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ARTICLE

Sonority Is Not Sufficient: Syllabification and Syllable Patterns in Jordanian Ammani Arabic

***Mohammed Nour Abu Guba*[1], *Abdallah Abu Qub'a*[2*]**

[1] *University of Sharjah, Sharjah University City, Sharjah 27272, United Arab Emirates*

[2] *English Language Center, King Faisal University, Hofuf, Al-Ahsa 31982, Saudi Arabia*

ABSTRACT

This study presents a novel approach to syllabification and syllable structure in Jordanian Ammani Arabic (JAA), addressing challenges posed by complex syllable patterns and codas. We show that sonority principles alone, as suggested by earlier research, cannot account for syllable structure in JAA. We introduce a new constraint, the Coda Cluster Requirement (CodaReq), which governs the occurrence of coda clusters in JAA, considering factors such as sonority, markedness, and morphological ones. We propose an algorithm that is better able to syllabify JAA complex syllables, adopting mora sharing and semisyllables, which maintain bimoraicity while accounting for complex onsets and codas. We also show that JAA exhibits characteristics of both VC and C dialects, suggesting an intermediate classification. The proposed algorithm may be extended to account for other Arabic dialects.

Keywords: Jordanian Ammani Arabic; Moraic theory; Semisyllables; Syllable structure; Syllabification algorithm

1. Introduction

Research on suprasegmentals of Arabic phonology such as syllable structure, stress and intonation has not received adequate attention (Abu Guba, Jarbou, & Qub'a, 2023, Davis and Ragheb, 2014;). Similarly, research targeting suprasegmentals in Jordanian Arabic as spoken in Amman (the capital city of the Hashemite Kingdom of Jordan (hereafter JAA)) is scarce. The current research is a contribution to the literature on JAA syllable structure and syllabification. This paper builds on and extends Abu Guba's (2018b) work.

Earlier studies on syllable structure in Arabic

*CORRESPONDING AUTHOR:
Abdallah Abu Qub'a, English Language Center, King Faisal University, Hofuf, Al-Ahsa 31982, Saudi Arabia; Email: aabuquba@kfu.edu.sa

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and Jordanian dialects in general have tried to account for syllable structure by resorting to sonority sequencing principles, while others adopted semi-syllables (see Section 1.2 for more details on previous accounts). However, neither sonority alone nor semisyllables can successfully account for syllable structure in JAA. Moreover, thorny aspects such as complex syllables and bimoraicity of syllables still need a thorough investigation. This paper aims at offering an analysis that can successfully account for syllables and syllabification in JAA, which can be extended to other dialects.

We focus here on Jordanian Arabic in general (as no study has been devoted to JAA, the focus of this study) and Palestinian Arabic as it is very similar to JAA. Previous work has established that these dialects share the same basic syllable structure CV, CVC, and CVV, (C = consonant and V = vowel), while more complex syllable types such as CVVC and CVCC appear because of phonological processes and in morphologically complex words or are restricted to final position (e.g., Abu Abbas, 2003; Watson, 2007; Abu Guba, Fareh, & Yagi, 2023; Al-Huneety et al., 2023; Mashaqba et al., 2019). Whether CVVCC syllables as in *dʒaadd* 'serious sg. m.' exist in Arabic dialects or not is controversial. For example, Abu Salim (1982) and Abu Abbas (2003) argue that these syllables are attested with geminate consonants, but they degeminate yielding CVVC syllables. Btoosh (2006), on the other hand, argues that they do surface in JA, as in *baarr* 'good m. sg. to his parents', but they are restricted to third person singular forms. He analyses them as two syllables morphologically namely CVVCCV(n), so that the last consonant in the first morpheme in the disyllabic word /baarrun/ is underlyingly syllabified as the onset of the following syllable yielding /baar.run/. This case ending is deleted in Arabic dialects; as a result, the form surfaces with a CVVCC monosyllabic word.

All previous research concurred that onsetless syllables are categorically forbidden in Arabic dialects. CC onsets are attested as a result of short vowel syncope in unstressed open syllables, as in /kilaab/ > *klaab* 'dogs', or from /ʔ/ and vowel deletion as in /ʔaf.raan/ > *fraan* 'ovens' (cf. Abu Salim, 1982; Amer et al., 2011).

Although CC codas in JA are not common, they are attested word internally and finally. Amer et al. (2011) argue that complex codas with a maximum of two consonants, despite being rare, appear in JA. Al Sughayer (1990) notes that word-medially complex codas in JA are allowed if the first member is a sonorant consonant and the second member is an obstruent consonant, cf. *zurt.ku* 'I visited you m. pl.'. He also adds that two-consonant codas following a long vowel are restricted to geminates or in monosyllabic words. On the other hand, Abu Abbas (2003), investigating the same JA dialect, argues that JA does not allow complex codas. They appear only as free variants or with geminates. Btoosh (2006) thinks that complex codas in JA spoken in Karak (in the south of Jordan) appear only if they obey sonority, i.e., if the second phoneme is less sonorous than the preceding one, otherwise epenthesis will be applied. Unlike Al Bay N (2001), who argues that complex codas do not appear in PA, Abu Salim (1982) maintains that they do appear as in *burd.ʔaan* 'orange fruit' and *ʔuxt.hum* 'their m. sister'.

Complex margins are usually avoided in Arabic dialects. Most Arabic dialects tend to avoid complex codas by inserting a short vowel to eliminate the cluster. In this regard, Kiparsky (2003) divided Arabic dialects into three groups: VC dialects (or coda dialects), CV (or onset dialects), and C dialects. VC dialects such as Levantine dialects and Libyan Tripoli dialect insert a vowel before the stray consonant, so the unsyllabified consonant surfaces as a coda, as in *ʃaraħitlu* 'I explained to him' (Broselow, 1992; Kiparsky, 2003; Watson, 2007). CV dialects such as Cairene Arabic and Meccan Saudi Arabic insert the vowel after the stray consonant and therefore it surfaces as an onset, as in Cairene Arabic where the unsyllabified consonant /t/ in /ʃaraħ-t-lu/ 'I explained to him' is licensed as an onset yielding *ʃaraħtilu*. C dialects such as Sudanese dialects allow complex margins, and no epenthesis is needed. Kiparsky (2003) argues that in C and VC dialects, the unsyllabified

consonant is formally represented as a semisyllable, a mora that is unaffiliated to a syllable node but attaches directly to the word node. By contrast, in CV dialects, semisyllables are not allowed.

The syllabification of Arabic syllables has been the focus of many studies. The syllabification of complex syllables has been controversial. The adoption of Kiparsky's (2003) semisyllable analysis that can successfully represent CC codas and onsets cannot account for syllables with a long vowel closed by a coda word-internally. Watson (2007), unsatisfied with Kiparsky's analysis (2003), proposed mora sharing between the long vowel and the coda. She pointed out that Kiparsky's semisyllable analysis predicts that CVVC syllables should undergo vowel epenthesis after the coda, which will be syllabified as an onset, or vowel shortening to maintain the bimoraicity of the syllable. Nonetheless, these syllables appear as such in many Arabic dialects. She suggests that the long vowel and the coda do not contribute three moras, as per moraic theory principles. Rather the coda shares a mora with the vowel and therefore the syllable will be bimoraic. This accounts for both lexical and post-lexical levels. Some evidence for this contention comes from Broselow, Chen, & Huffman's acoustic study (1997). They compared long vowels followed by a coda as in CVVC syllables with long vowels in open syllables (CVV) and found that long vowels in CVV syllables were statistically significantly longer than those in CVVC syllables. Moreover, they reported that the codas following long vowels were significantly shorter than those followed by short vowels. However, note that these measurements can be influenced by processes of polysyllabic shortening where segments, especially vowels, are usually shorter the more segments there are in the word (Abu Guba, 2023; Abu Guba, Mashaqba, & Huneety, 2023). In this paper, we will incorporate the insights of both accounts: semisyllables and mora sharing to formally represent JAA syllables (see Section 3).

This paper is different from earlier research in that it incorporates the tenets of moraic theory with those of semisyllables (cf. Section 3). This will maintain the successful assumption of foot binarity by showing that a JAA syllable is maximally bimoraic. This is achieved by adopting mora sharing to license CVVC syllables and the notion of semisyllables to formally represent the stranded consonant in CVCC and CCV(V) syllables, i.e., the second member in the coda and the first member in the onset. Moreover, this study shows that sonority alone is not able to account for JAA syllables and proposes new phonetic and phonological conditions that need to be satisfied to account for permissible syllables in JAA.

This paper is organized as follows: in the following section, we describe the methods used to collect the data for this study; in Section 3, we present the syllable types in JAA and an algorithm that successfully accounts for their representation; and we conclude the study in Section 4.

2. Method

2.1 Participants

Data for this study comes from twelve native speakers of JAA. The participants consisted of six male and six female participants aged between 30 to 60. All participants were monolinguals who spoke only Arabic to avoid the effects of second-language phonology on the phonology of the native language. Additionally, all participants lived in the same neighborhood in the middle of Amman. The researchers gave the participants the necessary information without telling them about the purpose of the study. After that, the participants signed a consent form, which had all the information about data storage, withdrawal, etc.

2.2 Materials

The materials used in this study included a set of pictures meant to elicit JAA words with different types of syllable patterns. When pictures were not feasible, information and details about the word in question were provided to the participants without saying the target word. Moreover, we used data from previous work on other Jordanian Arabic (JA)

dialects and Palestinian Arabic (PA), which is very close to JAA.

2.3 Procedure

Participants were shown pictures on a laptop screen and asked to name them. To ensure that the word was pronounced in its citation form and to avoid the effects of phonological processes in connected speech, each word was elicited in a carrier sentence: "baʔuul ____ marra taanyih" ('I say ____ again'). Again, when pictures were not feasible, after the participants identified the target word, they were requested to say it in the carrier sentence above.

2.4 Data collection

A total of more than 650 words were elicited and recorded using a professional voice recorder in waveform audio file format. The recorded words were transcribed using IPA symbols. Syllable boundaries were identified by the first researcher and verified by the second researcher, with very few discrepancies.

3. Results and discussion

3.1 Syllable patterns in JAA

This section lays out syllable patterns in JAA. Similar to many modern Arabic dialects, JAA has three basic syllable patterns and six syllable patterns that result from the application of phonological and morphological processes. The former are the core syllables that are attested word-initially, medially, and finally, while the latter are the ones that result from short vowel deletion, or in morphologically complex words, or in final positions only (Abu Guba et al., 2023). The following syllable patterns in (1) represent the basic patterns and the ones in (2) represent the derived ones in JAA.

(1) Core syllables in JAA

1) /CV/ sa.ʔa.lu 'they asked'

2) /CVV/ saa.ʔil 'questioner', katabuulu 'they ms. wrote to him', kaanuu 'they ms. were'

3) /CVC/ sam.ne 'ghee', katabha 'he wrote it', kaa.tib 'writer'

(2) Derived syllables

1) /CVCC/ sadd 'he blocked', bint.na 'our daughter', biss.na 'our cat'

2) /CVVC/ faat 'he entered' ʃaaf.ha 'he saw her', naadʒ.ħiin 'successful ms. pl.'

3) /CVVCC/ dʒaadd 'serious ms. sg.'

4) /CCVC/ ʃraħ.ha 'explain it fem.'

5) /CCVCC/ mʃadd 'fastener'

6) /CCVVC/ klaab 'dogs'

As can be seen in (1), core syllables can occur in all positions and appear in morphologically simple words, i.e., they can appear without affixation. On the other hand, derived syllables in (2) appear only in morphologically complex words, word-finally, or result from phonological processes. However, /CVVC/ and /CVCC/ syllables in 2a and 2b appear also in the medial position in morphologically complex words. For example, in *naadʒ.ħiin* < /naa.dʒi.ħiin/, the first syllable *naadʒ* results from the deletion of the short vowel /i/ in the second syllable and the resyllabification of the onset of the second syllable /dʒ/ as a coda in the first syllable. Another example is the morphologically complex word /bint-na/ > *bintna*. Here, the syllable with a complex coda (CVCC) was word-final, and suffixation of the plural possessive morpheme (na) renders the heavy syllable word-internal. The last three types result from vowel syncope where short high vowels are deleted in open syllables (see the next subsections for more details).

More evidence for the contention that these syllables are not basic/core syllables in JAA (although they appear word-internally in many native and loan words) relates to the fact that these syllables appear only at the post-lexical level. That is, they appear after morphological processes and stress rules have applied at the lexical level. Evidence comes from vowel shortening in JAA where long vowels, as in CVVC syllables, surface as short vowels word-internally at the lexical level. For example, the underlying long vowel in /staʕaar-na/ is realized as a short vowel yielding *staʕarna* 'we borrowed'. Also, complex codas in CVCC syllables are avoided word-in-

ternally where a short vowel is obligatorily inserted to break codas with illicit coda consonants, as in /nahr-na/ > *nahirna* 'our river' and optionally in legal coda clusters, as in /ʔuxt-na/ > *ʔuxutna* 'our sister' (see Section 3.1.2 for more details on coda clusters). Our proposed algorithm in Section 3.2 will account for all these cases.

/CVVCC/ syllables in JAA are also derived syllables as they are restricted to geminate codas only. These geminates surface phonetically as singletons if the geminate is a true geminate, i.e., they de-geminate, as they do in PA (Abu Salim, 1982), or the geminate is broken up by a vowel if it is a fake geminate, as in *ʕaadid* 'someone who is counting'. Note that it is not uncommon for JAA speakers to resort to other linguistic tools such as paraphrasing to avoid such syllables (see Abu Guba, 2016 for more details).

In terms of weight, syllables here can be categorized into light, heavy, and superheavy. According to moraic theory tenets (Hayes, 1989), a short vowel contributes a mora (weight unit), a long vowel or a diphthong contributes two moras, and a coda consonant contributes one mora, as per the Weight-by-Position (WBP) principle that assigns a mora to coda consonants (Hayes, 1989). Coda consonants in the word-final position do not contribute weight as they are deemed extrametrical. CV syllables are light syllables, CVC and CVV syllables are heavy syllables, and CVVC and CVCC are superheavy syllables. CVC syllables in the word-final position are light as the last consonant is extrametrical, i.e., it is not seen/counted by metrical rules.

Onsets

JAA, like other Arabic dialects, does not allow onsetless syllables at all. When a morphological process results in an onsetless syllable, JAA resorts to glottal stop /ʔ/ prosthesis, which serves as an onset to the new onsetless syllable. Word internally, JAA resorts to resyllabification to ban onsetless syllables cf. *ʃuf.tak* 'I saw you ms. sg.'. Underlyingly, the form is /ʃuf-t-ak/. The last consonant in the first morpheme is syllabified as the onset of the otherwise onsetless second syllable yielding *ʃuf.tak*. More evidence for the ban on onsetless syllables in JAA comes from loanword adaptation where all onsetless loanwords in JAA are realised with an onset, as in *ʔaṭlas* 'atlas' (Abu Guba, 2016). Also, consonant gemination in Ammani Arabic is invoked in English loanword adaptation, as in *bik.kiini* 'bikini' and *tattuu* 'tattoo' where /k/ and /t/ geminate to maintain the onset of the second syllable as Ammani Arabic requires the first syllable in such words to be heavy (see Abu Guba, 2021). These processes provide evidence that syllables in JAA never surface without an onset.

Moreover, the ideal onset in JAA is simplex, and CC onsets are avoided as much as possible, as in other Levantine dialects (cf. Abu Abbas, 2003). Consider the imperative form of the word *katab* 'wrote'. It should surface as *ktub* 'write ms.' This form has a complex onset at the lexical level, so a vowel is inserted to break up the complex onset yielding *uk.tub.* Still, this form is ill-formed because it surfaces with an onsetless syllable, so the glottal stop is inserted yielding *ʔuk.tub*.

Although CC onsets are not allowed at the lexical level, they appear in word initial position at the post-lexical level as a result of syncope, as in other Arabic dialects. They arise from unstressed short vowel deletion in open syllables, e.g., /si'haam/ > *'shaam* 'arrows' and /tu'raab/ > *'traab* 'sand' (cf. *turbeh* 'sand'). Complex onsets also result from the deletion of the glottal stop and short vowel, as in /ʔis'waara/ > *swaara* 'a bracelet' and /ʔas.naan/ > *snaan* 'teeth'. However, this type of deletion does not apply across the board and needs to satisfy certain circumstances. It applies provided that no compromise of meaning is incurred. That is, if the new form can result in a form that already exists in the dialect, deletion is blocked. Consider, for example, the word /ʔalʕaab/ 'toys', which surfaces as *ʔal.ʕaab* without deletion. This is because deletion would result in *lʕaab*, which already exists in JAA after applying vowel syncope to *lu.ʕaab* 'saliva'. Note that vowel deletion in cases such as /ʔas.naan/ > *snaan* does not represent low vowel syncope as it might appear. Rather, this relates to optional CC onsets, which undergo optional vowel epenthesis that trig-

gers glottal stop prothesis.

Codas

The ideal coda in morphologically simple words in JAA is simplex, except for true geminates, which do not invoke vowel epenthesis due to geminate integrity (Abu Guba, 2021). Nonetheless, CC codas in simple forms are optionally attested as a result of free variation. It should be pointed out that this free variation is very rare, and it may result from code mixing Standard Arabic forms within JAA. It is almost impossible to find such free variation in uneducated people's speech.

Three types of CC codas are allowed in JAA: geminate consonants, optional sonorant and obstruent codas, and codas composed of two obstruents. **Table 1** below presents permissible and disallowed types of codas in JAA.

Table 1. CC codas in JAA.

Possible Coda Clusters	
1. Geminate	sitt > sitt 'grandmother' samm > samm 'poison' ʔumm > ʔumm 'mother' ʔamall > ʔamall 'more boring' ʔaxaff > ʔaxaff 'lighter'
2. son+obs	silk > silk ~ silik 'string' kinz > kinz ~ kiniz 'treasure' ʕanz > ʕanz ~ ʕaniz 'goat'
3. heteromorphemic	zurt-kum > zurt.kum ~ zu.rit.kum 'I visited you pl.' ward-na > ward.na ~ waridna 'our flowers' bint-ha > bint.ha ~ binitha 'her daughter'
obs+obs	wagt > wakt, ~wagit 'time' dist > dist, ~disit 'pan'
heteromorphemic	taxt > taxt, ~ taxit 'bed' ʃuf-t-hin > ʃuft.hin ~ ʃufit.hin 'I saw them f.'
Impossible Coda Clusters	
1. obs+obs	ʕuʃb > ʕuʃub 'grass' suṭħ > suṭuħ 'roof' xubz > xubiz 'bread' nasf > nasif 'blowing' ʕabd > ʕabid 'slave'
heteromorphemic	katab-t > katabit 'I wrote' kamaʃ-t > kamaʃit 'I held'
2. obs+son	ħuzn > ħuzun 'sadness' kufr > kufur 'disbelief' ʔibn > ʔibin 'son' sahl > sahil 'easy' baṣm > baṣim 'rote learning'
heteromorphemic	ʔibn-ha > ʔibinha 'her son' ħuzn-hum > ħuzunhum 'their ms. sadness'
3. son+son	samn > samin 'ghee' ħilm > ħilim 'dream' ħiml > ħimil 'load' ʕumr > ʕumur 'age'
heteromorphemic	ħilm-hin > ħilimhin 'their f. dream' ʕumr-hum > ʕumurhum 'their ms. age'
4. son+obs	ɣulb > ɣulub 'defeat' malħ > maliħ 'salt' balʕ > baliʕ 'swallowing' salg > salig 'boiling'
heteromorphemic	ʔakal-t > ʔakalit 'I ate' kasar-t > kasarit 'I broke'
5. fake geminates	sakat-t > sakatit 'I kept silent' ma-xadaʃ-ʃ > maxadaʃiʃ 'he did not scratch'

As can be seen above, CC codas in JAA are not common. They are attested only in true geminates while they are optional in a few cases where the first member of the CC coda is a sonorant and the second is an obstruent or when the coda has two obstruents. However, these optional cases are subject to certain circumstances as we will demonstrate here. First, these coda clusters must not violate the Sonority Sequencing Principle (SSP), presented in (3) below.

(3) SSP: Sonority in a syllable should rise as much as possible toward the vowel (nucleus), while it should drop steadily away from the nucleus toward the margin (cf. Clements, 1990; Parker, 2011).

This principle requires consonants in a syllable to follow sonority principles, and it functions according to the order presented in (4) below, which depicts the sonority levels of natural sounds.

(4) Sonority order: low vowels > high vowels > glides > liquids > nasals > voiced obstruents (fricatives > affricates > stops) > voiceless obstruents (fricatives > voiceless affricates > voiceless stops) (Parker, 2011).

According to this order, codas made up of an obstruent (e.g., a stop, a fricative, or an affricate), and a sonorant (e.g., a nasal, liquid, or glide) are not well-formed as sonority increases toward the margin, so they are not allowed in JAA, and vowel epenthesis is called for to eliminate the illicit coda cluster. Similarly, a coda with two sonorants or obstruents belonging to the same natural class violates sonority as they do not drop in sonority and therefore vowel epenthesis is required to improve the sonority profile of the coda.

On the other hand, according to the hierarchy above, codas made up of a liquid and a nasal, as in *ħilim* should be allowed as they drop in sonority. However, these codas are not allowed in JAA. This means that JAA does not allow codas that do not exhibit a sufficient drop in sonority. These facts call the SSP into question and necessitate a revision of this principle.

Moreover, CC codas that satisfy sonority as in codas made up of a sonorant (e.g., a liquid) and an obstruent (e.g., a stop) are optional in JAA, as in silk ~ silik. However, such codas are prohibited, and a vowel is obligatorily inserted to break up the cluster if a guttural consonant is involved or exists in the same morpheme, as in malħ > maliħ. A guttural consonant refers to a uvular, laryngeal, or pharyngeal consonant (see Mashaqba et al., 2022).

These observations show that sonority principles alone are not enough to account for complex codas in JAA, and probably in other Arabic dialects. Other morphological factors play a role. Likewise, CC codas made up of two obstruents behave differently. They are usually forbidden but they are optional if the two consonants are voiceless, and the second one is either the stop /t/ or the sibilant /s/. These two consonants are special as they are the least marked phonetically. /t/ is the least marked coronal in the world languages and Arabic (Farwaneh, 1995), and /s/ is the least marked fricative sound thanks to its salient acoustic and phonetic cues (Goad, 2011). This means that CC codas in JAA are closely linked to markedness (cf. Farwaneh, 1995).

Furthermore, CC codas made up of a voiceless obstruent and a voiced one trigger vowel epenthesis. This follows Harms' phonetic universal law which asserts that voicing cannot be resumed if it is turned off tautosyllabically (cf. Harms, 1973,). In addition, CC codas in heteromorphemic words are disallowed in JAA. For instance, the morphologically complex word /saafar-t/ (saafar-(verb) + t (subject pronoun)) is realized as *saafarit* with an epenthetic vowel. This is unexpected as the coda here has a sonorant and a non-guttural obstruent (with a sufficient drop of sonority). This is because the two consonants occur in two different morphemes; they are not tautomorphemic. This shows that a legal CC coda in JAA must occur in the same morpheme. Note that this requirement is applied to fake geminates, which invoke vowel epenthesis too, as in sakat-t > *sakatit*.

As we demonstrated above, sonority principles alone cannot account for complex codas in JAA: CC codas made up of a sonorant followed by a guttural sound are disallowed (albeit they satisfy sonority), and codas with sonority plateaus are attested (although they undergo optional epenthesis), as in

wakt ~ wagit 'time'. Moreover, the existence of licit coda clusters in JAA is not related to the distance in sonority as in some languages. To illustrate, JAA allows codas obstruents that are very close in sonority as in *baxt* 'luck' but disallows codas that are further apart on the sonority scale, as in *salg* > salig 'boiling'. This means that SPP cannot account for codas in JAA, as proposed by previous researchers (cf. Section 2). This led Farwaneh (1995) to propose a modified version of SSP requiring codas not to exhibit a rise in sonority to permit plateaus in PA. Farwaneh's proposal does not work as it predicts that sonority plateaus made up of two sonorants or two obstruents should be allowed. This modified version also fails to explain why codas with a sonorant and a guttural are disallowed in JAA. To solve all these issues, we propose the constraint in (5) below.

(5) Coda Cluster Requirement (henceforth CodaReq): coda clusters are allowed in JAA only in tautomorphemic words in three cases. 1) The first consonant is a sonorant sound, and the second is an obstruent on condition that no guttural sound exists in the same word. 2) If both consonants in the coda are obstruents, the first consonant needs to be voiceless and the second consonant can be either /t/ or /s/. 3) It relates to true geminates.

This requirement can account for all types of complex codas in JAA, and it may be applied to codas in other Arabic dialects. In the next section, we show how these different types of syllables can be formally syllabified.

3.2 Syllabification

Earlier accounts of syllabification in Arabic dialects (cf. Section 2) had problems with accounting for superheavy syllables and complex margins. We propose here a syllabification algorithm for JAA that can account for these issues more successfully. We adopt moraic theory (cf. Section 2) and syllable bimoraicity, which requires syllables not to exceed two moras. Recall that under moraic theory, short vowels contribute only one mora, while long vowels and diphthongs are assigned two moras. Coda consonants in the non-final position are assigned one mora and a geminate has one mora. This means superheavy syllables with a long vowel and a coda or a short vowel with two codas should be trimoraic; however, these syllables are still bimoraic in JAA. Evidence against the trimoraicity of such syllables comes from stress assignment in JAA where there is no distinction between heavy syllables and superheavy ones (Abu Guba, 2018a). To retain the bimoraicity of such syllables, we adopt mora sharing, which successfully represents CVVC syllables and semisyllables, which can successfully represent CC onsets and codas.

Syllabification algorithm

In this section, we suggest a syllabification algorithm that follows Clements (1990) and Watson (2002). This algorithm assigns syllable positions in the prosodic word in JAA. (A dot marks syllable boundary).

(6) Syllabification algorithm

1) Consonants in the absolute word-final position are extra-metrical (these are separated by two brackets). C > <C> /___] word.

2) Each vowel sound is linked to a node at the syllable level.

3) A consonant preceding a vowel is linked to onset.

4) A coda consonant receives one mora through the Weight-by-Position Principle.

5) A moraic coda is linked to the syllable node.

6) The extrametrical consonant is linked to the final syllable.

The following example in (7) illustrates this.

(7) A tree for *sa.ʔal.ni* 'he asked me' (only relevant steps are shown in **Figures 1–4**)

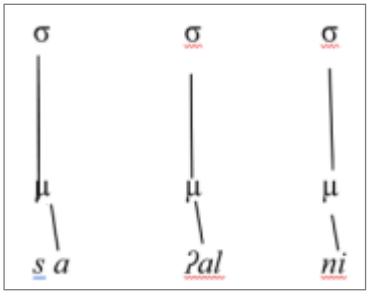

Figure 1. Each vowel sound is linked to a node at the syllable level.

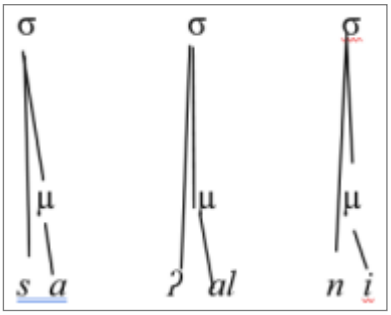

Figure 2. A consonant preceding a vowel is linked to the onset.

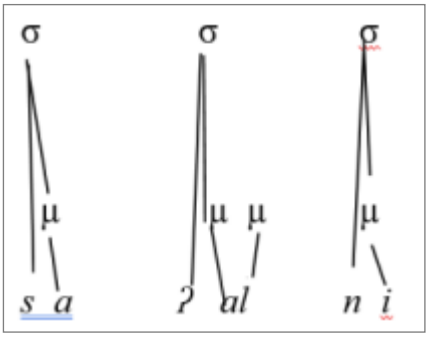

Figure 3. A coda consonant receives one mora through the Weight-by-Position Principle.

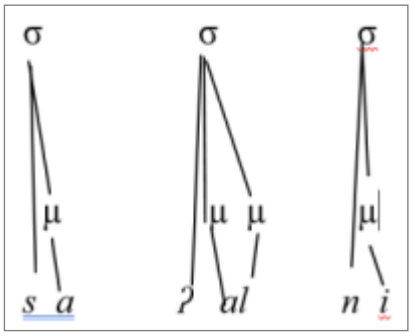

Figure 4. A moraic coda is linked to the syllable node.

The above algorithm can account successfully for syllables with simple margins, but it cannot account for complex ones and CVVC syllables. Therefore, we amend this algorithm to account for these complex syllables. Kiparsky's (2003) semisyllable will formally represent CC onsets and codas where the unsyllabified consonant (the first consonant in the complex onset and the second member in the complex coda) is analyzed as a semisyllable, i.e., a stranded mora that links directly to the prosodic word. Evidence for this analysis originates from stress assignment in JAA. Opaque stress assignment in words such as *xa.'ba.zit* 'I baked' (Abu Guba, 2018a; Kiparsky, 2003), where stress falls on the second syllable (a light syllable that should not be stressed) rather than the first syllable, shows that stress in JAA is assigned at the lexical level / xabaz-t/ where the final consonant /t/ is analyzed as a semisyllable giving *xa.'ba.zit*. That is, stress assignment follows JAA stress rules as the heavy final syllable receives stress as per JAA rules. This form functions as the input at the post-lexical level where semisyllables are disallowed in JAA. This calls for vowel epenthesis to repair the illicit CC coda resulting in the surface form *xa.'ba.zit*. The algorithm in **Figure 5** exemplifies the inclusion of semisyllables to represent CVCC syllables.

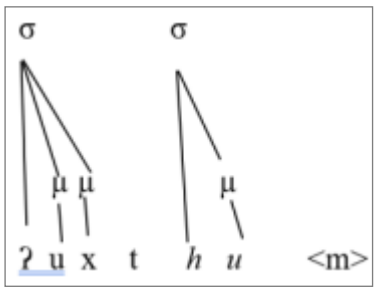

Figure 5. A partial tree for ʔuxt.hum 'their sister'.

The above tree has one problem: it has an unsyllabified consonant /t/. We cannot adjoin the unsyllabified consonant to the first or the second syllable as this will give rise to a complex coda or onset. Therefore, the unsyllabified consonant is analyzed as a semisyllable that links directly to the prosodic word as illustrated in **Figure 6**.

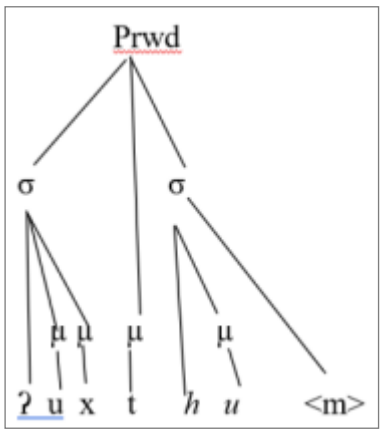

Figure 6. A tree for ʔuxt.hum.

Having accounted for CVCC syllables, we turn now to CVVC syllables. Recall that these syllables have a long vowel, which is bimoraic, so assigning

the coda consonant a mora will render the syllable trimoraic. Adopting a semisyllable analysis is not possible as CVVC syllables do occur word-internally at the post-lexical level (Watson, 2007). Since these syllables exist in JAA without vowel shortening or vowel epenthesis, we follow Watson (2007) and adopt mora-sharing. Recall that under this analysis, the vowel and the coda that follows it share one mora, which fits well for lexical and post-lexical levels (see Section 2 for more arguments in favor of this analysis).

To illustrate how mora sharing operates, consider the word *blaadku* 'your countries' in **Figure 7** below. Recall that the algorithm in (6) would not be able to account for the syllabification of this word as it will have two stray consonants: the first member in the complex onset /b/ and the coda after the long vowel /d/.

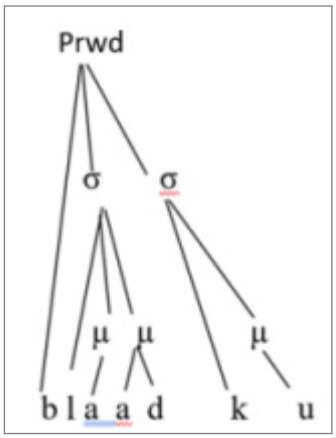

Figure 7. A tree for *blaadku*.

The consonant /b/ in the complex onset is analyzed as a semisyllable. It links directly to the word node. The coda consonant after the long vowel shares a mora with /a/, and this maintains the syllable bimoraicity.

To recapitulate, the amended algorithm we proposed can account for superheavy syllables thanks to mora sharing and semisyllables. The semisyllable analysis here, unlike that of Kiparsky's, accounts for complex margins only, and the mora sharing analysis is different from Watson's analysis as it allows mora sharing only between a vowel and a consonant.

Before concluding this section, a word on the classification of JAA dialect is in order. The results indicate that JAA should not be classified as a VC-dialect, as per Kiparsky's (2003) grouping. Instead, it should be classified as an intermediate dialect that has characteristics of VC and C dialects. It is similar to C dialects in that it allows semisyllables at the post-lexical level provided that CodaReq is not violated.

4. Conclusions

This study has examined the syllable structure and syllabification processes in JAA, contributing to the relatively underexplored area of suprasegmental features in this dialect. The findings of this study indicate that JAA adheres to a bimoraic syllable structure, allowing complex syllables such as CVVC and CVCC under specific conditions.

Unlike previous models (cf. Section 2), including those relying solely on sonority sequencing principles or semisyllables, this study could successfully account for the syllabic patterns observed in JAA. By integrating moraic theory with semisyllables, this study successfully addresses the complexities of syllable structure in JAA, providing a framework that can be extended to other Arabic dialects.

In this study, we have suggested a syllabification algorithm that can formally represent CVVC syllables and CC onsets and codas. We have demonstrated that sonority principles by themselves cannot account for syllables in JAA and therefore we proposed a new constraint, namely CodaReq, which can account more successfully for codas in JAA and probably other Arabic dialects. We have shown that codas with non-guttural obstruents that agree in voicing are well formed in JAA.

We have suggested a syllabification algorithm that embraces semisyllables and mora sharing to formally represent superheavy syllables. This maintains syllable bimoraicity in JAA and accounts successfully for complex onsets and codas. With regards to Kiparsky's (2003) classification, we have shown that JAA does not fit well with VC dialects. Although it exhibits many features of VC dialects, it has also characteristics of C dialects. It is similar to C dialects in that it licenses semisyllables postlexically (pro-

vided CodaReq is not violated). Further research that applies this syllabification algorithm to other Arabic dialects is highly recommended.

In summary, this research highlights the need for a comprehensive approach to analyzing syllable structure in JAA, combining multiple theoretical perspectives to capture the intricacies of the dialect. The findings underscore the importance of considering both phonetic and phonological conditions in understanding syllable formation, paving the way for more detailed and comprehensive studies in the field of Arabic linguistics.

A limitation of this study can be its small sample size, although a sample size of 12 in phonetics and phonology studies is acceptable. We recommend that future studies include larger samples to support the results of the current study.

Author Contributions

The first author conceived the original idea and took the lead in writing the manuscript. The second author collected the data from the participants. Both authors discussed the results and contributed to the final manuscript.

Conflict of Interest

The Authors declare that there is no conflict of interest.

Data Availability Statement

Data is available upon request.

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References

Abu Abbas, K.H., 2003. Topics in the Phonology of Jordanian Arabic: An Optimality Theory Perspective [PhD thesis]. KS: University of Kansas.

Abu Guba, M.N., 2016. Phonological Adaptation of English Loanwords in Ammani Arabic [PhD thesis]. Manchester: University of Salford.

Abu Guba, M.N., 2018a. Stress assignment in polysyllabic words in Levantine Arabic: An Optimality-Theoretic analysis. Lingua Posnaniensis, 60(2), 7–24.

DOI: https://doi.org/10.2478/linpo-2018-0009

Abu Guba, M.N., 2018b. Syllable structure and syllabification of English loanwords in Ammani Arabic: A Stratal Optimality-Theoretic analysis. In: Petykó, M., Rossi, O., Yu, S. (eds). Papers from the Lancaster University Postgraduate Conference in Linguistics and Language Teaching. pp. 19-55.

Abu Guba, M.N., 2021. Gemination within English loanwords in Ammani Arabic: An optimality-theoretic analysis. Journal of Linguistics, 57(1), 3–40.

DOI: https://doi.org/10.1017/s0022226720000183

Abu Guba, M.N., 2023. Foot duration and polysyllabic shortening among Arab speakers of English. Loquens: Phonetics Laboratory Journal, 9(1–2), 1–9.

DOI: https://doi.org/10.3989/loquens.2022.e091

Abu Guba, M.N., Jarbou, S., Qub'a, A.A., 2023 Levels of prosodic prominence in Arabic: The case of function words. Al-'Arabiyya: Journal of the American Association of Teachers of Arabic, 55-56, 1–36.

Abu Guba, M.N., Mashaqba, B., Huneety, A., 2023. Polysyllabic shortening in Modern Standard Arabic. Journal of Semitic Studies, 68(2), 759–770.

DOI: https://doi.org/10.1093/jss/fgac030

Abu Guba, M.N., Fareh, S., Yagi, S., 2023. Speech rhythm in English and Arabic: A contrastive

review. International Journal of Arabic-English Studies, 23(1), 183–202.

DOI: https://doi.org/10.33806/ijaes2000.23.1.10

Abu Salim, I., 1982. A Reanalysis of Some Aspects of Palestinian Arabic: A Metrical Approach [PhD thesis]. Urbana: University of Illinois.

Al Bay, N., 2001. Some Aspects of a Palestinian Arabic Variant and Standard English Stress Patterns: A Metrical Approach [Master's thesis]. Amman: University of Jordan.

Al-Huneety, A.I., Mashaqba, B.M., Al-Shdifat, K.G., et al., 2023. Multisyllabic word production by Jordanian Arabic speaking children. Speech, Language and Hearing, 26(4), 249–265.

DOI: https://doi.org/10.1080/2050571x.2023.2189377

Al Sughayer, K., 1990. Aspects of Comparative Jordanian and Modern Standard Arabic Phonology [PhD thesis]. MI: Michigan State University.

Amer, F.H., Adaileh, B.A., Rakhieh, B.A., 2011. Arabic diglossia. Argumentum, 7(2011), 19–36.

Broselow, E., 1992. Parametric variation in Arabic dialect phonology. Perspectives on Arabic linguistics IV, 85, 7–45.

DOI: https://doi.org/10.1075/cilt.85.04bro

Broselow, E., Chen, S.I., Huffman, M., 1997. Syllable weight: convergence of phonology and phonetics. Phonology, 14(1), 47–82. Available from: https://www.stonybrook.edu/commcms/linguistics/faculty/ellen.broselow/files/BCH1997.pdf (cited 8 February 2024).

Btoosh, M.A., 2006. Constraint interactions in Jordanian Arabic phonotactics: An optimality-theoretic approach. Journal of Language and Linguistics, 5(2), 102–221.

Clements, G.N., 1990. The role of the sonority cycle in core syllabification. In: Kingston, J., Beckman, M.E. (eds). Papers in Laboratory Phonology. Cambridge University Press: Cambridge. pp. 283–333.

DOI: https://doi.org/10.1017/cbo9780511627736.017

Davis, S., Ragheb, M., 2014. Geminate representation in Arabic. Perspectives on Arabic linguistics, 24, 3–19.

DOI: https://doi.org/10.1075/sal.1.04dav

Farwaneh, S., 1995. Directionality Effects in Arabic Dialect Syllable Structure [PhD thesis]. UT: University of Utah.

Goad, H., 2011. The representation of sC clusters. In: van Oostendorp, M., Ewen, C. J., Hume, B., et al. (eds). The Blackwell companion to phonology. John Wiley and Sons: NJ. pp. 1–26.

DOI: https://doi.org/10.1002/9781444335262.wbctp0038

Harms, R. T., 1978. Some nonrules of English. In: Jazayery M., Polomé E., Winter W. (Eds.), Volume 2 Descriptive Linguistics. De Gruyter Mouton: Berlin . pp. 39–52.

DOI: https://doi.org/10.1515/9783110800432.39

Hayes, B., 1989. Compensatory lengthening in moraic phonology. Linguistic inquiry, 20(2), 253–306.

Kiparsky, P., 2003. Syllables and Moras in Arabic. In Féry, C., van de Vijver. R. (eds). The Syllable in Optimality Theory. Cambridge University Press: Cambridge. pp. 147–182.

DOI: https://doi.org/10.1017/cbo9780511497926.007

Mashaqba, B.M., Al-Shdifat, K.G., Al-Huneety, A.I., et al., 2019. Acquisition of Syllable Structure in Jordanian Arabic. Communication Sciences & Disorders, 24(4), 953–967.

DOI: https://doi.org/10.12963/csd.19657

Mashaqba, B., Huneety, A., Abu Guba, M.N., et al., 2022. Production of gutturals by non-native speakers of Arabic. Indonesian Journal of Applied Linguistics, 12(2), 334–347.

DOI: https://doi.org/10.17509/ijal.v12i2.26143

Parker, S., 2011. Sonority. In: van Oostendorp, M., Ewen, C., Hume, E., et al. (eds). The Blackwell Companion to Phonology. John Wiley and Sons Ltd: NJ. pp. 1160–1184.

DOI: https://doi.org/10.1002/9781444335262.wbctp0049

Watson, J.C.E., 2002. The Phonology and Morphology of Arabic. Oxford University Press: UK.

DOI: https://doi.org/10.1093/oso/9780199257591.001.0001

Watson, J.C.E., 2007. Syllabification patterns in Arabic dialects: Long segments and mora sharing. Phonology, 24(2), 335–356.

DOI: https://doi.org/10.1017/S0952675707001224