loose terms to refer to distinct varieties of the same dialect, a point first raised by Alzoubi (2017). In addition, a great number of these studies provided evidence based on a small population sample or a small data sample. Moreover, none of these studies addressed the speech of younger age groups, viz. children. For this purpose, the present study was designed to analyze the impact of social variables, namely age and education, on the production of emphasis among children in an under-researched variety of JA, namely rural Jordanian Arabic (henceforth AJA). To achieve this goal, the study addresses the following questions:

1. Does gender influence children’s production of emphasis?
2. Does parental education influence children’s production of emphasis?
3. Does the intersection of gender and education affect emphasis in a socially meaningful manner?

To answer these questions, the following hypotheses were formulated for testing:

1. Male children show a higher degree of emphaticness than their female peers.
2. The speech of children whose parents are more educated is less emphatic than that of their peers whose parents are less educated.
3. The intersection of gender and education does not reveal any socially significant patterns of change.

Literature Review:

Several studies have been recently, but not sufficiently, devoted to the sociophonetics of emphasis in JA varieties³ (Al-Masri and Jongman, 2004; Abudalbuh, 2011; Alzoubi, 2017; Omari

³ Since emphasis is realized differently in different Arabic dialects, the researcher resorted to reviewing those studies that are closer to the dialectological scope of the current study (i.e., AJA) for a more feasible and profound comparability of the findings.

and Jaber, 2019; Omari and Jaber, 2020; Almomany, 2023a; Almomany, 2023b; Almomany, 2024, among others).

Al-Masri and Jongman (2004: 5) investigated the acoustic cues of emphasis in “the northern dialect of Jordanian Arabic”. Their objective was threefold: to identify what holds as a reliable indicator of emphasis, to identify the domain and directionality of emphasis spread, and to identify gender-graded effects. To achieve this, their stimulus materials included four lists of mono-, di-, and trisyllabic minimal pairs contrasting in /t^s/-/t/, /d^s/-/d/, /s^s/-/s/, and /ð^s/-/ð/, which were examined in different vowel contexts, namely /ɪ, i:, æ, a:/. The stimulus words were each embedded in a carrier sentence and read five times by eight native speakers of JA (five males and three females), who were living abroad (i.e., the USA) at the time of the experiment. The acoustic measurements were confined to consonant duration (CD), vowel durations (VD), and the vowel’s second formant frequency⁴ (F2). In general, the study revealed that only F2 was reliable in detecting emphasis, where it was consistently lower in emphatic environment than in plain environment. It was also demonstrated that while vowels in the target syllable consistently showed F2 lowering, vowels falling to the right of the target syllable did not show any F2 lowering as far as the vowel in the target was /i:/ or /u:/. As for gender-related effects, the study showed that while both males and females exhibited emphatic-plain contrast in terms of F2, females led males, a finding that contradicts the mainstream trend in the literature.

Criticizing Al-Masri and Jongman (2004), Abudalbuh (2011) examined the potential impact of gender on the production of emphasis in JA. His goal was: to identify the reliable acoustic cues of emphasis in JA, to identify the effect of vowel quality on emphasis production in JA, and to better identify the differences between males and females in the production of emphasis other than those arising from physiological differences (e.g., vocal tract size). To do so, his data consisted of nine CVC minimal pairs, contrasting in /t^s/-/t/, /d^s/-/d/, and /s^s/-/s/ in word-initial position in the environments of /a:, i:, u:/. The stimulus materials were each embedded in a carrier sentence and read by 22 native speakers of JA⁵ (12 males and 10 females) once. The acoustic measurements included Voice Onset Time (VOT), friction duration, spectral mean of fricatives, VD, and the vowel’s first three formant frequencies⁶ (F1-F3) at the beginning, middle, and end of the vowel.

In short, the analysis showed that VOT was a reliable exponent of emphasis, where emphatic VOTs were shorter than plain ones. Friction duration was also found to be reliable in detecting emphasis, where emphatic fricatives were shorter than plain ones. Similarly, VD turned out to be a reliable exponent of emphasis, where emphaticized vowels were significantly longer than their plain cognates. Emphasis was also characterized by a higher F1, lower F2, and higher F3. However, the spectral mean of fricatives was found to be unreliable in detecting emphasis. As for the impact of vowel quality, the study revealed that emphasis was more acoustically pronounced on low vowels than on front and back vowels. More significantly, the analysis showed emphasis was more acoustically pronounced in males’ speech than in that of females, as evinced on F1 and F2 at the onset and midpoint of the vowel. Notwithstanding, none of the temporal cues was reliable in pinpointing the differences between males and females.

⁴ Al-Masri and Jongman (2004) did not normalize F2 against sex differences between males and females.

⁵ Abudalbuh (2011) used a loose term, viz. JA, without any precision in terms of regional dialectology.

⁶ Abudalbuh (2010: 37) utilized Nearey’s (1977) normalization algorithm, which he cited as Nearey (1978).

A more diversified, yet methodologically sound, account of the sociophonetics of emphasis is Alzoubi's (2017) study, in which he analyzed the relative impact of gender, social class, and speaker's origin on the production of emphasis in Amman Jordan. His stimuli consisted of a word list, comprising 40 words, and a minimal pair list, comprising 36 minimal pairs, contrasting in /t^h/- /t/ and /s^h/- /s/ in word-initial, word-medial, and word-final positions in different vowel contexts (i.e., /æ, a:, ɪ, i:, ʊ, u:, aɪ, aʊ/). The population sample⁷ comprised 28 native speakers of JA, equally divided in terms of gender, social class, and origin (for further details, see Alzoubi, 2017: 68), who read the stimulus words twice. The acoustic measurements included VOT of voiceless stops, Center of Gravity (COG) for stops and fricatives, and the vowel's first three formant frequencies (F1-F3) at 10-percent intervals of the vowel.

In summary, the study divulged that emphasis had a main effect on VOT, stop COG, F1, F2, and F3. While emphatic VOT was significantly shorter than its plain counterpart, COG of emphatic stops was significantly lower than that of plain stops. In addition, emphaticized vowels were marked by a higher F1, lower F2, and higher F3. The interaction between emphasis and manner also yielded a significant effect on F3, where it was higher in the vicinity of a stop than in that of a fricative. Likewise, the interaction between emphasis and vowel quality indicated significance on F2 and F3. The former showed that emphasis was more pronounced in the environment of /æ, a:/ than in those of /ɪ, i:/ and /aɪ/ whereas the latter showed, similar to previous studies, no specific pattern of change, with /ʊ, u:/ exerting the greatest emphatic-plain contrast, followed by /aʊ/, /aɪ/, /æ, a:/, and /ɪ, i:/. In addition, the analysis indicated a significant interaction between emphasis and position of the target consonant/vowel on stop COG, F1, and F2. The emphatic-plain contrast in terms of stop COG was maintained only in word-final position. While F1 was significantly higher only when the vowel preceded the emphatic consonant, F2 was consistently higher before and after the emphatic consonant, with a greater effect when the vowel was right-adjacent to the emphatic consonant, thus confirming the salience of F2 as the most reliable acoustic cue of emphasis.

More importantly, the study revealed a statistically significant interaction between emphasis and gender on VOT, COG of stops and fricatives, F1, F2, and F3. The emphatic-plain contrast was consistently greater for males than for females, a pattern of consistency that was not reported earlier. Besides, the interaction between emphasis and social class was significant on COG and F3. Speakers from East Amman significantly maintained the emphatic-plain contrast in terms of COG, speakers from West Amman showed only a trend (i.e., approaching significance). In terms of F3, speakers from East Amman exhibited a smaller emphatic-plain contrast than their peers from West Amman. In other words, these findings suggest that different social groups utilize different acoustic cues to maintain phonemic contrasts, probably pointing to the preservation of distinct social identities. As for the effect of speaker's origin or "ORD", to use Alzoubi's term, the analysis showed that while speakers from rural Palestinian origin maintained the greatest emphatic-plain contrast in terms of VOT, F2, and F3, followed by those from rural Jordanian and urban Palestinian origins, speakers from rural Jordanian origin exhibited the greatest emphatic-plain contrast in terms of COG than those from rural and urban Palestinian origins, who patterned together, a finding that points to either residual linguistic features or social identity markers (Alzoubi, 2017).

⁷ This study is, to the best of my knowledge, the first to meticulously control for the sample, given that locality of the speakers prior to the experiment and intermarriage effects were taken into consideration (Alzoubi, 2017: 68).

Omari and Jaber (2019) investigated the influence of gender and social class on emphasis production in JA. They utilized a corpus comprising 12 monosyllabic CVC minimal pairs that varied in the contrasts /t^h/-/t/, /d^h/-/d/, /s^h/-/s/, and /ð^h/-/ð/ across three vowel settings (/a:/, /u:/, /i:/). The study involved an equal number of participants from two social classes (lower-middle and upper class) and two genders (male and female). A total of 40 native JA speakers, aged 17 to 20, participated, each pronouncing the target words thrice, amassing 72 tokens per speaker. Various temporal and spectral measures were employed, such as VD, VOT of voiceless stops, post-release duration of voiced stops, friction duration, and the vowel's first three formant frequencies (F1-F3) at the onset and midpoint of the vowel. Overall, the analysis demonstrated that emphasis had a statistically significant main effect on VOT, VD, as well as on F1, F2, and F3. It was observed that the VOT for /t^h/ was significantly shorter than for /t/. Moreover, vowels in emphatic environment showed much longer durations compared to those in plain environment. In a similar pattern, the F1 for emphaticized vowels was notably higher than for plain vowels, though this was only observed at the vowel's onset. More prominently, the F2 of emphaticized vowels was considerably lower than that of plain vowels, affecting both the onset and midpoint of the vowel. Similarly, the F3 of emphasized vowels was significantly higher than in plain vowels at both onset and midpoint. Despite these substantial differences, emphasis did not cause any statistically significant changes in post-release and friction duration between emphatic and plain environments.

The interaction of emphasis with gender revealed significant effects on F1 and F2. Although both males and females exhibited a higher F1 in emphatic contexts compared to that in plain context at both the onset and midpoint, males demonstrated a larger emphatic-plain contrast in F1 than females. Emphatic vowels also had a significantly lower F2 for both genders when compared to plain vowels, with males displaying a more pronounced emphatic-plain difference in F2 than females. However, the emphasis by gender interaction did not produce statistically significant differences for VOT, post-release duration, friction duration, and F3 between emphatic and plain contexts.

Additionally, interaction effects based on social class showed a significant impact on post-release duration, VD, F1, and F2. In the lower-middle class, the post-release duration of /d^h/ was significantly shorter than that of /d/, while upper-class speakers displayed the opposite pattern. This points to a reversal in the direction of change. Similar patterns were found in VD, where emphaticized vowels of lower-middle-class speakers were longer than plain vowels, in contrast to upper-class speakers, where both environments had similar durations. Although emphasis and social class significantly affected F1 at both onset and midpoint, significant F1 raising in emphatic environments compared to plain settings was only present for lower-middle-class speakers at the onset. Unlike F1, the F2 of emphatic vowels was consistently lower than plain vowels in both social groups, with a more pronounced decrease seen in lower-middle-class speakers. However, there was no significant interaction effect between emphasis and social class on VOT, friction duration, and F3 across emphatic and plain conditions.

The interaction between emphasis, gender, and social class revealed a statistically significant influence on both F1 at the onset and midpoint and F2 at the midpoint. For F1 at the onset, emphaticized vowels displayed a significantly higher F1 in males compared to plain vowels, while females showed an insignificant decrease within the upper class. In contrast, males and females from the lower-middle class exhibited similar patterns in F1 differences between emphaticized and

plain vowels. At the midpoint, upper-class males sustained a notably higher F1 for emphatic vowels, unlike females who significantly lowered F1. Despite contrasting F1 behaviors, where males held higher and females showed slight decreases, gender distinctions were statistically insignificant. For F2, upper-class gender differences were not significant, with both males and females achieving significantly lower F2 for emphatic vowels compared to plain ones. However, significant gender differences emerged within the lower-middle class for F2 lowering, with males leading. These results indicate that gender differences are influenced by social class, with speech patterns interplaying with social meaning and identity. Essentially, understanding gender differences relies heavily on social class (Omari and Jaber, 2019).

In their follow-up study, Omari and Jaber (2020) examined how linguistic and social factors influence emphasis in the urban variety of JA, namely Urban Jordanian Arabic (UJA). They analyzed data from 12 CVC minimal pairs differentiated by /tʰ/-/t/, /dʰ/-/d/, /sʰ/-/s/, and /ðʰ/-/ð/ across three vowel contexts /a:/, u:/, i:/. The words were each placed within a carrier sentence and then randomized. The study involved 40 native UJA speakers, carefully grouped by gender and social class (upper class versus lower-middle class). Each speaker read the stimulus materials three times, yielding 72 tokens per speaker. The measured acoustic parameters included the first (F1), second (F2), and third (F3) formant frequencies at the beginning and middle of the vowel. The research found that emphasis was characterized by a higher F1 only at the onset position, with a lower F2 and a higher F3 both at the onset and midpoint positions.

Additional statistically significant interaction effects between emphasis and other variables were detected. Firstly, the interaction between emphasis and manner demonstrated a notable impact on F2 and F3. Specifically, F2 values were considerably lower after an emphatic stop compared to an emphatic fricative at both the onset and midpoint, whereas the F3 values were higher after an emphatic stop than an emphatic fricative but only at the midpoint. Nonetheless, this interaction did not lead to any significant effects for F1 onset and midpoint, nor for F3 onset. Secondly, there was a significant interaction involving emphasis, manner, gender, and social class affecting the F1 onset. In detail, lower-middle-class males, unlike females, showed increased F1 values after an emphatic fricative compared to an emphatic stop, while their upper-class counterparts exhibited the reverse pattern, with higher F1 after an emphatic stop than an emphatic fricative. Third and last, the interaction between emphasis and voicing (voiced vs. voiceless) revealed a statistically significant impact on the F1 midpoint and F2 onset and midpoint. While the effect on the F1 midpoint was statistically significant, it did not align with the direction of emphasis. Specifically, vowels in emphatic environment exhibited lower F1 values than raised. Conversely, F2 values were consistently lower following a voiced emphatic consonant than a voiceless one. These findings imply that social factors like gender and social class did not influence the interactions between emphasis and manner or voicing, with the exception of the interaction involving emphasis, manner, gender, and social class on the F1 onset. It was proposed that this particular interaction was not affected by social variables but rather by the combined influence of gender and social class (Omari and Jaber, 2020). Nevertheless, an argument can be made that speakers from various social groups may exhibit emphasis differently, at least acoustically.

Almomany (2023a) investigated the relative impact of gender on emphasis production in AJA, which is the specific dialect under present scrutiny. His research involved 48 minimal pairs that were mono- and bi-syllabic, containing target consonants /tʰ, t, sʰ, s/ at both the beginning and

the end of the words. These consonants were examined across six vowel environments /æ, a:, ɪ, i:, ʊ, u:/ as articulated by 12 native AJA speakers, equally divided between males and females. The analysis focused on five acoustic properties, such as VOT, consonant duration, and the first three formant frequencies (F1-F3) of the vowel in both the syllable with the emphatic consonant and the neighboring syllable. In essence, the study concluded that, while the interaction of emphasis and gender did not affect consonant duration or formant frequencies in the target and adjacent syllables, it did influence VOT. Specifically, the VOT for male speakers was significantly longer than for females, which might imply, according to the figure (Almomany, 2023a, p. 65), that female speakers exhibited a more pronounced contrast between emphatic and plain sounds in relation to VOT.

In a subsequent study, Almomany (2023b) examined how age influences the production of emphasis in AJA. This research mirrored the methodological approach outlined in his earlier work (Almomany, 2023a), with the only alteration being the division of participants into three age groups: 18-35, 36-50, and 51 and older. The findings indicated that the interaction between emphasis and age had a statistically significant impact on VOT. Specifically, participants in the second age group displayed the most pronounced emphatic-plain contrast in VOT, followed by those in the third and first age groups, in that order. However, no statistically significant differences were found for consonant duration or formant frequencies in either the target or distant syllables between emphatic and plain contexts.

In his ongoing investigation, Almomany (2024) examined how age and gender impact emphasis production in AJA. His method paralleled his earlier work (refer to Almomany, 2023a), systematically dividing participants into two gender groups (6 males, 6 females) and three age ranges (2: 18-35, 2: 36-50, 2: 51 & older). The findings revealed that emphasis significantly influenced both VOT and the F1, F2, and F3 of the target syllable. Specifically, emphatic VOTs were considerably shorter than plain VOTs. F1 and F3 of emphaticized vowels were notably higher than those of plain vowels, while F2 was significantly lower. However, emphasis did not affect consonant duration or formant frequencies in the neighboring syllable. Furthermore, the interaction of emphasis with age and gender showed a significant effect on VOT. Specifically, while both genders across age groups maintained the emphatic-plain VOT contrast, notable gender differences emerged only in the third age group (51+). Females from this group exhibited greater VOT reduction between emphatic and plain contexts than their male counterparts. Although VOT differences between males and females in the first (M: 14.33 ms vs. F: 15.12 ms) and second (M: 22.08 ms vs. F: 23.04 ms) groups were minor, Almomany (2024) identified a trend where women exhibited more pronounced change towards emphasis. Nonetheless, these findings suggest an imperative to explore how age and gender interact, providing a deeper understanding of the interplay between emphasis and gender and between emphasis and age. This partially supports Holmes' (2013, pp. 177-178) sociolinguistic model, which associates speakers' age with vernacular use, stating older speakers tend to revert to vernacular usage later in life due to relaxed social constraints.

2. Methodology:

2.1. Data:

The data of the current study comprised 48 CVC minimal pairs contrasting in /t^s/-/t/, /s^s/-/s/, and /ð^s/-/ð/ across different vowel contexts, viz. /æ, a:, ɪ, i:, ʊ, u:, o:, e:/. The bulk of the words (67%) were commonly used real words in AJA. However, it was inevitable to incorporate nonsense words to complete the minima pair sets, which are phonologically legal in JA (Abudalbu, 2011).

2.2. Participants:

Twenty schoolchildren, all native AJA speakers, participated in the present study, with an equal distribution by gender and educational background. The participants' ages ranged from eight to eleven years. In order to control for random effects, the selection of participants was meticulously executed based on predetermined criteria. First, each participant was born and raised by parents who are native speakers of AJA and who had no prior history of relocation. Second, each participant's parents were both pertaining to either tertiary education or below tertiary education. Those whose parents had varying levels of education did not qualify for the study. Third, each participant was excellent at the Arabic language in terms of reading, writing, speaking, and listening. Fourth and last, each participant did not suffer from any speech or hearing impairment. These criteria were verified by school records, as reported by the school principal and/or classroom teacher, prior to the experiment. Table 2 below displays the distribution of the participants.

Gender	Parental education	Number
Male	Tertiary	5
	Below tertiary	5
Female	Tertiary	5
	Below tertiary	5

Table (02): Distribution of the participants of the current study.

2.3. Procedures:

Upon receiving the needed authorization letter from Ajloun Directorate of Education, the researcher started visiting governmental schools in the villages of Ajloun City, where AJA is mainly spoken. Each participant was asked to have the letter of consent (see Appendix A) filled and signed by either of their parents before the recording session. Next, each respondent was seated in the school's library and welcomed by the researcher and, when the respondent was a female, his wife with a friendly discussion to make them feel more relaxed and comfortable. Then, each respondent was given the three lists, responding to the three phonemic contrasts, where each target word was embedded in the carrier sentence *ihki ____ kama:n marrah* [Say ____ once more] and thus randomized to distract the participant's attention from the goal of the study. While being monitored, each respondent was instructed to read the minimal pairs in a normal tone and at a normal pace three times, of which only the second token was analyzed. Participants had the option to pause whenever they felt they would.

2.4. Acoustic Measurements:

The bulk of previous research verified the salience of F2 and, though less frequently, VOT, F1, and F3 in detecting emphasis in JA; the researcher resorted to utilizing these cues. It is noteworthy that a modified PRAAT script (Herrero de Haro, 2020) was employed to obtain the formant frequencies at the beginning, middle, and end of the vowel. Since the main objective of this study is to seek the potential impact of gender, along with that of education, it was undoubtedly essential to normalize vowel formants against physiological differences for a feasible comparability between males and females (Abudalbh, 2011; Alzoubi, 2017; Omari and Jaber, 2019, among many others). To achieve this, the researcher utilized Thomas and Kendall's (2007) online free service The Normalization and Plotting Suite (NORM), in which he used Nearey's (1977) formant-intrinsic normalization method, which allows for the inclusion of F3.

2.5. Statistical Analysis:

The statistical analysis was conducted using the IBM Statistical Package for the Social Sciences (SPSS) version 27. The author utilized full-factorial Two-Way and Three-Way Analyses of Variance (ANOVA) based on the recommendation of a statistician who is a friend to the author. The former were used to assess the interaction effects between emphasis and gender/education on the acoustic cues, whereas the latter were used to assess the overall interaction effects between emphasis, gender, and education on the acoustic cues.

3. Findings:

3.1. Emphasis x Gender:

A Two-Way ANOVA indicated a significant main effect of emphasis on VOT [$F(1.316)=370.220$, $p=.001$], where emphatic VOTs were significantly shorter than plain VOTs. However, the test showed that there was no significant main effect of either gender [$F(1.316)=.989$, $p=.321$] or emphasis and gender [$F(1.316)=10.651$, $p=.807$] on VOT.

Moreover, the ANOVA analysis indicated a significant main effect of emphasis on F1 at the onset of the vowel [$F(1.1916)=23.559$, $p=.000$], where emphaticized vowels exhibited a higher F1 mean value than plain vowels. However, the analysis showed that emphasis did not have a significant main effect on F1 at the midpoint [$F(1.1916)=3.039$, $p=.081$] or offset [$F(1.1916)=2.012$, $p=.156$]. Besides, the ANOVA test indicated a significant interaction between emphasis and gender on F1 at the onset [$F(1.1916)=5.558$, $p=.018$], where males exhibited a higher emphatic-plain contrast than females, as shown in Figure 1 below.

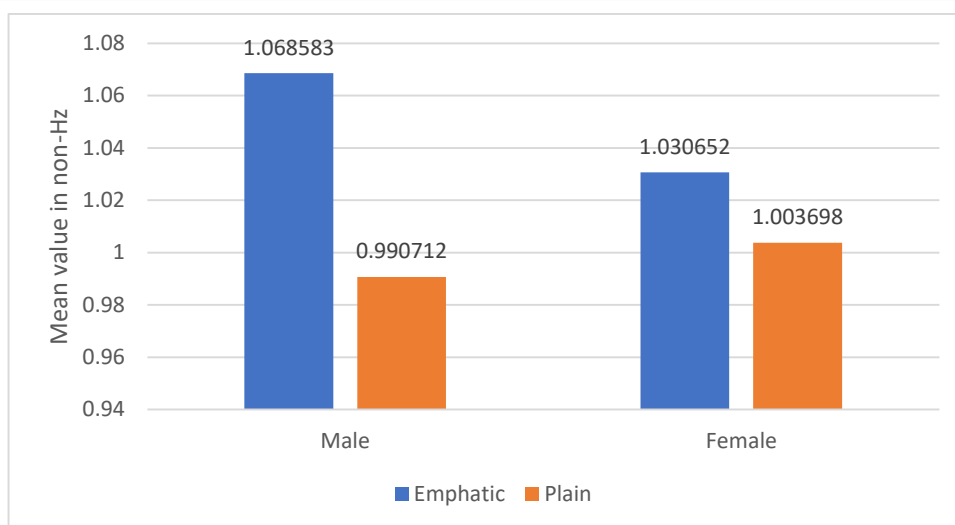


Figure (01): F1 mean values in emphatic and plain environments for males and females at the onset of the vowel.

Nevertheless, the ANOVA test showed that there was no significant interaction effect between emphasis and gender on F1 at the midpoint [$F(1.1916) = 3.039$, $p = .081$] or offset [$F(1.1916) = 3.295$, $p = .070$].

As for F2, the Two-Way ANOVA indicated a significant main effect of emphasis on F2 at the onset [$F(1.1916) = 137.184$, $p = .000$], midpoint [$F(1.1916) = 31.724$, $p = .000$], and offset [$F(1.1916) = 100.835$, $p = .000$], where emphaticized vowels exhibited a lower F2 mean value than plain vowels. On the other hand, the analysis showed that there was no significant main effect of gender on F2 at the onset [$F(1.1916) = .033$, $p = .857$], midpoint [$F(1.1916) = .116$, $p = .734$], or offset [$F(1.1916) = .065$, $p = .799$]. Moreover, the analysis indicated a significant interaction effect between emphasis and gender on F2 at the onset [$F(1.1916) = 4.644$, $p = .031$] and offset [$F(1.1916) = 5.517$, $p = .019$], where males maintained a higher emphatic-plain contrast than females, as shown in Figure 2 below.

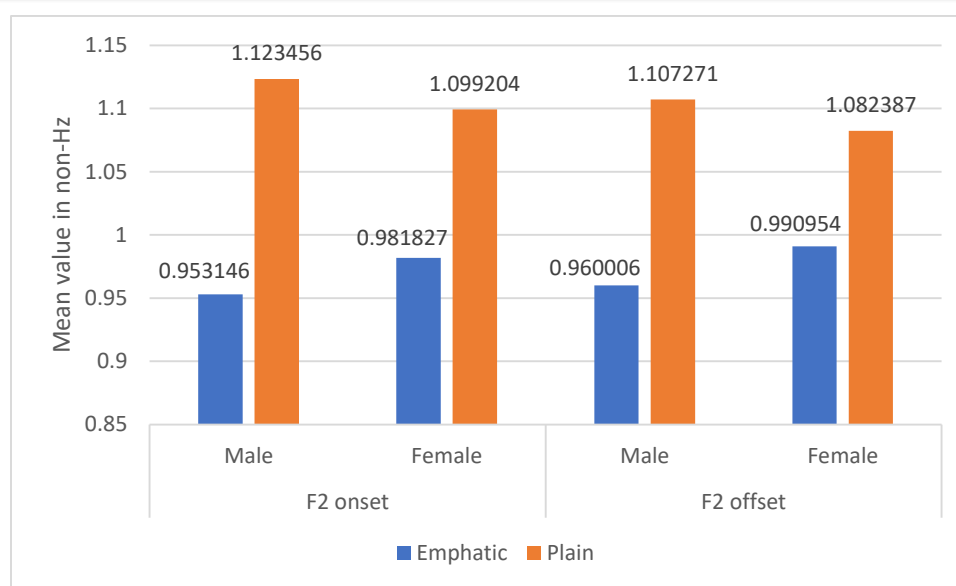


Figure (02): F2 mean values in emphatic and plain environments for males and females at the onset and offset of the vowel.

Conversely, the ANOVA test showed no significant main effect of emphasis on F2 at the midpoint [$F(1.1916) = 2.493$, $p = .115$].

In addition, the Two-Way ANOVA indicated a significant main effect of emphasis on F3 at the onset [$F(1.1916) = 5.059$, $p = .025$], where emphasized vowels exhibited a lower F3 mean value as compared to that of plain vowels. However, the analysis showed that there was no significant main effect of emphasis on F3 at either the midpoint [$F(1.1916) = 2.203$, $p = .138$] or offset [$F(1.1916) = .006$, $p = .936$]. On the other hand, the ANOVA test showed that there was a significant main effect of gender on F3 at the midpoint [$F(1.1916) = 6.475$, $p = .011$], where females exhibited a higher F3 mean value than males. Nonetheless, the analysis showed that there was no significant main effect of gender on F3 at the onset [$F(1.1916) = 2.773$, $p = .096$] or offset [$F(1.1916) = 3.211$, $p = .073$].

As for the interplay between emphasis and gender, the analysis indicated a significant interaction effect on F3 at the onset [$F(1.1916) = 5.071$, $p = .024$] and midpoint [$F(1.1916) = 11.646$, $p = .001$]. At the onset, while males maintained comparable F3 mean values, females significantly lowered their F3 in emphatic environment as compared to that in plain environment. At the midpoint, while males maintained the emphatic-plain contrast, females lowered rather than raised their F3 in emphatic environment. Figure 3 below displays these differences.

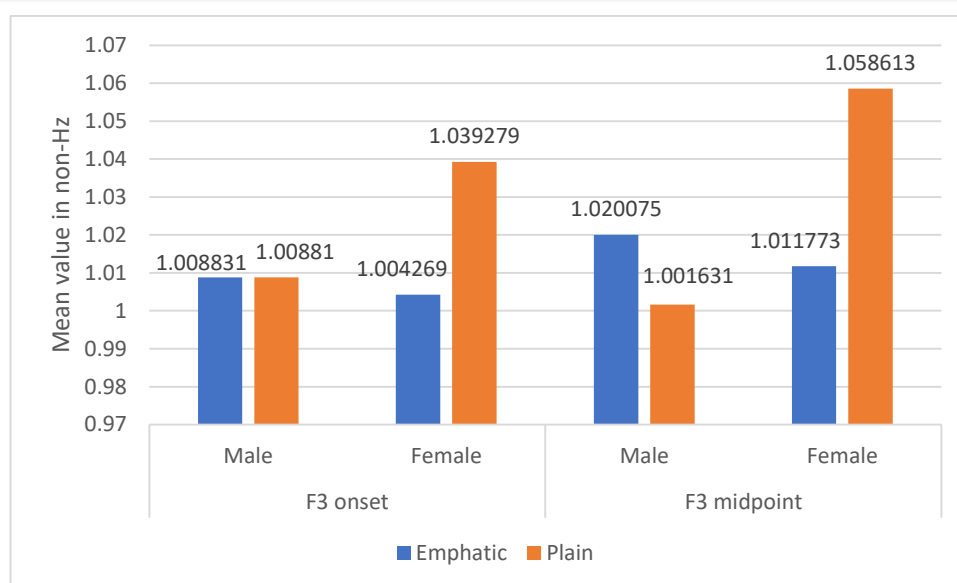


Figure (03): F3 mean values in emphatic and plain environments for males and females at the onset and midpoint of the vowel.

Conversely, the ANOVA test showed no significant interaction between emphasis and gender in terms of F3 at the offset [$F(1.1916) = 1.844$, $p = .175$].

3.2. Emphasis x Education:

A Two-Way ANOVA showed that there was no significant main effect of education on VOT [$F(1.316) = .361$, $p = .548$], F_1 (onset: [$F(1.1916) = 1.156$, $p = .283$]; midpoint: [$F(1.1916) = .413$, $p = .520$]; offset: [$F(1.1916) = .982$, $p = .322$]), F_2 (onset: [$F(1.1916) = .000$, $p = .996$]; midpoint: [$F(1.1916) = .180$, $p = .672$]; offset: [$F(1.1916) = .040$, $p = .842$]), and F_3 (onset: [$F(1.1916) = .032$, $p = .859$]; midpoint: [$F(1.1916) = .084$, $p = .772$]; offset: [$F(1.1916) = .010$, $p = .920$]) throughout the vowel.

Likewise, the ANOVA analysis showed that there was no significant interaction between emphasis and education in terms of VOT [$F(1.316) = .104$, $p = .748$], F_1 (onset: [$F(1.1916) = 2.111$, $p = .146$]; midpoint: [$F(1.1916) = .100$, $p = .751$]; offset: [$F(1.1916) = .169$, $p = .861$]), F_2 (onset: [$F(1.1916) = 2.051$, $p = .152$]; midpoint: [$F(1.1916) = .143$, $p = .706$]; offset: [$F(1.1916) = 1.658$, $p = .198$]), and F_3 (onset: [$F(1.1916) = .036$, $p = .849$]; midpoint: [$F(1.1916) = .242$, $p = .623$]; offset: [$F(1.1916) = 1.812$, $p = .178$]) throughout the vowel.

3.3. Emphasis x Gender x Education:

A Three-Way ANOVA showed that there was no significant interaction between emphasis, gender, and education in terms of VOT [$F(1.312) = .881$, $p = .349$], F_1 (onset: [$F(1.1912) = 1.076$, $p = .300$]; midpoint: [$F(1.1912) = 1.327$, $p = .250$]; offset: [$F(1.1912) = 1.982$, $p = .159$]), F_2 (onset: [$F(1.1912) = .572$, $p = .450$]; midpoint: [$F(1.1912) = .405$, $p = .524$]; offset: [$F(1.1912) = .023$, $p = .880$]), and F_3 (onset: [$F(1.1912) = .118$, $p = .732$]; midpoint: [$F(1.1912) = 1.185$, $p = .277$]; offset: [$F(1.1912) = .085$, $p = .771$]) throughout the vowel.

3.4. Summary of the Findings:

This section provides a concise summary of the principal findings with particular attention to emphasis, as illustrated in Table 2 below. An asterisk (*) denotes a significant interaction effect, the (↑) symbol indicates increased value, and the (↓) symbol denotes decreased value, and the more (↑)/(↓) symbols there are, the more/less increased values there are.

Acoustic Cue	Variable(s)	Measurement point	Interaction Effect	Groups ⁸			
VOT	Emphasis	--	*	E.	↓	P.	↑
F1		onset	*	E.	↑↑	P.	↑
F2		onset, midpoint, & offset	*	E.	↓↓	P.	↓
F3		onset	*	E.	↑↑	P.	↑
F1	Emphasis x Gender	onset	*	M.	↑↑	F.	↑
F2		onset & offset	*	M.	↓↓	F.	↓
F3		onset & midpoint	*	see Section 4.1.			

Table (02): Summary of the significant interaction effects.

4. Discussion and Conclusions:

4.1. Discussion:

The primary objective of this study was to investigate the potential influence of gender and education as social variables on the linguistic interaction of emphasis in AJA. 20 schoolchildren, all native speakers of AJA, were recorded reading lists of C^sVC and CVC^s minimal pairs. Several measurements were carried out, including VOT, on the one hand, and the vowel's F1, F2, and F3 at three vowel intervals: onset, midpoint, and offset.

Relative to the first research, the study indicates a significant effect of gender on the production of emphasis, where males generally produced a higher degree of emphaticness than females in terms of F1 at the onset. While this finding runs in tandem with Abudalbuh (2011), Alzoubi (2017), Omari and Jaber (2019), who found that males' F1 was significantly higher than that of females, it runs counter to Omari and Jaber (2020), who found that the gender did not have a significant bearing on the interactions between either emphasis and manner or emphasis and voicing. Similarly, our finding contradicts that of Almomany (2023a), where he found that gender

⁸ E. represents emphatic, P. Plain, M. male, and F. female.

did not significantly affect emphasis in terms of F1, a finding that probably resulted from the small number of respondents (i.e., 12).

More consistently, the present study showed that gender exerted a significant effect on F2, where males maintained a higher degree of emphaticness than females. This finding corroborates those of Abudalbuh (2011), Alzoubi (2017), and Omari and Jaber (2019), who found that F2 was more lowered in males' speech than in females', thus supporting the salience of F2 in detecting emphasis. However, our finding is at odds with Al-Masri and Jongman (2004), who argued that females exhibited a greater degree of emphaticness in terms of F2 than males. Running counter to our finding is Omari and Jaber (2020) and Almomany (2023a), who found that gender did not have any significant impact on emphasis in terms of F2.

As for F3, the current study demonstrates that while males maintained comparable F2 mean values between emphatic and plain environments at the onset, females rather lowered than raised their F2 in emphatic environment. At the midpoint, the females' pattern of departure was maintained, whereas males exhibited the emphatic plain contrast (see Figure 3). Since these findings on F3 show, for the most part, the degree of lowering rather than raising, they are considered peripheral.

On the other hand, the study shows that there was no significant interaction effect between emphasis and gender in terms of VOT, a finding that was substantiated by Abudalbuh (2011) and Omari and Jaber (2019), who pinpointed that gender did not have any significant impact on VOT. Nevertheless, the present study's finding contradicts Alzoubi (2017), who found that males' emphatic VOTs were significantly shorter than those of females. At odds with our finding is Almomany's (2023a), where he suggested that females' emphatic VOTs were significantly shorter than males'.

Concerning the second research question on whether parental education or the intersection between emphasis, gender, and parental education affects children's production of emphasis, the study shows no significant interaction effects in terms of VOT, F1, F2, and F3. This finding, though not targeted in previous research, would suggest that the effect of gender is not contingent upon other variables (e.g., education), as was the case in Omari and Jaber's (2019: 189) study, where they argued that gender-graded differences are contingent upon social class in terms of F2.

4.2. Conclusion:

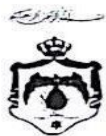
This article examined the relative influences of gender and parental education as extralinguistic variables on children's production of emphatic segments in AJA. The analysis demonstrated a significant effect of gender, with male children displaying a greater emphatic-plain contrast as indicated by F1 and F2 measurements. Conversely, it reveals an insignificant effect of parental education, whether considered independently or in conjunction with gender, on children's production of emphasis in AJA. This study is deemed preliminary, with the aspiration that it encourages future research investigating the speech of children in comparison to adult speech in JA varieties.

Bibliography:

- Abudalbh, M. (2011). Effects of Gender on the Production of Emphasis in Jordanian Arabic: A Sociophonetic Study. *Kansas Working Papers in Linguistics*, 32: 20–47.
- Al Malwi, I. M. (2017). The effects of gender and age on voice onset time by Abah Arabic speaker (MA Thesis, California State University).
- Alarifi, A. (2010). An acoustic analysis of pharyngealization in urban Najdi Arabic (MA Thesis, University of York).
- Al-Deaibes, M., Al-Shawashreh, E., & Jarrah, M. (2021). Emphatic variation of the labio-velar /w/ in two Jordanian Arabic dialects. *Heliyon*, 7(11), 1–18.
<https://doi.org/10.1016/j.heliyon.2021.e08295>.
- Al-Masri, M., & Jongman, A. (2004). Acoustic correlates of emphasis in Jordanian Arabic: Preliminary results. In: A. Agwuele, W. Warren, and S.-H. Park (Eds.), *Proceedings of the 2003 Texas Linguistics Society Conference*. Somerville, MA: Cascadia Proceedings Project, pp. 96–106.
- Almbark, R. A. (2008). A Sociophonetic study of emphasis in Syrian Arabic (MA Thesis, University of York).
- Almomany, I. E. O. (2023a). Effects of gender on emphasis production in Jordanian Arabic: A socio-phonetic study. *Contemporary Studies in Social Sciences*, 2(2), 169–179.
<https://doi.org/10.31559/CSSS2023.1.1.5>
- Almomany, I. E. O. (2023b). Effects of age on emphasis production in Jordanian Arabic: A socio-phonetic study.. *Journal of Studies in Language, Culture, and Society*, 6(1), 10–26.
- Almomany, I. E. O. (2024). The sociophonetics of emphasis in Jordanian Arabic: Age and gender. *Contemporary Studies in Social Sciences*, 1(1), 59–72. .
<https://doi.org/10.31559/CSSS2024.2.2.5>
- Alzoubi, A. (2017). The effects of social factors on emphatic-plain contrast in Jordan: A sociophonetic study of Arabic in Amman City (Doctoral Dissertation, University of Utah).
- Davis, S. (1995). Emphasis Spread in Arabic and Grounded Phonology. *Linguistic Inquiry*, 26(3): 465–498.
- Herrero de Haro, Alfredo (2020). Formants, duration, pitch and intensity [PRAAT script].
<https://aherrerodeharo.com/research-resources/>.
- Jaradat, M. (2020). Gutturals, emphatics, and the phenomenon of emphasis spread in Fallaahi Jordanian Arabic: A non- linear analysis. *Journal of Language and Linguistic Studies*, 16(4), 1656–1679.
- Jasim, M. I. (2020). Tafxi:m in the vowels of Muslawi Qəltu and Baghdadi Gilit dialects of Mesopotamian Arabic (Doctoral Dissertation, Newcastle University).
- Lehn, W. (1963). Emphasis in Cairo Arabic. *Language*. 39: 29–39.
- McCarthy, J. (1994). The phonetics and phonology of semitic pharyngeals. In: P. Keating (Ed.), *Phonological Structure and Phonetic Form: Papers in Laboratory Phonology III*, pp. 191–234. Cambridge: Cambridge University Press.
- Nearey, T. M. (1977). Phonetic feature system for vowels (Doctoral Dissertation, University of Alberta).

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- Salem, N. & Sebane, Z. (2023). The effect of gender on the voiceless emphatic stop in Arabic-French code-switching: An acoustic study on Oran Spoken Arabic. *Language Practices*, 14(1), 315–339.
- Omari, O., & Jaber, A. (2019). Variation in the acoustic correlates of emphasis in Jordanian Arabic: Gender and social class. *Folia Linguistica*, 53(1), 169–200.
- Omari, O., & Jaber, A. (2020). Emphasis, manner, and voice in Urban Jordanian Arabic: Linguistic and extralinguistic interactions. *International Journal of Arabic-English Studies*, 20(1), 7–18.
- Thomas, E. R. & Kendall, T. (2007). NORM: The vowel normalization and plotting suite. [Online Resource: <http://ncslaap.lib.ncsu.edu/tools/norm/>]
- Zawaydeh, B. A. (1998). Gradient uvularization spread in Ammani-Jordanian Arabic. In E. Benmamoun, M. Eid, & N. Haeri (Eds.), *Perspectives on Arabic linguistics XI: Papers from the Eleventh Annual Symposium on Arabic Linguistics* (pp. 117–141). John Benjamins.

Appendix A: Authorization letter from Ajloun Directorate of Education



وزارة التربية والتعليم العالي

مديرية التربية والتعليم لمحافظة عجلون

مديري ومديرات المدارس الحكومية

الرقم
التاريخ
الموافق
٦٩٨٤ / ١٣ / ٧ / ٧
٢٠ صفر ١٤٤٥
٢٠٢٣ / ٠٩ / ٠٦

الموضوع: البحث التربوي

السلام عليكم ورحمة الله وبركاته،،،،

أرفق طياً كتاب جامعة سيجد (المجر) رقم بلا تاريخ 2023/8/30 ،

راجياً تسهيل مهمة الطالب ابراهيم شلاش عوده المومني وتقديم المساعدة الممكنة له

. وعلى أن لا تستخدم البيانات المتحصلة إلا لأغراض البحث العلمي .

وتفضلوا بقبول فائق الاحترام

مدير التربية والتعليم



نسخة السيد مدير الشؤون التعليمية .

نسخة السيد ر.ق الإشراف التربوي .