University of Szeged

Faculty of Humanities and Social Sciences

Doctoral School of Linguistics

Department of General Linguistics

Summary of the Dissertation

The Sociophonetics of Emphasis Among Children and Adolescents in Jordanian Arabic: Linguistic and Extra-linguistic Variables

By:

Ibrahim Eshlash Odeh Almomany

Supervisor:

Dr. Zsigri Gyula

Program: Theoretical Linguistics

2026

1. Introduction

Emphasis (tafkhīm in Arabic), found in almost all Semitic varieties, involves coarticulation of a primary feature in the dental/alveolar region and a secondary feature in the back of the vocal tract (Ghazeli, 1977; Bin-Muqbil, 2006; Jongman, Herd, and Al-Masri, 2007; Jongman, Herd, Al-Masri, Sereno, and Combest, 2011). The nature of this secondary articulation is disputed, and terms such as uvularization, pharyngealization, velarization, dorsalization, and backing have been used.

Research on Arabic emphatics (/tˤ dˤ sˤ ðˤ/) and gutturals (pharyngeals, laryngeals, uvulars) disagrees on whether they form a single natural class. Zawaydeh (1999) treats emphasis as uvularization and uses "gutturals" to cover emphatics, pharyngeals, laryngeals, and uvulars, but argues that only pharyngeals, uvulars, and emphatics share a common articulatory property (pharyngeal constriction), excluding laryngeals. In contrast, McCarthy (1994) proposes the feature [pharyngeal] to group gutturals as one natural class, claiming pharyngeals, laryngeals, and uvulars occupy a shared articulatory region from the larynx to the oropharynx. He further notes that these gutturals, together with emphatics, consistently raise vowel F1, supporting their treatment as a unified natural class. Problematic as it appears, the articulatory classification of emphatic segments in Arabic has been discussed by other researchers. Bin-Muqbil (2006) adopts, similar to Younes (1982), Laufer and Baer (1988), Herzallah (1990), and Davis (1995), *pharyngealization* to refer to emphatics since the secondary articulation of these sounds entails the retraction of the tongue towards the upper oropharynx. Contrary to this, Algryani (2014) argues that it is not true that all emphatics involve a constriction at the pharynx, hence they cannot be referred to by *pharyngealization*.

However, several competing phonetic accounts of Arabic emphatics were proposed. Bin-Muqbil (2006) contrasts analyses that treat emphasis as velarization with those that call it uvularization, noting two interpretations of the latter: one aligns emphatic consonants with /x/ and /ɣ/ via velar involvement, while the other links them to retracted tongue root (RTR), where the tongue dorsum retracts toward the uvula (Davis, 1995; Watson, 2002). On this basis, emphatics are argued to form a phonological natural class, sharing features such as [+pharyngeal], [+RTR], or [+emphatic], and patterning together in emphasis spread (e.g., retraction of /æ/ near emphatics). Phonetically, they are also a natural class, sharing a common secondary articulation and causing systematic acoustic effects on neighboring vowels: lowering F2 and, to a lesser extent, raising F1 and F3 (Al-Masri & Jongman, 2007; Al-Masri, 2009; Abudalbuh, 2011; Alzoubi, 2017).

Besides, Arabic emphatics are typically split into primary and secondary types. Primary emphatics consist of four phonemic consonants /tˤ, dˤ, sˤ, ðˤ/ that contrast with their plain counterparts /t, d, s, ð/, as illustrated by minimal pairs in Modern Standard Arabic. Secondary emphatics, by contrast, are claimed to be either allophonic or free variational (for details, see Al-Deaibes et al., 2021: 2). Yet, there are a couple of other instances that prompt the failure of such classification, such as [mˤɑj] 'water' versus [mæj] 'proper name', [ʤɑːrˤɪ] 'my neighbor' versus [ʤaːrɪ] 'ongoing', and [dɑːrˤɪ] 'my home' versus [daːrɪ] 'be patient with!', in which there is a contrast.

To resolve this nonconformity among the researchers, several acoustic investigations were carried out. Most studies show that emphasis systematically affects neighboring vowels, especially their first three formants: vowels adjacent to emphatic consonants typically exhibit lowered F2 and, less consistently, raised F1 and F3 compared to vowels near plain consonants. F2 lowering emerges as the most robust and consistent acoustic marker of emphasis across dialects and consonant positions (pre- or postvocalic). Additionally, though somewhat less reliable, correlates include shorter VOT for voiceless emphatic stops and a lower spectral mean for emphatic stops relative to plain stops, with the spectral mean reported as the least consistently used cue. Overall, F2 lowering is identified as the single most consistent acoustic denominator of emphasis in Arabic dialects.

More importantly, emphasis in Arabic is examined as both a physical (acoustic) phenomenon and one shaped by social factors (e.g., age, gender, social class, education, and regional dialect), since speakers use linguistic choices to index social identity. Prior sociophonetic studies of emphasis across several Arabic dialects have shown that: (1) gender affects emphasis, with women typically producing weaker emphatic contrasts than men (e.g., Abudalbuh, 2011); (2) social class matters, with lower and lower-middle classes showing stronger emphatic vs. plain contrasts than upper classes (e.g., Omari and Jaber, 2019); and (3) speakers' original regional dialect (ORD) influences emphasis, with urban speakers producing the weakest emphatic contrasts relative to rural and other dialects (e.g., Alzoubi, 2017).

More recent work has investigated how emphasis interacts with multiple linguistic and nonlinguistic variables simultaneously (e.g., Almomany, 2024). These studies demonstrate that the apparent effect of a single variable (such as emphasis) on an acoustic cue can disappear once other variables are considered, implying complex interaction effects. Consequently, emphasis must be

studied across multiple interactional environments rather than in isolation to allow for more reliable and generalizable conclusions.

Moreover, although the sociophonetics of emphasis has recently gained notable attention, no study has, to the best of the researcher's knowledge, tackled the speech of children and/or adolescents. Notwithstanding, several studies have been devoted to researching children's acquisition of consonant sounds, of which only few included the emphatic sounds (Al Amayreh, 1994; Amayreh and Dyson, 2000; Amayreh, 2003, among others). Al Amayreh (1994) shows the four main emphatics are acquired after 6;4 years, with no gender differences. Amayreh and Dyson (2000) find that children aged 13–24 months produce only a limited set of non-emphatic consonants, supporting the view that emphatics appear later. Amayreh (2003) reports that /dˤ/ is acquired around 6;6–7;4 and /tˤ, sˤ, ðˤ/ around 7;8–8;4. Hamdan and Amayreh (2007) find first graders (mean age 6;4) have acquired /sˤ/ and /tˤ/ but not /dˤ/ and /ðˤ/, attributing this to dialectal variation (Urban vs. Rural Jordanian Arabic). The more recent study by Mashaqba, Daoud, Zuraiq, and Huneety (2022), using both accuracy and acoustic measures, concludes that /tˤ, dˤ, sˤ/ are produced in an adult-like way by age six in word-initial and medial positions and by age seven in word-final position; however, they also show that traditional accuracy criteria misleadingly suggest acquisition by age four and mastery by age five. Overall, most research relies on accuracy tests, with only one major study combining accuracy and acoustic analyses (Mashaqba et al., 2022), and there is no consensus on the precise age at which emphatic consonants are acquired.

In a nutshell, the present study has been sparked by: (1) the lack of consensus as regards what is reliable and what is not in detecting emphasis, which probably resulted from methodological shortcomings, such as the fact that some researchers increased the number of participants at the expense of the data; (2) very few studies meticulously controlled for the social variables, especially the speaker's dialect, which is why the current study focuses on Ajlouni Jordanian Arabic; (3) very few studies investigated age, which was represented only in the speech of adults, leaving out that of children and adolescents.

1.1. Theoretical Framework

The current study is grounded in Labov's (1966) framework of Variationist Sociolinguistics. This framework holds that variation is inherent to language, since it is shaped by both linguistic and social (extralinguistic) factors. According to Meyerhoff (2006), a clear illustration of this inherent variability is intraspeaker variation, in which speakers frequently switch from more spontaneous

to more careful speech. Holmes (2013: 254) offers a useful example to distinguish between intraspeaker and interspeaker variation. She draws on Trudgill's research into the use of the vernacular variant [in] and its association with different social classes and speech styles. Trudgill's findings show that, with respect to intraspeaker variation, speakers tend to move from the vernacular [n] to the more careful, formal [iŋ] as their speech style shifts from casual to formal. Holmes (2013) maintains that intraspeaker variation reflects interspeaker variation. In other words, when lower-class speakers participate in a formal event, such as a conference, they adjust their speech to resemble that of another social group (e.g. the upper class).

To gain insight into linguistic variation in general, and phonological/phonetic variation in particular, it is essential to consider the social context in which different variants arise. Labov (2001) sets out several principles of linguistic change. He maintains that women worldwide consistently favor standard or prestigious variants more than men do, a pattern he labels "Principle 2: the linguistic conformity of women" (p. 266). In interaction with social class, gender exhibits significant correlations: lower-middle-class women display the strongest inclination to use prestigious forms and to avoid stigmatized ones, whereas women from the lower and upper-middle classes show this tendency to a lesser degree. To explain this interaction, Labov (2001) proposes a third principle: "In linguistic change from above, women adopt prestige forms at a higher rate" (p. 274). Supporting evidence comes from Haeri's (1996) investigation of the palatalization of /t/ and /d/ in Cairene Arabic, in which women emerged as the primary agents of change. This case, together with other examples (e.g., from Vancouver and Toronto), demonstrates that when age is examined alongside gender, younger speakers—especially women—are more likely to move in the direction of ongoing change (see Labov, 2001: 281–284 for further discussion).

Because a number of explanations—such as women's supposed verbal superiority and biologically based accounts—failed to explain irregularities in sound change, Labov (2001) proposed that gender differentiation should be treated as independent from purely psychological or phonetic factors, and instead be understood through a separate principle (Principle 4). Turning to the relationship between gender and social class, Labov (2001) emphasizes the link between social awareness and the interaction of gender with class. He maintains that the greater the social awareness of an ongoing change, the stronger and more apparent the correlation between gender and social class becomes. Hazen (2017) focuses on sociophonetics, the field that examines variation in sound patterns. According to Hazen, sociophonetic research aims to obtain quantitative

data on a specific set of sounds, which are digitized and analyzed acoustically—by measuring vowel formants and other acoustic characteristics with speech analysis software—and then compared acoustically and interpreted in relation to their social context. Hazen adds that although the term sociophonetics is relatively new, the use of acoustic methods in sociolinguistic research goes back to the 1960s, citing Labov's (1963) groundbreaking study of the vowel system of Martha's Vineyard.

1.2. Questions of the Study

The present study seeks to answer the following research questions:

1. Which of the acoustic cues are reliable in detecting emphasis among children and adolescents in AJA?
2. Does emphasis significantly interact with other linguistic variables?
3. Does age affect emphasis as produced by children and adolescents?
4. Does gender affect emphasis as produced by children and adolescents in AJA?
5. Does parental education affect emphasis as produced by children and adolescents in AJA?
6. Which of the social variables (i.e., age, gender, and parental education) is/are the most powerful in detecting emphasis in AJA?

1.3. Hypotheses

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

1. Emphasis is mainly characterized by a shorter VOT, higher F1, lower F2, and higher F3.
2. Emphasis significantly interacts only with PTC, vowel quality, and vowel length.
3. Emphasis is more pronounced in males' speech than in that of females.
4. Emphasis is more evident in adolescents' speech than in children's.
5. Emphasis is more salient in the speech of participants whose parents are less educated.
6. Gender is the strongest controlling variable among the other social variables.

2. Methodology

2.1. Variables of the Study

The variables of the current study were divided into two main categories: independent and dependent. The former refers to two subcategories, namely independent linguistic variables and independent social variables. The independent linguistic variables included emphasis, manner of articulation, position of the trigger consonant (PTC), vowel quality (VQ), and vowel length (VL)

while the independent social variables included gender, age, and parental education[1]. The latter refers to the acoustic cues, including friction duration of fricatives (FD), stop closure of voiceless stops (SC), voice onset time of voiceless stops (VOT), vowel duration (VD), and the vowel's first three formant frequencies (F1-F3).

2.2. Sample of the Study

The study's sample comprises 40 native AJA-speaking children and adolescents from Ajloun City, equally divided in terms of the social variables (e.g., 20 children versus 20 adolescents). The age range for the child cohort was 8–11 years, whereas the age range for the adolescent cohort was 13–17 years., with puberty—confirmed by teachers and parents—used as the criterion for adolescence. The age range was deliberately chosen: children under 8 were excluded because they could not reliably perform the reading-list task (which included nonwords), their noise levels would interfere with PRAAT acoustic analysis, and obtaining official permission to test such young children was difficult.

The study used strict selection criteria to control sociolinguistic variables. Participants and their parents had to be native AJA speakers who had never lived outside Ajloun City. Bidialectal speakers were excluded by checking parents' family names, which indicate regional origin and dialect. Only participants without reported speech or hearing impairments and who excelled in the Arabic language subject (to ensure proper reading) were included.

2.3. Data

The study examined the acoustic correlates of emphasis in the consonant contrasts /tˤ/-/t/, /sˤ/-/s/, and /ðˤ/-/ð/. Each contrast was tested in word-initial and word-final position within monosyllabic minimal pairs, yielding 32 nonwords. The target consonants were analyzed adjacent to a range of vowels—mid-low front short /æ/, low front long /aː/, mid-high back short /ʊ/, high back long /uː/, mid-high front short /ɪ/, high front long /iː/, mid back long /oː/, and mid front long /eː/.

Each target word was embedded in the carrier sentence ɪħki ___ kamaːn marrah [Say ___ once more] to control for context effects. Stimuli were organized into three randomized lists for the /tˤ/-/t/, /sˤ/-/s/, and /ðˤ/-/ð/ contrasts, written in Arabic orthography with necessary diacritics, to mask the study's purpose and elicit spontaneous production. The design included 48 minimal pairs (96 tokens per speaker). The study focused only on three emphatic consonants because, in AJA,

[1] Parental education refers to the educational attainment of the participant's parents, which corresponds to tertiary or below tertiary.

/dˤ/ merges with /ðˤ/, and the goal is to analyze phonetic variation in emphatics that are common to all speakers in the sample.

3. Findings

The present study pursued three primary observations: (1) to examine the main effect of emphasis, (2) to investigate the interaction between emphasis and other linguistic variables (e.g., manner of articulation), and (3) to analyze the interaction between emphasis and other social variables (e.g., gender).

The first experiment shows a significant main effect of emphasis only for SC, VOT, F1, F2, and F3. The SC of emphatic stops was markedly longer than that of plain stops. In contrast, emphatic VOTs were markedly shorter than their plain counterparts. In addition, F1 of emphaticized vowels was consistently higher than that of plain vowels across the entire vowel. Likewise, F2 of emphaticized vowels was consistently lower than that of plain vowels over the course of the vowel. However, although emphasis exerted a statistically significant main effect on F3 only at vowel onset, this effect did not align with the predicted direction of emphasis, as emphaticized vowels exhibited a lower rather than a raised F3. Overall, these results partly support our hypothesis that emphasis is primarily associated with shorter VOT, higher F1, lower F2, and higher F3, while also indicating that an extended SC interval is a robust acoustic indicator of emphasis.

In relation to the second experiment, several notable interaction effects emerged between emphasis and the other linguistic variables for both temporal and spectral cues. The study verifies the stability of the low vowels /æ, aː/ in signaling emphasis with respect to both SC and VOT. With regard to spectral cues, the findings underscore the prominent role of stops in exhibiting a larger degree of change in the direction of emphasis through shifts in F1 and F2 onsets. Moreover, the study emphasizes the substantial influence of PTC on the production of emphasis, such that vowel segments closer to the emphatic consonant display a stronger emphatic–plain contrast in F1 and F2 at both onset and offset. The results also show that emphasis is acoustically more evident in low than in high front and back vowels, as reflected in F1 at the midpoint and F2 across the entire vowel. Additionally, the study reveals that emphasis is acoustically more marked in short than in long vowels, as indicated by the F2 offset. Taken together, these findings provide strong support for our hypothesis that emphasis significantly interacts with PTC, VQ, and VL, as well as with manner.

More importantly, the study reports several key findings on how social variables shape the production of emphasis, as reflected in the spectral cues. First, it shows that gender exerts a strong influence on emphasis: males consistently exhibited a larger emphatic–plain contrast than females in F1 across the entire vowel, and in F2 at the midpoint and, to a lesser extent, at the offset. The study further reveals that, although less systematically, adolescents generally displayed a greater emphatic–plain contrast than children in terms of F1 at the midpoint and offset and, despite some overlap by gender, in F2 at onset. Regarding the effects associated with parental education, the data suggest that participants whose parents had higher educational attainment showed, albeit only slightly, a larger emphatic–plain contrast than those whose parents had lower educational attainment.

The interaction between emphasis, gender, age, and parental education, however, reveals a different pattern of variation, especially in the adolescents' group, where only female adolescents appeared sensitive to parental education. Put differently, parental education appears to shape females' degree of emphaticness: female adolescents with more highly educated parents exhibited a weaker emphatic–plain contrast than those with less educated parents. Among male adolescents, this trend was reversed, likely indicating that they are less attentive to their speech.

The study also highlights how emphasis interacts with gender, age, and VQ. Among these groups, only adolescents—particularly males compared to females—showed a stable and systematic pattern of change. In contrast, children displayed variability and overlap between emphatic and plain contexts across the different vowel environments. This result is viewed as crucial because it pinpoints the developmental stage children are currently undergoing. In addition, the study stresses the combined effect of emphasis, gender, and VQ on F2 at the offset: males consistently exhibited a greater contrast between emphatic and plain realizations than females across most vowel contexts, with the exception of /u/, which stands out as a deviation from the general pattern. Consequently, this supports the idea that low rather than high front and back vowels are more salient cues to emphasis, particularly for male speakers.

The present study's findings on the sociophonetics of emphasis partly confirm and partly challenge our original hypotheses. They corroborate our claim that males play a more prominent role than females in driving a stronger shift toward emphatic realizations. Our results also confirm that, although less robustly than gender, age matters: emphasis is acoustically more salient in

adolescents' speech than in children's. However, our data do not fully support the hypothesis that participants with less educated parents sound more emphatic than those with more educated parents, with the exception of female adolescents, who appear more influenced by parental education than their male counterparts. Moreover, the effect of parental education emerges only in the two-way interaction of emphasis and parental education and in the four-way interaction between emphasis, gender, age, and parental education, suggesting that its role is indicative rather than systematically determinant. In parallel, our hypothesis that gender is the most influential factor relative to age and parental education is confirmed: males consistently produce a larger contrast between emphatic and plain tokens than females, aside from a minor convergence between male and female adolescents in the three-way interaction of emphasis, gender, and age on F2 onset.

List of Publications

1. 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. [published]
2. 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. [published]
3. 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. [published]
4. Almomany, I. E. O. (2025). Acoustic correlates of emphasis among Jordanian Arabic-speaking children. *Bucharest Working Papers in Linguistics, XXVII*(2). [published]
5. Almomany, I. E. O. (to appear). Variation in the production of emphasis among children in Jordanian Arabic: Gender and Education. *Applied Linguistics,* [Accepted].

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