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# Patterns of the Urban Jordanian Arabic Broken Plural

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PATTERNS OF THE URBAN JORDANIAN ARABIC BROKEN PLURAL

A Thesis

Presented to

The Faculty of the Department of Linguistics and Language Development

San José State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

by

Netta Ben-Meir

May 2015

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The Designated Thesis Committee Approves the Thesis Titled

PATTERNS OF THE URBAN JORDANIAN ARABIC BROKEN PLURAL

by

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APPROVED FOR THE DEPARTMENT OF LINGUISTICS AND LANGUAGE

DEVELOPMENT

SAN JOSÉ STATE UNIVERSITY

May 2015

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## ABSTRACT

### PATTERNS OF THE URBAN JORDANIAN ARABIC BROKEN PLURAL

by Netta Ben-Meir

The Arabic plural system is of great linguistic interest due to its diversity, complexity, and resistance to classification. Arabic is a non-concatenative language that applies a masculine and feminine suffix plural, a dual, and a “broken plural” to mark number. The broken plural involves vowel changes internal to the noun stem and is defined by 30 to 34 distinct patterns. Previous research has established the broken plural as a primarily iambic productive pattern that adheres to a **CVCVV-** template, but more recent evidence suggests that all of the templates in the system are productive to some extent. Much of the previous research also focuses on Modern Standard Arabic while ignoring colloquial dialects of Arabic. The focus of this study is the Urban Jordanian dialect of Arabic based on data collected from a native speaker.

The study begins by introducing the Arabic plural system and the Urban Jordanian dialect of Arabic. Previous work on the Arabic broken plural is examined, in particular the application of the framework of prosodic morphology. The study outlines the shortcomings of prosodic morphology in capturing the true nature of the plural system. The data gathered for Urban Jordanian Arabic are then presented systematically, with detailed analyses of certain patterns. Based on the resistance of the data to defaulting to any singular pattern, a framework is presented that defines the pluralization process as a product of phonetic and semantic “gang effects” (Dawdy-Hesterberg & Pierrehumbert, 2014), enforced by frequency distributions and entrenchment.

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## 1. Introduction

Arabic plurals may be formed with either non-concatenative morphology or concatenative suffixation. Non-concatenative morphology involves vowel changes around a predefined consonantal root, while concatenative morphology involves the linear affixation of morphemes to a stem. Current frameworks used to analyze both concatenative and non-concatenative morphology are not adequate for explaining morphological processes such as Arabic plural inflection.

The non-concatenative strategy for plural formation in Arabic is known as the broken plural, which has between 30 and 34 possible forms. The concatenative suffixation strategy is known as the sound plural, where [-aat] attaches to feminine stems and [-uun] to masculine stems.<sup>1</sup> Gender in Arabic is grammatical, though it may also correspond to biological distinctions. For example, in Modern Standard Arabic, the feminine [mutarziima] “translator” pluralizes to [mutarziimaat] by replacing the feminine singular suffix [-a] with the sound feminine plural, and the masculine [mutarzim] pluralizes to [mutarzimuun] using the sound masculine plural. A few examples of the broken plural include the singular [razul] “man” pluralizing to [rizaal], [kalb] “dog” pluralizing to [kilaab], and [kitaab] “book” pluralizing to [kutub]. In general, the analyses conducted of this inflectional system are based on dictionaries or Arabic grammars, and all assume that Arabic has three phonemic vowels, /i/, /u/, and /a/, around which the discussion of vowel quality of the plural forms takes place.

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<sup>1</sup> There is also a case marking system in Modern Standard Arabic that interacts with plurals, but it has been abandoned in spoken dialects and so will be ignored.

Arabic is also in a situation of diglossia. Every Arabic speech community uses one or more colloquial dialects, which apply in the home and in daily life, along with Modern Standard Arabic (MSA), which is used in official forums and acquired at a later stage in an educational setting. Colloquial dialects may differ significantly from each other and from MSA. This thesis examines the particulars of a specific colloquial dialect's plural formation strategies alongside those of MSA in order to demonstrate the linguistic consequences of ignoring dialect analysis in a diglossic language such as Arabic. The focus is on the Urban Jordanian Arabic (UJA)<sup>2</sup> dialect, because there are only a handful of studies of the broken plural for any Jordanian dialect, let alone UJA. Additionally, this thesis suggests an alternative framework of analysis built on previous research of "gang-size" generalizations and the power of frequency distributions in predicting the productivity of the broken plural system. In conjunction with the power of entrenchment, "gang-size" and frequency effects provide guidance in an otherwise persistently diverse and fairly disorderly system. This framework will be compared to the theory of prosodic morphology in its ability to predict plural formation processes.

### **1.1 The Dialect Disparities in the Plural System**

A major issue with most previous analyses of the Arabic plural system, several of which will be presented herein, is that they do not actually examine spoken Arabic in order to draw conclusions about the phonology of the language. McCarthy and Prince (1990), for example, base their conclusions on dictionaries of Modern Standard Arabic

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<sup>2</sup> This may be considered interchangeable with Ammani Jordanian Arabic.

(MSA), which they define as a slightly updated form of Classical Arabic.<sup>3</sup> MSA is not a natively spoken language, and it is difficult to see how it would be susceptible to sound based rules in the same way as a natively spoken language. Additionally, MSA may differ drastically from colloquial regional dialects of Arabic, which themselves may differ drastically from each other. Depending on the dialects, colloquial Arabic variants may not be considered mutually intelligible (McCarthy, 2004, p. 866). MSA itself also exhibits certain regional variations, but these differences are not as extreme (Versteegh, 2014, p. 234).

MSA is a formal register that according to Ethnologue is a second language (L2) that “only the well-educated have adequate proficiency in.” These well-educated people constitute only about half of all Arabic speakers. Haddad (2008) addresses this point, explaining that “Given that there has been no such thing as a native speaker of SA since as early as the tenth century (Versteegh 1997: 64), it is not possible to talk about first language acquisition of SA” (p. 138). He believes that MSA is a factor in the patterns of Arabic but that it is not analyzable in the same terms as the spoken language. Since regional dialects probably evolved at least from the same proto-language as the very conservative MSA, MSA can give tremendous insight into the history of Arabic. As Ratcliffe (1998) suggests in his consideration of the evolution of the broken plural diachronically, “we are not concerned here so much with the rule system of a single speaker, but with possible rule systems which may have been developed by a variety of speakers over a long period of time ” (Ratcliffe, 1998, p. 111). MSA can contribute to

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<sup>3</sup> McCarthy and Prince say that the differences are “negligible” (McCarthy & Prince 1990, p. 211).

the description of the evolution of the broken plural but not necessarily its synchronic formation mechanisms. When drawing conclusions about the phonology of a language, which by definition involves the organization of *sounds*, it is critical to base the data and conclusions on actual *spoken* language.

The differences among the dialects of Arabic also present a problem in drawing conclusions about the pluralization patterns themselves. Table 1 compares plurals in Lebanese and MSA using data adapted from Haddad (2008, p. 145).

Table 1

*Broken plurals in MSA and Lebanese Arabic*

<b>Singular</b>	<b>MSA plural</b>	<b>Lebanese plural</b>	<b>Gloss</b>
/θawr/	[ʔaθwaar]	[twaar]	ox
/kitf/	[ʔaktaaf]	[kteef]	shoulder
/walad/	[ʔawlaad]	[wleed]	child
/razul/	[rizaal]	[rʒeel]	man
/ʒabal/	[ʒibaal]	[ʒbeel]	mountain
/kalb/	[kilaab]	[kleeb]	dog

The Lebanese plurals have a markedly different syllabic structure than the MSA plurals. When describing the default pluralization pattern in Arabic, a sweeping phonological generalization cannot be made about Lebanese using MSA. The same applies to Moroccan Arabic (Haddad, 2008, p. 146).

Table 2

*Broken plurals in MSA and Moroccan Arabic*

<b>Singular</b>	<b>MSA plural</b>	<b>Moroccan plural</b>	<b>Gloss</b>
/ʕaamud/	[ʔaʕmud]	[ʕmed]	column
/bajt/	[ʔabjut]	[bjut]	house
/himaar/	[ʔaħmir-at]	[ħmir]	donkey

The Moroccan broken plurals in Table 2 are problematic for the same reasons as the Lebanese ones. More evidence of this difference among plural patterns cross-dialectally may be drawn from Sakarna's (2013) comparison of Rural Jordanian (RJ) and the Jordanian 'Abady Arabic (AA) dialect (p. 51), shown in Table 3.

Table 3

*Broken plurals in RJ and AA*

Singular	RJ plural	AA plural	Gloss
/baab/	[bwaab]	[biibaan]	door
/faas/	[fuus]	[fiisaan]	axe
/bint/	[banaat]	[bnitta]	girl
/balad/	[blaad]	[bildaan]	country

Here the broken plural forms again show dialectal variation. The broken plural is clearly a paradigm that may structurally vary between colloquial dialects. Studying a particular dialect when analyzing this inflectional process is critical from a linguistically informative and typological standpoint.

## 1. 2 Phonological and Dialect Facts of Urban Jordanian Arabic

As discussed above, having an idea of the surface forms in a specific Arabic dialect is crucial to morphological and phonological examination. This section will provide a brief overview of the history and relevant phonology of UJA.

**1. 2. 1 Consonant and vowel inventories of UJA.** Al-Wer (2007) provides an informative overview of the specific factors contributing to the manifestation of an Urban Ammani dialect of Jordanian. She explains that the Ammani dialect is a recent development because Amman did not have a native population for many years. Until the 1930's, the dialect of Sult, which is phonologically similar to Bedouin dialects of Jordan,

was considered to be the “urban” dialect (Al-Wer, 2007, p. 59). High levels of Syrian and Palestinian immigration to Amman, located in the northeast of Jordan, have led to a strong influence of the Syrian and Palestinian village dialects on UJA. Al-Wer also highlights the different paths of evolution of UJA between male and female speakers due to their differing social roles. Women have adopted more features of Palestinian dialects than men, resulting in the frequent pronunciation of the MSA voiceless uvular stop /q/ as a glottal stop [ʔ] by women, and as a voiced velar stop [g] by men (Al-Wer, 2007, p. 66). For example, the word “heart” is pronounced [qalb] in MSA, [gelb] by men in UJA, and [ʔelb] by women.

Al-Wer also addresses some other differences between UJA and MSA, such as the raising of the vowel /a/ to [æ], [ɛ], or [e] in certain environments or by certain speakers (Al-Wer, 2007, p. 68). For instance, the name of the city “Amman” might be pronounced either as [ʕammaan], [ʕammææn], [ʕammæen], or [ʕammeen]. She also explains that there is free variation between the production of the post-alveolar affricate [dʒ], and the post-alveolar fricative [ʒ], resulting in alternations such as [ʒameʕ] ~ [dʒameʕ] “mosque” (Al-Wer, 2007, p. 66).

Table 4 and Table 5 represent consonants in MSA and UJA, respectively. The UJA inventories are based on elicitations conducted by the author, and the MSA inventory is adapted from Amayreh (2003, p. 518).



Table 4

*Consonants in MSA*

	bilabial	labio-dental	interdental	alveolar	post-alveolar	velar	uvular	pharyngeal	glottal
stop	b			d t d <sup>s</sup> t <sup>s</sup>		k	q		ʔ
fricative		f	ð θ ð <sup>s</sup>	z s z <sup>s</sup> s <sup>s</sup>	ʃ		ʁ χ	ħ	h
affricate					ʤ				
nasal	m			n					
trill/tap				r/r					
lateral approximant				l					

Table 5

*Consonants in UJA*

	bilabial	labio-dental	interdental	alveolar	post-alveolar	velar	uvular	pharyngeal	glottal
stop	b			d t d <sup>s</sup> t <sup>s</sup>		g k	q		ʔ
fricative		f	ð θ ð <sup>s</sup>	z s z <sup>s</sup> s <sup>s</sup>	ʒ ʃ	ɣ x		ħ	h
affricate					ʤ				
nasal	m			n					
trill/tap				r/r					
lateral approximant				l					

Both UJA and MSA also have a labio-velar approximant [w] and a palatal approximant [j].

MSA is analyzed as having only a three-way vowel quality contrast between [a], [i], and [u], while UJA clearly has a more expansive vowel inventory. The long vowels [a:], [i:], and [u:] contrast with their short counterparts in MSA. Table 6 presents the vowel inventory of UJA.

Table 6

*Vowels in UJA*

	Front	central	back
high	i, i: ɪ		u, u: ʊ
mid	e, e:	ə	ʌ o
low	æ, æ: a, a:		

The mid-vowels [ɛ] and [ɔ] may also appear in UJA, but they are not included in my transcriptions and are not significant in contrast to [e] and [o] in the analysis of broken plurals. Additionally, the vowel [ɑ] may appear, but only in the context of uvularized or uvular consonants, and so has also not been transcribed. This analysis is not intended to provide a detailed phonetic description of UJA. However, phonetic distinctions will be addressed if they are critical to plural formation.

**1. 2. 2 Phonological processes in UJA.** There are several phonological processes in UJA that might affect the surface forms of plurals, including vowel deletion, degemination, uvularization, and stress assignment.

Syllable shortening and syncope in UJA may involve either the shortening of certain word-medial syllables, the deletion of unstressed short high vowels that are not part of a suffix in open syllables, and the deletion of the high vowel [i] between two identical consonants word finally. For example, /stafaarna/, “we consulted” surfaces as [stafarna] in an instance of word medial syllable shortening. Also, /kitaabi/ “my book” surfaces as [ktaabi], and /ʕumuru/ “his age” surfaces as [ʕumru] in cases of unstressed short high vowel deletion. Abu-Abbas (2003) analyzes these processes by identifying

several syllable constraints for UJA using Optimality Theory (OT) in his dissertation on topics in Jordanian Arabic phonology (Abu-Abbas, 2003, p. 139-171). OT defines phonological rules in terms of competing phonotactic constraints that are language dependent. Unfortunately, Abu-Abbas appears to use MSA forms as inputs for UJA outputs, so his work is less a description of synchronic mechanisms and more of a historical overview.

Abu-Abbas, Zuraiq, and Abdel-Ghafer (2011) continue to explore the applications of OT in Jordanian Arabic by examining gemination. They report that it is not clear whether word final geminates are phonetically contrastive with single consonants in some Arabic dialects, but claim that there is evidence that in Jordanian Arabic they are (Abu-Abbas, Zuraiq, & Abdel-Ghafer, 2011, p. 7). They believe that the alternations of the surface forms are best described in terms of OT constraints. However, there are some important pieces of acoustic information that they neglect in their analysis. For instance, in their example of the similar words [ʔamm] “paternal uncle,” [ʔaam] “year,” and [ʔaamm] “general,” contrast will be maintained whether or not de-gemination occurs. The simple fact that they contrast overall cannot be considered evidence for a word final geminate phonetic contrast with a singleton consonant. In “paternal uncle”, there would remain a vowel length distinction to maintain contrast, and in “general” there would remain a vowel quality distinction (Abu-Abbas, Zuraiq, & Abdel-Ghafer, 2011, p. 11). Therefore, the word final phonetic contrast of geminates with single segments is still in question, and geminates may always de-geminate word finally.

UJA also exhibits different uvularization<sup>4</sup> behavior than other Arabic dialects. Zawaydeh (1997) explores which phonetic segments may block uvularization, also known as emphasis, in UJA by examining recordings of her own speech. She finds that segments that usually block uvularization in other dialects do not block uvularization in UJA, and that the uvular voiceless stop [q] does not spread uvularization to the same extent as the uvularized consonants (Zawaydeh, 1997, p. 198). The emphatic consonants [tˤ], [dˤ], [sˤ], and [ðˤ] may spread uvularization rightward or leftward throughout an entire word, including into suffixes and prefixes. Zawaydeh suggests that this is because the emphatic consonants must contrast with other consonants in the same place of articulation that are not uvularized, so the acoustic information regarding their uvularization needs to be more strongly encoded in the speech stream. Meanwhile, the uvular stop does not contrast with any other stops in the same place of articulation. Zawaydeh also claims that the only phonemically uvular consonant in UJA is the uvular voiceless stop [q]. Other dialects may also have the uvular fricatives [χ] and [ʁ], which she believes are most probably velar in UJA, because their neighboring vowels do not exhibit the acoustic properties of uvular place of articulation (Zawaydeh, 1997, p. 199).

Stress in UJA prefers final syllables if they are **CVVC** or **CVV**, penultimate syllables if they are not **CV**, and antepenultimate syllables if the penultimate syllable is **CV** (Ahn, 2003, p. 364). For example, [dux.'xaan] “smoke” with a final **CVVC** syllable receives final stress, [fan.'naa.dig] “hotels” and [ʃa.'mal.ti] “you did” receive penultimate

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<sup>4</sup> Zawaydeh (1997) defines uvularization, or “emphasis,” as “the retraction of the back of the tongue accompanying primary articulation at another point in the vocal tract...characterized by a drop of the second formant in the vowels and sonorants in general.” (p. 1)

stress, and [ˈka.ta.bu] “he wrote” receives antepenultimate stress. Ahn (2003) explains that because of their long vowels, **CVV** syllables are phonetically ideal to convey the acoustic characteristics of stress, which are fundamental frequency, length, and amplitude. **CV** syllables usually avoid stress in languages where vowel length is phonemic to avoid lengthening effects on short vowels and the loss of vowel length contrasts (Ahn, 2003, p. 363-364). She describes an experiment she conducted to measure vowel length in a northern Jordanian dialect of Arabic, predicting that **CV** syllables in the penultimate position would lengthen more drastically than **CV** syllables in the antepenultimate position. Jordanian stress behaves as predicted by the phonetic facts, so Ahn concludes that stress falls on the antepenultimate position to avoid drastic lengthening in penultimate **CV** syllables (Ahn, 2003, p. 371). Ahn also addresses the “extrametrical” behavior of **CVC** syllables word finally, dismissing the idea that the final consonant of the **CVC** syllables is considered to be outside the prosodic domain due to the phonological treatment of these syllables as **CV** syllables (Ahn, 2003, p. 371-373). She proposes that **CV** and **CVC** word final syllables avoid stress not because they have extrametrical elements, but because lengthening effects in the word final position are too extreme, and could neutralize contrasts with **CVV** and **CVVC** syllables.

UJA has a different vowel and consonant inventory than MSA, and undergoes phonological processes that may affect syllable structure, as detailed above. Keeping these differences in mind is significant for the outcome of a prosodic or phonological broken plural analysis in UJA.

## **2. The Leading Theory of the Broken Plural as an Iambic Template**

The work of McCarthy and Prince (1990) is currently regarded as the leading analysis of the broken plural, describing it as a primarily iambic template, and employing the tools of prosodic morphology and prosodic circumscription. The details of their analysis are presented in section 2. 1.

### **2. 1 McCarthy and Prince 1990**

McCarthy and Prince argue for the broken plural as the dominant pattern of pluralization in the language. They explain that the sound plural does not dominate the language in productivity because it only involves a “short list (of) proper names; transparently derived nouns or adjectives such as participles, de-verbals, and diminutives (Levy 1971); noncanonical or unassimilated loans (tilifuun/tilifuun+ aat); and the names of the letters of the alphabet” (McCarthy & Prince, 1990, p. 212). Broken plurals are the default because they are “formed on literally every canonical noun type in Arabic” (McCarthy & Prince, 1990, p. 212), and therefore must also abide by some kind of systemic pattern or their productivity would be limited. Assuming that a minimal word is equivalent to two morae, McCarthy and Prince define the broken plural as a pattern that primarily involves the mapping of the first minimal word of the singular stem onto an iambic foot, defined as a light syllable followed by a heavy syllable or **CVCVV-** pattern (McCarthy & Prince, 1990, p. 210). Everything following the first two morae of the singular stem is extrametrical, and either just added after the iamb, or modified and added following a certain vowel melody or rule in the plural. Figure 1, Figure 2, and Figure 3 demonstrate this mapping for [zundub] “grasshopper,” adapted from McCarthy and

Prince (1990, p. 247-248). First, the initial bimoraic minimal word, [ʒun], is mapped onto an iambic foot, or  $F_I$ , as in Figure 1.

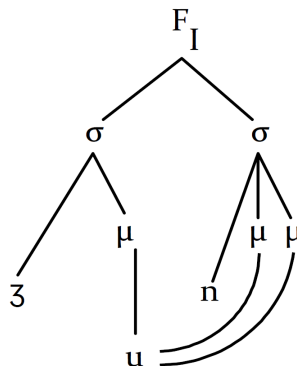


Figure 1. Initial mapping of minimal word onto iambic foot.

The consonants occupy the syllable onset positions while the vowel is overwritten by the templatic plural melody [a\_i].<sup>5</sup> In this case the [a] spreads to fill the moraic positions of the iamb, while the [i] overwrites any extrametrical vowel material, and so is left aside until the extrametrical content is reattached, as in Figure 2.

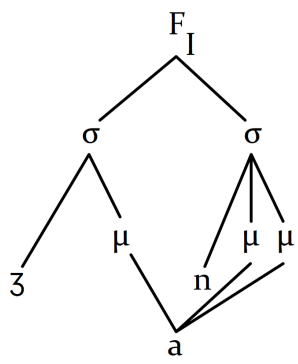


Figure 2. Initial vowel melody mapping onto iambic foot.

Finally, the extrametrical residue concatenates with the iamb, resulting in the plural output [ʒanaadib], seen in Figure 3.

<sup>5</sup> Vowels contribute additional semantic features to words in Arabic. For this template, there is a predetermined set of vowels, or “melody,” that appears in the plural. There is also an element of vowel polarity in the broken plural system, or the appearance of vowels in the plural that have opposing phonetic features to vowels in the singular stem.

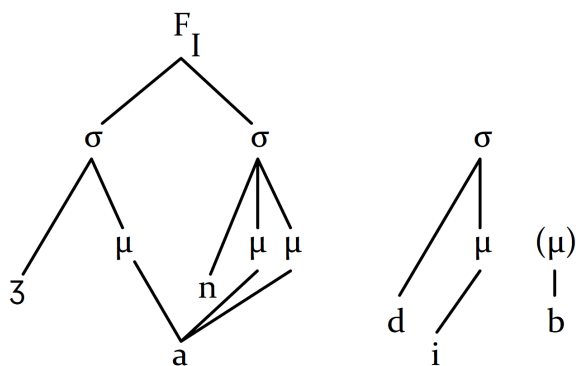


Figure 3. Affixation of residue to iambic foot.

The iambic plural is not the only pattern seen in broken plural formation, but it is the most prevalent one (McCarthy & Prince, 1990, p. 213). McCarthy and Prince base their data on Wright (1971) and Wehr (1971), a grammar and dictionary of Arabic, respectively. Using syllable structure as a metric, they divide Wright's 31 plural types into four general categories: the Iambic plural, the Trochaic plural, the Monosyllabic plural, and one category consisting of "Other" (McCarthy & Prince, 1990, p. 213). Trochaic in this case refers to two light syllables, or a CVCVC- pattern. Table 7 summarizes their analysis.

Table 7

*Groupings of broken plural patterns in MSA*

Iambic	Trochaic	Monosyllabic	Other <sup>a</sup>
CVCVVC	CVCVC	CVCC	CuCCaC
/CaCaaC/	/CaCuC/	CiCC + at	CuCCaaC
CVCVVC + /ay/	CVCaC + at	CVCC + aan	
CVCVVC + at	CuCaC + aa?	CaCC + /ay/	
CawaaCiC	/CaCiC/ + at		
CaCaa?iC	/CaCiC/ + aa?		
CaCaaCiC			
CaCaaCiiC			

<sup>a</sup> The word medial CC cluster in this group represents a geminated consonant.



However, McCarthy and Prince are required to manipulate some of the surface forms in order to make them fit the pattern. In both the Iambic and Trochaic categories, there are forms in which the initial **CV** of the plural is observed to metathesize after the initial formation of the plural. Since Arabic is considered to disallow onsetless syllables, a glottal stop is epenthesized before the resulting initial **VC** to produce **ʔVC**. The **V** in this initial sequence is presumably lowered to produce **ʔaC**. In the Arabic prosodic system **ʔaC** would not be considered an appropriate initial syllable in an iambic or trochaic formation, but perhaps would fall under the “other” group. These metathesized forms are indicated by virgules in Table 7, surfacing as either **ʔaCCaaC**, **ʔaCCuC**, or **ʔaCCiC**. Importantly in this analysis, the singular stem, rather than the consonantal root, is considered to be the base for pluralization. The formation of the broken plural is then not assumed to be based on a vowel template that is imposed on root consonants, as the morphology of Arabic is traditionally defined. The authors give convincing evidence for this, particularly that the vowel length features of the extrametrical portion of the singular are maintained in the plural. For instance, **jundub** “grasshopper” pluralizes to **janaadib**, while **sultaan** “sultan” pluralizes to **salaatiin** rather than **\*salaatin**.

McCarthy and Prince present the iambic plural as the “only broadly-based, productive mode of plural formation in the language” (McCarthy & Prince, 1990, p. 221). They include as arguments in support of its dominance the statistical distribution of the broken plural forms, the iambicity of the plural-of-the-plural, and the pluralization of loanwords. The plural-of-the-plural refers to what is also known as the plural-of-multiplicity, which is intended to indicate a quantity of more than ten in contrast with the

plural-of-paucity. The plural-of-paucity is intended to indicate a quantity between two and ten.<sup>6</sup> McCarthy and Prince's analysis of the dominance of the iambic plural involves a statistical glance at what percentage of each singular type pluralizes as an iambic broken plural, based on data collected from Wright (1971) and Wehr (1971) (McCarthy & Prince, 1990, p. 216). Their results are summarized and compared in Table 8.

Table 8

*Distribution of iambic plural in MSA*

<b>Stem Type</b>	<b>Masculine</b>	<b>Feminine</b>
CvCC	<b>HIGH</b> Greater than 90% have iambic form as a plural	<b>MEDIUM</b> Iambic plural is significant competitor (20%-50% total)
CvCvC	<b>HIGH</b> Greater than 90% have iambic form as a plural	<b>MEDIUM</b> Iambic plural is significant competitor (20%-50% total)
CvCvvC	<b>LOW</b> Iambic plural is insignificant (less than 10%)	<b>HIGH</b> Greater than 90% have iambic form as a plural
CvvCvC	<b>MEDIUM</b> Iambic plural is significant competitor (20%-50% total)	<b>HIGH</b> Greater than 90% have iambic form as a plural
CvXCv(v)C	<b>ALL</b> All have iambic form as plural	<b>ALL</b> All have iambic form as plural

Since there is only one form that makes “LOW” use of the iambic pattern, the iambic pattern is considered to be the most productive. McCarthy and Prince's analysis of the iambic template as the dominant form also claims to explain [w] epenthesis in cases such as **jaamuus** “buffalo” pluralizing to **jawaamiis**, since the minimal word, or first two morae, maps onto the resulting iambic form. They argue that the [w] is epenthesized in order to allow the first two morae to fully express themselves, since there

<sup>6</sup> There are also dual forms in MSA as well as in UJA, but they are not thought to be relevant to the formation of broken plurals themselves.

is no consonant present in **jaa-** to fulfill the onset requirements of the iambic template.

Some of their data regarding the different manifestations of the iambic plural are

summarized in Table 9 (McCarthy & Prince, 1990, p. 217).

Table 9

*Manifestations of iambic plural in MSA*

<b>Iambic Broken Plurals</b>			
<b>CVCC</b>			
	Singular	Plural	Gloss
	[nafs]	[nufuus]	soul
	[hukm]	/hakaam/ [ʔaħkaam]	judgment
<b>CVCVC</b>			
	Singular	Plural	Gloss
	[ʔasad]	[ʔusuud]	lion
	[ʕinab]	/ʕanaab/ [ʔaʕnaab]	grape
<b>CVCVVC + at</b>			
	Singular	Plural	Gloss
	[zaziir + at]	[zazaaʔir]	island
	[kariim + at]	[karaaʔim]	noble
<b>CVVCVC + at</b>			
	Singular	Plural	Gloss
	[faakih + at]	[fawaakih]	fruit
	[ʔaanis + at]	[ʔawaanis]	cheerful
<b>CVVCV(V)C</b>			
	Singular	Plural	Gloss
	[xaatam]	[xawaatim]	signet-ring
	[zaamuus]	[zawaamiis]	buffalo
<b>CVCCV(V)C</b>			
	Singular	Plural	Gloss
	[zundub]	[zanaadib]	locust
	[sult <sup>s</sup> aan]	[salaat <sup>s</sup> iin]	sultan

**2. 1. 1 Issues with McCarthy and Prince's analysis.** There are several issues with McCarthy and Prince's analysis that will be explored here. The first issue, discussed

in section 2. 2, relates to the lack of evidence for the dominance of the iambic template over other forms, including issues with the metathesis proposed by McCarthy and Prince and the resulting shifts in statistical distributions. The second, discussed in 2. 3, involves the questionable establishment of the broken plural as a default system over the sound plural. Another major issue involves the problematic usage of Modern Standard Arabic as the basis for phonological analysis, as well as the differences between Arabic dialects. This final issue has already been addressed in section 1. 1.

## **2. 2 Iambicity**

**2. 2. 1 The absence of metathesis.** The initial CV metathesis that McCarthy and Prince claim is occurring may not really be a metathesis. Haddad (2008) addresses this issue by describing the surfacing of **ʔaCCaaC**, **ʔaCCuC**, and **ʔaCCiC** plurals as a probable “pseudo-metathesis,” rather than a genuine instance of the phenomenon. The two main flaws he finds with the argument for metathesis are that there is no defined environment where it occurs, and that the “epenthesized” word initial glottal stop that is purportedly a result of metathesis does not phonologically pattern like an Arabic epenthesized glottal stop. Haddad provides a diachronic analysis of the forms in question involving the deletion of a vowel, leaving a word initial consonant cluster that is repaired by epenthesis. The forms are then lexicalized. Therefore, the word [xabar], meaning news, could be assumed to have pluralized to [xabaar], and then undergone syncope to become [xbaar]. The form [xbaar], with a complex onset, would have been repaired to become [ʔaxbaar]. He still describes McCarthy and Prince’s prosodic analysis as “elegant and probably true” (Haddad, 2008, p. 150), but believes that the forms in

question have become broken plural templates in and of themselves. The other details of Haddad's reconstruction are not critical, but the flaws he draws attention to in assuming a metathesis are. He reasons that there cannot be a metathesis because there is no phonological environment that is unique to the proposed metathesis, and adds that McCarthy and Prince also do not provide one. Evidence adapted from Haddad 2008 in Table 10 shows that there are congruent environments where "metathesis" does and does not occur (p. 137).

Table 10

*Environments where "metathesis" could but does not occur*

Metathesis			No-Metathesis		
Singular	Plural	Gloss	Singular	Plural	Gloss
[ʒihaaz]	[ʔaʒhiz-at] /ʒahiz-at/	device	[ʒuhd]	[ʒuhuud]	effort
[ʒaaniḥ]	[ʔaʒniḥ-at] /ʒaniḥ-at/	wing	[ʒamal]	[ʒimaal]	camel
[ʕajṇ]	[ʔaʕjun] /ʕajun/	eye	[ʕajb]	[ʕujuub]	defect
[riʒil]	[ʔarʒul] /raʒul/	leg	[raʒul]	[riʒaal]	man

Additionally, the glottal stop in the **ʔaC-** initial forms is not treated like a typical Arabic epenthesized glottal stop phonologically. Haddad notes that McCarthy and Prince recognize this discrepancy as well (McCarthy & Prince, 1990, p. 280), but do not explain the reasons behind it. The epenthesis of a glottal stop and a vowel is described by Haddad as an acceptable way to avoid an initial consonant cluster in Arabic. However, the epenthesized glottal stop will be dropped if the preceding word is consonant final, and the vowel will also be dropped if the preceding word is vowel final. For example, [drus]

“study” surfaces as [ʔudrus] in the imperative in order to avoid the initial consonant cluster. But when following [qum] “go,” the surface form will be [udrus] without an intervening glottal stop, producing [qumudrus] “go study.” Additionally, following [hajja] “come on” the surface form will just be [drus], producing [hajjadrus] “come on study.” Adhering to this behavior, if the glottal stop of a broken plural form were epenthesized following a metathesis, we might expect to see [ʔanzum], meaning *stars*, surface with the definite article as [\*ʔal-anzum] meaning *the stars*, rather than its actual surface form [ʔal-ʔanzum]. The glottal stop in the broken plural is retained rather than discarded, as an epenthesized glottal stop would usually be following a consonant. If the “metathesized” broken plural forms never surface as un-metathesized, and never give any phonological evidence of their underlying form, it is difficult to argue that there is an actual metathesis process happening. As Haddad clarifies, there is not a synchronic reordering of sounds in the broken plurals that begin with **ʔaC**, but the realization of a historical process that has taken place in these forms (Haddad, 2008, p. 137).

Ratcliffe’s (1998) summary of Levy’s (1971) analysis of the statistical distribution of the broken plural shows that between forms that pluralize using either an iambic or **ʔaC**- initial template, there is actually a preference for the latter. Levy’s statistical distributions in Ratcliffe (1998) contradict McCarthy and Prince, who assert that the iambic template shape dominates plural formation for all singular stem shapes. Only singulars that are **CaCC** prefer the iambic plurals **CuCuuC** and **CiCaaC**,<sup>7</sup> at 61%

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<sup>7</sup> These are the only major iambic plural groups that occur with the specified singular forms in the chart by Ratcliffe summarizing Levy. Ratcliffe’s summary of Levy’s analysis considers only major forms (Ratcliffe, 1998, p. 75).

of the time, which is still not an overwhelming majority. Singulars that are **CiCC**, **CuCC**, and **CvCvC**, which are distributed among the same broken plurals as **CaCC**, prefer the iambic plurals only 30%, 25%, and 15% of the time, respectively (Ratcliffe, 1998, p. 75). In all other cases these singulars pluralize as either the non-iambic **?aCCuC** or **?aCCaaC**, with a strong preference for **?aCCaaC**.<sup>8</sup> Without the “metathesis” stipulated in McCarthy and Prince, the iambic plural as the majority pattern for the singular forms supplied can only be attested in one instance. The consideration of **?aC-** initial templates as iambic appears to be a significant factor in calculating the numbers.

Further shown in Levy’s distribution is that the broken plurals formed with iambic [w] epenthesis do not actually prefer this mode of pluralization. Only the feminine singular **CaaCiCat** overwhelmingly pluralizes to **CawaaCiC**, at 84% of the time. Singulars of the form **CaaCiC**, the other singular that would have to epenthesize a [w] in order to comply with the iambic template, only use the iambic plural 24% of the time. The preferred plural for the singular **CaaCiC** is actually **CuCCaaC**, which according to Levy is the plural form 26% of the time for this singular. Only one of the remaining plurals of **CaaCiC** is iambic, supplying the plural for this singular 11% of the time (Ratcliffe, 1998, p. 75). There is no [w] epenthesis in that iambic plural form. In sum, although McCarthy and Prince suggest that [w] epenthesis occurs in order to accommodate a particular stem shape to the iambic plural, these stems actually utilize other plural forms more often than the iambic.

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<sup>8</sup> **CvCvC** only pluralizes with an iambic plural or **?aCCaaC** plural.

The absence of a methathesis in the iambic plural forms significantly affects the statistical distribution of iambic plurals. Other distributional evidence, such as that for plurals with [w] epenthesis, also brings into question the dominance of the iambic plural.

### **2. 2. 2 The plural-of-the-plural (plural-of-multiplicity vs. plural-of-paucity).**

The second major issue in the consideration of the broken plural as an iambic device is the use of the plural-of-the-plural's iambicity as proof of prevalence. The plural-of-the-plural, or plural-of-multiplicity, is believed to have fallen out of use from the sense it originally conveyed in spoken Arabic. Ferrando (2006) explains in an overview of the plural-of-paucity (PP) compared to the plural-of-multiplicity that "Generally, the PP form is no longer in use in the modern language, or it is merely perceived as an archaic and/or high-register variant" (Ferrando, 2006, p. 48). He goes on to explain that, during interviews he conducted, speakers indicated that they do not see a difference in meaning between plural-of-paucity and plural-of-multiplicity forms.

Additionally, Ferrando presents some interesting data of singular forms that, when pluralized with the accepted plural-of-paucity form, adopt an entirely different sense than their plural-of-multiplicity form. The iambic plural [nufuus] means "souls," while the plural [ʔanfus] of the same singular means "themselves." Furthermore, the iambic plural [wuzuu] means "faces," but the plural [ʔawzu] of the same singular means "aspects" (Ferrando, 2006, p. 47-48). Ferrando acknowledges that these data have not yet been examined in depth, but present an interesting avenue for further study. Critically, the plural-of-multiplicity forms also have an initial **ʔaC-**, which does not fit in with the



iambic pattern since it has been shown that there is no metathesis occurring on these forms.

Sakarna (2013) gives another example of this phenomenon of semantic differentiation in a paper using OT to provide a divergent analysis from McCarthy and Prince, of specifically the Jordanian Arabic broken plural. He explains that the word **bayt** “house” for example, may either be pluralized as **buyuut** to mean “houses,” or to **?abyat** to mean “lines of verse” (Sakarna, 2013, p. 48). This points to an actual semantic distinction between different broken plural templates, in this case between a plural that is iambic and a plural that is not iambic. These plural forms are manifesting on the basis of different senses of the word **bayt** and not based on the syllabic structure of the stem. Furthermore, even if the “metathesized” forms were considered iambic, the analysis of McCarthy and Prince offers no reason for the semantic distinction, especially if the plural-of-the-plural is not actually a valid category in Modern Arabic. There is no explanation by McCarthy and Prince of why a single stem would pluralize in two different ways, assuming that the broken plural is a purely phonologically conditioned pattern. Clearly, syllabic structure is not the sole determinant of the output of the broken plural forms, which may also indicate semantic distinctions.<sup>9</sup> Additionally, the plural-of-the-plural, an outdated mode, is irrelevant to the defaultness of the iambic broken plural.

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<sup>9</sup> Additionally, the forms that McCarthy and Prince use to exemplify the plural-of-the-plural phenomenon for the word [kalb] “dog” are incorrect. The regular plural of dog is [kilaab], which they list as [?aklub]. A native speaker of Saudi Arabic has confirmed that [?aklub] is an outdated classical Arabic form that is never used in colloquial variants.

### 2.3 The Broken Plural is not the Clear Default

The broken plural is not definitively the default or majority pattern of pluralization in Arabic. McCarthy and Prince have overestimated both the productivity and the prevalence of the broken plural, and have underestimated the productivity and prevalence of the sound plural. They dismiss the sound plural as only occurring with “a short list,” including “derived” words or “unassimilated” loan words, as detailed in section 1.1. Boudelaa and Gaskell (2002) are not so quick to dismiss the importance of the sound plural as an inflectional process in Arabic. They believe that the sound plural is actually the default mode of pluralization, citing a difference between quantitative and qualitative productivity. They argue that both the broken and sound plural have limited qualitative productivity, but that the sound plural is quantitatively more productive. Verbal noun derivation is the most productive part of the Arabic language, and therefore the fact that the sound plural attaches to derived nouns makes it the necessarily more applied form of pluralization. Boudelaa and Gaskell (2002) explain that the sound plural would not be a minority even if it occurred only with transparent derivatives, because transparent derivatives are incredibly productive (p. 327-328). The authors show that transparent derivatives are much higher in number than canonical nouns based on dictionary estimates of the number of Arabic roots and their derivatives. They also compare the phonological distribution of sound and broken plurals, arguing for a connectionist model, where new forms are inflected based on phonological similarity to familiar patterns. They find that sound plurals are more widely distributed in the phonological space and therefore have a wider sphere of influence. Broken plurals form

coherent groups in the phonological space, while the sound plural is ubiquitous in its distribution (Boudelaa & Gaskell, 2002, p. 335).

Additionally, Boudelaa and Gaskell (2002) point to a semantic difference between the derivatives that use the sound plural and those that use the broken plural. Words with a more substantive sense form a broken plural while words with a more adjectival sense form a sound plural. For example, the word [kaatib] “author” pluralizes brokenly as [kuttaab]. However, when the sense of [kaatib] is “someone who writes” rather than “author,” it is pluralized with the sound plural as [kaatibuuna] (Boudelaa & Gaskell, 2002, p. 328). The authors also conduct their own statistical analysis of the prevalence of each plural type in a collection of the 3,000 most common Arabic words, using the Basic Lexicon of Modern Standard Arabic (Khouloughli, 1992). Assuming that this source is representative of the Arabic language in general, they find that 56% of Arabic words are nouns, and that of those nouns 59% apply the sound plural while only 41% apply the broken plural (Boudelaa & Gaskell, 2002, p. 329). Their results consisted of 1,500 nouns in total, clearly demonstrating that the sound plural must not be dismissed as a minority derivational process. In addition to applying to a greater number of actual word forms, speakers are probably exposed to both derivational processes to at least the same extent, if not more to the sound plural, since they both apply very often to commonly used words. The distributions of the methods of pluralization and prevalence of the iambic template are not as clear-cut as McCarthy and Prince have presented.

### 3. Analyses Since McCarthy and Prince 1990

#### 3.1 Ratcliffe 1998

Ratcliffe (1998) approaches the broken plural issue from a historical perspective, and believes that both diachronic and synchronic analyses must be used in the exploration of the plural system. He also focuses on the challenges in isolating morphemes, identifying underlying forms, and defining what aspects of words may be contrastive in non-concatenative languages like Arabic. Ratcliffe questions the validity of the triconsonantal root in the underlying grammatical systems of Arabic speakers, and also views the nominal stem as the base for pluralization processes in Arabic.

Ratcliffe observes the statistical distribution of the plural system and its meaning for productivity of forms within the system. The broken plural is divided into seven major groups, that themselves may fall under three major groups. The groupings are based on a combination of semantics, morphological shape, and phonological shape. He explores the idea that some plural patterns actually mark semantic contrasts as opposed to simply being allomorphic variations of a single plural morpheme or pattern. For example, he identifies the preferences of masculine and feminine singulars for different plurals, other semantic correlates to certain plural templates, and a trend of vowel quality polarity (Ratcliffe, 1998, p. 39-40, 77, 88). Vowel quality polarity refers to the replacement of a vowel with one that has an opposing quality on a spectrum, and is meant to explain the vowel changes that sometimes occur between a singular and its broken plural. For example, [nafs] “soul” has a low vowel but pluralizes to [nufuus], which has high vowels. Ratcliffe also identifies the most productive and statistically prominent

plural patterns in Arabic as **CaCaaCiC** and **ʔaCCaaC** (Ratcliffe, 1998, p. 72-74).

Additionally, he attributes the tendency of derived nouns to use the sound plural as a consequence of words being unlikely to undergo multiple derivations internal to the stem. Lexicalized derived nouns are a relatively large class of exceptions to this idea that are “semantically independent of their source,” and use the broken plural (Ratcliffe, 1998, p. 55-56).

In earlier theories, the broken plural was considered to have resulted from a variety of different processes, such as the change and movement of the sound plural suffix internally, from a system of nouns that derived from verbs termed “verbal nouns,” or from a former noun class system (Ratcliffe, 1998, p. 118-120). However, Ratcliffe is dismissive of semantics or noun classes as the driving force of the system. Evidence for a noun class system would need to be reconstructable in Proto-Semitic to support this argument, but it is not (Ratcliffe, 1998, p. 133). In many cases nonetheless, the only reason he gives for the selection of a specific plural template are semantic, such as in the case of color adjective plurals, plurals of defect such as deafness, and differentiations between rational and non-rational referents, meaning humans and inanimate objects or abstract notions.

Ratcliffe presents the historical motivation for the broken plural by comparing pluralization in the Semitic language family, in particular the Southern Semitic group that contains Arabic. Other languages in the Southern group have internal stem modifying pluralization processes, displaying a vowel change in the second syllable among other phonological changes that can occur in the Arabic plurals. Ratcliffe concludes that

internal pluralization must have existed in Proto-Semitic since most of the Semitic languages have internal plurals for **CVCC** and **CVCCat** singulars. These internal plurals must have spread in Arabic to other nouns of varying shapes through analogies that have created a more divergent rather than convergent system. Different analogies may have applied at different points in language development or through contact between dialects (Ratcliffe, 1998, p. 222). This also suggests that plural patterns may have previously been iambic and became idiosyncratic due to historical sound changes and developments.

To describe synchronic inflection, Ratcliffe combines his historical overview with prosodic morphology templates (Ratcliffe, 1998, p. 108, 238), supporting the idea that plural derivation is based on a vowel tier, a consonant tier, and a syllable template base. He admits that in some instances prosodic templates are problematic, since they cannot capture the function of morphemes, but only the form.

Ratcliffe approaches the patterning of forms like **?aCCaaC** as the result of an iambic plural **CaCaaC** that metathesized, in the same way as McCarthy and Prince, though he admits that this metathesis is suspect and may indeed be more like Haddad's (2008) pseudo-metathesis. However, many of the other languages he examines in the Semitic language family, such as Geʿez and Tigre, have the initial [**?a-**] template as a strong pattern, or exclusively. This suggests that [**?a-**] can be reconstructed at some level of Proto-Semitic, had meaning historically, or was incorporated into Arabic through language contact.

Ratcliffe brings attention to the influence of historical forms on present day inflection, even though many of the ideas he discusses are inconclusive.

### 3. 2 Al-Shboul 2007

Al-Shboul (2007) describes broken plural formation specifically in Urban Jordanian Arabic. He notes that the masculine and feminine sound plural suffixes in UJA are **-een** and **-aat**, as opposed to the MSA [-uun] and [-aat]. Gender is interpreted by semantics or the presence of [-a] at the end of a word, indicating the feminine. He also views the singular stem as the input to the plural.

The author continues to designate the sound feminine plural as the most open default form of pluralization, since it can apply to both human and non-human nouns regardless of their gender, and most nouns with a final feminine [-a] pluralize with the sound feminine plural. The masculine sound plural generally affixes to male human nouns and in particular to male human nouns that are derived from action verbs, for example “driver,” “teacher,” or “engineer.” The masculine sound plural can also be used with loan words that are in the present participle form.

Al-Shboul assumes a dual route model for pluralization in Arabic, where the broken plural forms are irregular and must be retrieved from lexical memory (Al-Shboul, 2007, p. 62-66). He believes that derived nouns and participles use the sound feminine plural because speakers have no access to the grammar of derivatives. This idea makes ungrounded assumptions about speakers’ knowledge of derived forms, and the marking of each individual noun’s plural in the lexicon.

The author also provides some discussion of the differences between UJA and MSA. However, he seems to conflate MSA and UJA at times, drawing evidence for UJA

from sources that are comprised of MSA content, such as the Basic Lexicon of Modern Standard Arabic (Khouloughli, 1992).

Al-Shboul is mostly occupied with determining which mode of pluralization is the default, and concludes that there are actually three defaults in UJA, the iambic broken plural, the sound feminine plural, and the sound masculine plural. This conclusion is based on a combination of how semantically diverse the singular nouns of these plurals are and the quantitative productivity of the patterns. He actually also observes that the trochaic broken plural has the highest type frequency in UJA, but claims it is not a default form because of its lack of openness to new forms in comparison with the iambic broken plural (Al-Shboul, 2007, p. 124). Although Al-Shboul draws attention to interesting characteristics of the UJA broken plural and acknowledges that there are probably multiple productive defaults in the system, he does not provide a complete picture of how the broken plural is formed, and some of his data are problematic.

### **3. 3 Sakarna 2013**

Sakarna (2013) offers a counter theory to the prosodic morphology hypothesis put forth by McCarthy and Prince in describing the Arabic broken plural. He also discusses the broken plural forms specifically in Jordanian, and points out several issues with McCarthy and Prince's analysis. The first, discussed in section 1. 1, is that they do not take into consideration that broken plural forms may vary from dialect to dialect. The second, raised in section 2. 2. 2, is that a single stem in the same dialect may have multiple output plural forms. This difference would not be accounted for in any way by prosodic morphology. Sakarna then explains his proposed model, in which there are



“template generators.” Essentially, he claims that when speakers pluralize nouns, all phonologically possible forms of a plural are generated based on a consonant and vowel template, along with sub-forms, and then these forms are ranked until the optimal form surfaces for what the speaker is trying to say. He also claims that this ranking varies from speaker to speaker, allowing different dialects to produce varying plural forms (Sakarna, 2013, p. 51-54). His proposed theory however does not account for why a form might be optimal.

### **3. 4 Dawdy-Hesterberg and Pierrehumbert 2014**

Dawdy-Hesterberg and Pierrehumbert (2014) discuss “defaultness” in Arabic pluralization and highlight the inability of prosodic morphology to determine whether a noun will have a sound or broken plural. They conclude that Arabic is not a minority default system, in which the sound plural, a regularly applying affix, would be used with fewer forms than the irregular stem internal broken plural. Previous support of a minority default has depended on dictionaries, rather than corpora, making the data unrepresentative of language use. In an analysis of the Corpus of Contemporary Arabic (Al-Sulaiti, 2009), a collection of around one million words taken from magazines, newspapers, websites, and radio, the authors find support for Boudelaa and Gaskell’s (2002) argument that the sound plural is the default, surfacing in 74% of forms by type.

Dawdy-Hesterberg and Pierrehumbert also conduct a quantitative analysis of Arabic plurals in order to compare the relevance of varying levels of phonetic features to pattern learnability in the system. They describe the higher performance of previous computational modeling studies operating under single-route premises. These consider

statistical generalizations of both sound and broken plural singular-plural word pairs, rather than only the statistical distributions of the broken plural word pairs as under dual-route premises. They suggest a computational model where patterns organize into gangs in the lexicon creating a “gang-size effect.” High pattern frequency for gangs of singulars leads to pattern generalization. In order to test this theory, they conducted a corpus study using five different predictive analogical generalization models trained and tested on gangs of both sound and broken plural singular-plural pairs. A gang is defined as a group of singulars with the same **CV** template that also share a plural **CV** template. Their analysis assumes that an abstracted coarse-grained **CV** template is psychologically real to an extent, or at least that it is a factor in derivation. Dawdy-Hesterberg and Pierrehumbert find that generalization in Arabic occurs through a combination of coarse-grained abstract templates and statistical knowledge, and to a lesser degree, fine-grained phonetic features. The largest gang in their corpus analysis is indeed the iambic plural, where a **CVCC** singular corresponds to a **CVCVVC** plural. However, it is not completely clear whether they are including [ʔa-] initial plurals, previously discussed as pseudo-metathesized, as **CVCVVC**.

Interestingly, their algorithms were able to learn both trochaic and iambic plurals, suggesting that both of these patterns should be considered productive in Arabic. The authors also found that the most common errors in pluralization by their predictive models were sound plurals being incorrectly pluralized as broken plurals or vice versa, rather than the selection of an incorrect broken plural pattern. This finding notably corresponds to the results of Ravid and Farah’s (1999) experiment testing noun plural

acquisition in Palestinian Arabic. Ravid and Farah tested children between the ages of two and six on pluralization of nouns that were deemed to be familiar to young children. Their three main findings were that sound feminine plurals are acquired earlier than the other types, that children over-regularize broken plurals to sound plurals rather than select incorrect broken plurals, and that the most common error in sound plural production is the replacement of the sound masculine plural with the sound feminine plural (Ravid & Farah, 1999, p. 192). The correspondence in error production during learning between Dawdy-Hesterberg and Pierrehumbert's model with human acquisition indicates an increased likelihood that their representation of the Arabic plural system is accurate. The findings of their experiment are also well aligned with Boudelaa and Gaskell's (2002) findings that broken plurals appear grouped in phonological space.

Dawdy-Hesterberg (2014) also created a follow up experiment to the corpus study using an open response "wug" format to elicit plurals for nonce forms, or never before seen singular nouns. She checked eight singular CV templates to look for four dominant broken plural templates and four dominant singular templates that use the sound feminine plural, basing frequency on the results of the corpus study described above by Dawdy-Hesterberg and Pierrehumbert (2014). Participants were asked to pluralize both the nonce forms and filler items in written contexts, all in the Modern Standard Arabic dialect. On average 61% of responses for nonce forms used the most frequent plural template for that singular type, but there was low agreement among speakers (Dawdy-Hesterberg, 2014, p. 49). Although the participants all had different backgrounds, Dawdy-Hesterberg concludes that dialect is not a factor in this result (Dawdy-Hesterberg,

2014, p. 72). She ultimately claims that the **CV** template does not restrict plural choice, but influences it via probability-matching, allowing speakers to select a plural that occurs in proportion to its type frequency in the lexicon for a particular singular template (Dawdy-Hesterberg, 2014, p. 69). This means that each plural pattern would be expected to be productive for certain singulars to the extent that it corresponds statistically to those singulars, and that all the broken plural patterns can be thought of as “productive” in that sense. For example, if a certain type of plural occurred 60% of the time with a certain type of singular, it would be applied to nonce forms of that type around 60% of the time. Dawdy-Hesterberg maintains the importance of coarse-grained **CV** template abstraction in plural selection akin to the previous corpus study.

#### 4. Conclusions and Expectations Based on Previous Literature

There are still many aspects of the broken plural patterns to dissect and analyze. Although McCarthy and Prince have observed the iambic foot as an important pattern that is a part of the system, there is insufficient evidence to claim that it is the predominant or only important pattern. The elimination of the initial CV metathesis they assume when analyzing their distributions has a significant effect on those distributions. This, in combination with the distributions of other plural forms such as those with [w] epenthesis, detracts from the argument for an iambic foot default.

Additionally, the sound plural must be considered a dominant and productive pluralization device. The work of Dawdy-Hesterberg and Pierrehumbert (2014) in combination with the work of Boudelaa and Gaskell (2002) has shown how the statistical distribution of both coarse-grained CV templates and more minute phonetic details can actually account for choices between plural patterns by speakers. When confronted with nonce forms, speakers choose plural patterns that are proportionally consistent with statistical type representation in the lexicon.

The forces driving the choice between the sound and broken plural draw attention to the need for an analysis of the relationship between form and semantics as well, particularly diachronically. Ratcliffe's (1998) work on the broken plural cross-linguistically and historically emphasizes this need. Taking the importance of historical development seriously allows for more convincing conclusions about the Arabic broken plural. Finally, analyses of Modern Standard Arabic must not stand in for analyses of regional dialects, but serve as a historical reference point for these spoken variants.

In a first effort to address this issue, the remainder of this thesis examines broken plural data gathered from an Urban Jordanian Arabic native speaker. The broken plural forms are expected to continue to exhibit the results of historical processes that are synchronically maintained by statistical and distributional pressures. In order to explain the diversity of the broken plural and regularity therein, I will appeal to a framework that incorporates pattern generalization and morphological analogy in reference to statistical representation and frequencies of occurrence. Any pattern, even a weak pattern, may be generalizable as long as it is either frequently encountered or widespread enough in a system. The plural system in Arabic is most likely a product of morphological analogy induced by “gang effects,” as outlined by Dawdy-Hesterberg (2014), with similarity or gangs defined by singular-plural correspondences in terms of coarse-grained **CV** templates, which are reinforced by fine-grained phonetic similarities. In this type of system, there is no rule application based on prosodic structure, but generalizability based on structural similarity and prevalence in the system and its subsystems. Prevalence refers to the incidence of certain plural types within groups of similar singular types, and not necessarily across the entirety of the system.

Although Dawdy-Hesterberg's argument is very compelling, I would like to emphasize the factor of semantic significance as an additional motivator of “gang effects.” If certain forms already “gang up” based on phonetic features, their similarity would only be strengthened by the addition of semantic features that are potentially contrastive with other gangs. This does not necessitate that all gangs must have a semantic element, but could explain why smaller gangs, which have semantic

significance, persist in such a system. Neither phonology nor semantics exists in a vacuum. Combining semantics and coarse-grained CV template abstraction can account for both the form and function of the system.

The notion of frequency affecting linguistic structures has been addressed previously in frameworks such as word-based morphology (Bybee, 1985), incorporating the idea of “entrenchment.” Entrenchment indicates that a more frequently encountered linguistic unit is more likely to become a cognitive pattern and extend to other forms by analogy. The type frequency of a particular Arabic plural pattern, or gang, has been shown to directly correlate with its appearance and application to novel forms. Frequency here refers to both type and token frequency. In cases of smaller gangs that provide fewer opportunities for the exposure of a template, those that have frequently encountered members are more likely to remain entrenched (Evans & Green, 2007, p. 114-116). This model also allows for variability among dialects in plural paradigms. If an analogy is consistent enough, a pattern can become entrenched and spur language change. The data analysis that follows is discussed within the framework described, combining frequency, similarity, generalization, and analogy to describe the UJA plural system.

## 5. Urban Jordanian Arabic Data and Analysis

### 5.1 Methodology and Participant Background

Data were obtained from interviews with a 27 year old male native speaker of Urban Jordanian Arabic. The speaker was born in Amman and attended university there. He moved to the San Francisco Bay Area at age 22, and maintains fluency by speaking regularly with family members and enjoying Jordanian media.

The broken plural forms were obtained in isolation, prompted from English words. These words were chosen from examples in literature that has been referenced herein. The data were recorded on an Olympus VN-722PC digital voice recorder and transcribed by the author in IPA. Certain phonetic details, such as nasalization and aspiration, are not specified in the transcriptions because they do not display phonological alternations that affect the formation of broken plurals. All acoustic analyses were performed using Praat. The data sample consists of only 205 singular-plural pairs. Although small, this sample must be considered somewhat representative of the plural system in UJA, at least in terms of which patterns may surface and how the patterns compare to MSA. Since there are evident patterns in the data, these should at the very least not be ignored.

**5.1.1 Analysis overview.** Plurals in UJA may conform with or entirely depart from forms in MSA. There is evidence for analogical leveling of some UJA paradigms, although in many cases the diversity of patterns remains rich. In the current analysis, MSA and UJA are assumed to be variants that most likely descended from the same proto-language, but in current times only interact via dialect contact. The influence of



MSA is particularly evident in semantic domains where MSA is more commonly used than the colloquial dialect. For example, words in the semantic domains of education, religion, or news media are more likely to resemble MSA. This may also be the product of a historical effect. This analysis compares UJA to MSA to showcase their differences and the need for the study of colloquial dialects, while still considering how MSA might interact with UJA given its present status.

The results of the investigation show active use of the sound feminine plural (SFP), sound masculine plural (SMP), dual, and at least nine different discernible groups of broken plurals. Plurals apply up to the number 11, after which a speaker will revert to the singular form of the noun. The broken plural groups have been delineated based on a shared plural **CV** template structure or other significant similarities. Table 11 provides an overview of the phonetic shapes of each broken plural group, their corresponding singulars, and other characteristics shared within each group. The corresponding singulars represent the more common singular shapes for a plural group based on the data collected. Importantly, this does not mean that the shapes of the singular for a plural group are limited only to those indicated in Table 11. The characteristics of each group are discussed in detail in the forthcoming analysis. Some of the plural groups do not possess any shared characteristics aside from the overall **CV** template shape of their singulars and the correlation between these **CV** templates and the plural **CV** template. These particular groups most visibly demonstrate the power of gang effects. Alternative phonetic manifestations of the plurals are also listed.

Table 11

*Phonetic shapes and characteristics of UJA broken plurals*

<b>Plural group</b>	<b>Common singular shapes</b>	<b>Characteristics</b>
<b>Ca.Caa.CiC</b> (Ca.waaCiC, Ca.waa.Ci, Ca.Ca.CiiC, Ca.Caa.Ci)	<b>CVC.CVC</b> <b>CV.CVVC</b> <b>CVV.CVC</b> <b>CVC.CV</b> <b>stem + /-a/</b>	Singular shapes
<b>CCVVC</b>	<b>CVCC</b> <b>CVVC</b> <b>CV.CVC</b>	Singular shapes
<b>CV.'CV(V)C</b>	<b>CVCC</b> <b>CV.CVC</b> <b>stem + /-a/</b>	Initial glottal stop or pharyngeal fricative in singular
<b>?aC.CaaC</b> (?aC.waaC)	<b>CVCC</b> <b>CVVC</b> <b>CV.CVC</b>	Perceptual motivation
<b>?VC.Ci.Ca</b>	<b>CV.CV</b> <b>CV.CVC</b>	Semantics and singular shape
<b>'CV.CVC</b>	<b>CCVC</b> <b>CVCC + /-a/</b>	Singular shapes
<b>stem less /-a/ (Collective- singular pairs)</b>	<b>CV.CVC + /-a/</b>	Semantics
<b>Cu.Ca.Caa</b>	<b>Ca.CiiC</b>	Semantics and singular shape
<b>stem + /-aan/</b>	<b>CVC</b> <b>CVVC</b>	Singular shapes

Despite the groupings defined in Table 11, the plurals remain irregular and do not lend themselves to an overall generalization. The sub-regularities in the groups are addressed in the following sections. This study is not intended to be an exhaustive listing of UJA plurals, a resource that has yet to be compiled. The goal of the analysis is to observe patterns in the data, suggest motivations where they are evident, and recommend further avenues of exploration. The systemic aspects of each identified singular-plural

gang are discussed along with justifications for the use of a gang-size based framework to analyze the UJA plural system. This also includes identifying the shortcomings of the prosodic morphology hypothesis specifically as it might apply to UJA.

## 5. 2 **Ca.Caa.CiC** Plurals

McCarthy and Prince (1990) define this plural template, which is the most prevalent in the UJA data, as iambic. There are 34 instances of this plural, which surfaces as trisyllabic with either a **Ca.Caa.CiC**, **Ca.Ca.CiiC**, or **Ca.Caa.Ci** shape. For example, the plural [ʒa.'naa.dɪb] is a member of this group, from the singular ['ʒun.dub] “grasshopper.” I have chosen to define this plural as **Ca.Caa.CiC** because it has a consistent vowel melody, with low vowels in the first two syllables followed by a high front vowel in the final syllable. Additionally, the regular vowel melody is the reason for the grouping of the other two trisyllabic plurals mentioned above with **Ca.Caa.CiC**. I have chosen the form **Ca.Caa.CiC** to represent this group simply because it is the most commonly referred to form in other literature. Classifying this plural as iambic, as in the prosodic hypothesis, misses both the plural’s vowel regularity and the lack of iambicity in the surface form **Ca.Ca.CiiC**. The precise quality of the vowels appears to be conditioned, allowing [a] to vary with [æ], and [i] to vary with [ɪ],[e], or even [æ] in the environment of pharyngeals. For singulars with penultimate stress, stress in the corresponding plural also falls on the penultimate syllable. For singulars with final stress, stress in the corresponding plural falls on the final syllable. These stress patterns parallel vowel length, since **CVV** and **CVVC** syllables attract stress in UJA, including

word finally (Ahn, 2003). The stress and vowel length features of these plurals are generally consistent with the patterns established by Ahn (2003).

Corresponding singulars are variable in shape, though singulars with more than 3 root consonants are prone to adopting this plural. The feminine singular suffix /-a/ is always dropped in the plural, and no more than four consonants of the singular are included. There is no single main characteristic unifying this singular-plural group, besides some degree of consistency in the number of consonants in the singulars. The correlations between the singulars and plurals of this group may therefore be described as maintained through gang-size effects and analogy, rather than as driven by a specific phonological or semantic factor. For example:

(1)	SG	PL	GLOSS
	ʕan.ka.'but	ʕa.'naa.kɪb	spider
	'mas.ḍʒad	ma.'saa.ḍʒɪd	mosque
	'ʔoɣ.ni.e <sup>10</sup>	ʔa.'yaa.ni	song
	'san.dal	sa.'naa.dɪl	sandal
	'ʕag.rab	ʕa.'gaa.rɪb	scorpion
	'ʔus.baʕ	ʔa.'saa.beʕ	finger

For singulars that have a long vowel in the initial syllable, a [w] is epenthesized in the plural to purportedly act as the second consonant in the iambic template, resulting in **Ca.waa.CiC**, **Ca.wa.CiiC**, or **Ca.waa.Ci**. This would be because the iambic plural is based on the first two morae of the singular, consisting of a long vowel, or **CVV**. Since there would be no consonant provided by the base to fill the second consonant position of

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<sup>10</sup> The final [e] is a manifestation of the singular feminine suffix. The feminine singular suffix is [-a] (or [-at]) in MSA, but appears raised in many contexts in UJA.

the iambic **CVCVV**- template, a [w] is epenthesized in this position. As an alternative to the prosodic explanation, I suggest a possibility that [w] is epenthesized in order to maintain the plural's overall structural similarity to the singular, especially at the word boundary or word finally. This aligns with Steriade's (2000) claims regarding "paradigm uniformity," or that stems are likely to maintain critical contrastive features under derivational or inflectional circumstances. This in turn preserves unity in the lexical paradigm of the stem. A lexical paradigm is defined by Steriade as consisting of a base word and its derivatives (Steriade, 2000, p. 317). Steriade provides examples of this phenomenon in the preservation of English stem stress properties even when affixation creates stress patterns that are not usually accepted in English. Imaginably, in a non-concatenative language, the characteristics of the consonantal root as well as the consonants' ordering with the vowels would be important for the preservation of a lexical paradigm. These features may be the only portions of the singular to appear in the plural. The ordering of the consonants with the vowels in the plural can provide transparency to the structure of its corresponding singular, especially if there is evidence for meaningfulness of a **CV** template in plural derivation, as suggested by Dawdy-Hesterberg and Pierrehumbert (2014). In this case, the plurals do not end in a vowel unless the singular stem, less the feminine singular suffix /-a/, also ends in a vowel. The epenthesis of a [w] allows the critical root consonants to maintain their ordering with the vowels in the plural, resulting in plurals that are more transparently related to the overall **CV** structures of their corresponding singulars.

Compare “song” and “chair” to “pregnant” and “thunderbolt”:

(2)	SG	PL	GLOSS
	'ʔoy.ni.e	ʔa.'yaa.ni	song
	kur.'sii	ka.'raa.si	chair
	'h̄aa.mɪl	h̄a.'waa.mɪl	pregnant
	sa.'ʕææ.qa	sa.'waa.ʕæq	thunderbolt

The first two singulars “song” and “chair” end in a vowel, and correspondingly their plurals do as well. By contrast, the singulars of “pregnant” and “thunderbolt” end in a consonant, and their plurals epenthesize a [w] while also ending in a consonant.

Hypothetically, and ignoring prosodic structure momentarily, ['h̄aa.mɪl] “pregnant” could pluralize as [\*'h̄a.maa.li] and [sa.'ʕææ.qa] “thunderbolt” as [\*sa.'ʕaa.qi], since these types are acceptable manifestations of this template, as in the case of “chair” [ka.'raa.si]. The epenthesis of the [w] allows these singulars to adopt the plural pattern **Ca.Caa.CiC** while maintaining lexical paradigm uniformity from the singular to the plural.

If vowels in the initial syllable of the singular were consistently long for plurals that have [w] epenthesized, then the prosodic hypothesis would be well suited to explain this phenomenon. However, a spectral evaluation of vowel lengths in the singular [sa.'ʕææ.qa] reveals an anomaly in the application of the prosodic hypothesis, supporting the suggestion of paradigm uniformity as the motivation for [w] epenthesis. Under the prosodic hypothesis, the [w] in the plural [sa.'waa.ʕæq] is meant to be fulfilling the requirements of a **CV.CVV-** plural template whose input was a **CVV.CVC** singular. However, the initial vowel [a] in the singular of “thunderbolt” only measures to about 70 milliseconds, which is unlikely to be the duration of a long vowel in UJA (Ahn, 2003, p.

367). Meanwhile, the second vowel [ææ] in the singular measures to about 160 milliseconds, a predicted length for a long vowel and over twice the length of the initial vowel. There is additionally no apparent phonological reason to consider the initial vowel to be long. Given the phonetic facts, there is no prosodic reason why [sa.'ʕææ.qa] should not pluralize as [\*sa.'ʕaa.qi], except for the detail that the stem does not end in a vowel, since the final [a] in the singular is an instance of the feminine singular suffix. I suggest continuing to explore the power of lexical paradigm uniformity by testing the pluralization of nonce forms that lack long vowels in the singular's initial syllable, but share other structural similarities to singulars of the **Ca.Caa.CiC** plural.

It is important to note that UJA does not seem to utilize the template **Ca.Caa.ʔiC** to the same extent as MSA, a template observed by McCarthy and Prince (1990) as also filling consonant slots in the iambic plural for a singular with fewer than four consonants. There is only one instance of this template in the data sample, the word [ri.'saa.le] “letter” pluralizing to [ra.'saa.ʔel]. However, the use of this plural could be influenced by MSA since it exists in the semantic domain of formal writing. Additionally, the word [ḍʒa.'zii.ra] “island,” which is cited by McCarthy and Prince (1990) as adopting this template, pluralizes in UJA as [ʔḍʒu.zar].<sup>11</sup> More research is needed to determine to what extent this template surfaces in UJA, and under what conditions.

Forms that do not have stress on the initial syllable are also problematic for the prosodic hypothesis, since unstressed long vowels in MSA correspond to unstressed short vowels in colloquial dialects (McCarthy, 2005, p. 10-11). Again, there is also no

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<sup>11</sup> The *Hans Wehr Dictionary of Modern Written Arabic* (Wehr, 1994, p. 146) cites this form as usually pluralizing with the same template as UJA, and “rarely” as [ḍʒa.'zaa.ʔir].

phonological reason in UJA to consider these vowels underlyingly long, unless the prosodic hypothesis is adopted for explaining [w] epenthesis. The difference in the vowel lengths between the UJA and MSA forms indicates that the prosodic approach taken in MSA is not appropriate for analyzing UJA. For example, the following forms would have initial long vowels in MSA. As predicted by McCarthy (2005), these unstressed initial vowels do not appear long in UJA.

(3)	SG	PL	GLOSS
	ʕa.'muud	ʕa.wa.'miid	column
	ʒa.'muus	ʒa.wa.'miis	buffalo

Besides maintaining lexical paradigm uniformity at the word boundary by preserving the order of the root consonants and vowels, these plurals also maintain the vowel length identity of the second vowel in the singular. Additionally, the plurals of these singulars are not actually iambic, with a short vowel in the second syllable. Maintaining uniformity with contrastive characteristics of the singular stem is more important than producing an iambic or other characteristic of the plural. These forms reinforce the idea that paradigm uniformity is a factor in manifestations of the **Ca.Caa.CiC** plural, and that prosodic structure is not a requirement for the explanation of [w] epenthesis or plural formation mechanisms.

Singulars with word medial geminate consonants also adopt this plural, splitting the geminate between the second and third consonant positions. For example:



(4)	SG	PL	GLOSS
	ten.'nuu.ra	te.na.'niir	skirt
	ʃub.'bææk	ʃa.ba.'biik	window
	sak.kii.ne	sa.kaa.'kiin	knife
	duk.kaan	da.kaa.'kiin	shop

This is an additional instance of maintaining paradigm uniformity, since both the consonant at the stem boundary and an indication of the geminate are maintained through reduplication or splitting.

The existence of gangs, or the regular correspondence of certain singular **CV** templates to certain plural **CV** templates, provides a basis for the analogical application of a plural template to singulars that may share some characteristics of a gang's singulars. This in turn may increase the size of the gang or add additional gangs, perpetuating the plural template's ability to be analogically applied. For example, consider ['ʃag.rab] "scorpion," and [ʃan.ka.'but] "spider." These singulars share a templatic **CVCCVC**-component, which is also a very typical singular template for the **Ca.Caa.CiC** plural. Since "scorpion" conforms to this singular template completely, the plural [ʃa.'gaa.rɪb] is produced for ['ʃag.rab]. Meanwhile, although [ʃan.ka.'but] has atypical additional consonants in its singular **CV** template, an analogy may be drawn on the components that this form shares with ['ʃag.rab], producing the plural [ʃa.'naa.kɪb]. The **CVCCVC** portion of [ʃan.ka.'but] transfers to the plural analogically to the way it does from ['ʃag.rab]. The **Ca.Caa.CiC** plural can be better interpreted as applying through analogy based on gangs, rather than the need to fulfill prosodic structure requirements.

### 5.3 CCVVC Plurals

The second most common broken plural in the data follows a **CCVVC** monosyllabic template whose corresponding singulars consist mostly of **CVCC**, **CVVC**, or **CV.CVC** forms. There are 24 instances of this plural in the data. These plurals correspond to iambic **CV.'CVVC** type plurals in MSA. The quality of the vowel in the plural form is either a long low vowel [a] or a long vowel that has contrasting frontness or height with the vowel in the singular. Biliteral singulars epenthesize a glide in the plural based on the conditioned long vowel. A [w] appears before [a], while [j] appears before [u]. Finally, geminate consonants also split in this plural template in order to maintain paradigm uniformity, as in “mouth.”

(5)	SG	PL	GLOSS
	'tæ.xɪt	'txuut	bed
	'ga.mar	'gmaar	moon
	'gelb	'gluub	heart
	'kelb	'klaab	dog (m.)
	'dɔɾɜ	'druuɜ	cupboard
	'baab	'bwaab	door
	'diik	'djuuk	rooster
	'beet	'bjuut	house
	'seɪf	'sjuuf	sword
	'tmm	'tmaam	mouth

Although these plurals correspond to what McCarthy and Prince (1990) define as iambic plurals in MSA, the fact remains that the iambic **CV.'CVVC** template is not a relevant or defining characteristic of this pattern in UJA. However, there is a clear

pattern throughout the **CCVVC** plural paradigm, requiring this group to be considered generalizable. In a framework with morphological analogy and gang effects the pattern is easily explained.

#### 5.4 CV.'CV(V)C Plurals

This plural pattern occurs for the same types of singulars as consonant cluster initial **CCVVC** plurals and the [ʔV-] initial templates (discussed in section 5.5). This plural may surface as it would in MSA, following a **CV.'CV(V)C** template. There are 16 singular-plural pairs that follow this pattern in the data. Interestingly, many of these plurals begin with a glottal stop or pharyngeal fricative. These segments are less common word initially in singulars of other plural types. Additionally, a syllabic nasal may occur in place of the initial **CV** sequence of this template. The surfacing of these forms, however, does not seem to be determined on a purely phonological basis, since there are singulars in example set (6) that would acceptably pluralize within one of the other groups.

(6)	SG	PL	GLOSS
	'ye.me	yi.'jum	cloud
	'niʒ.mɛ	ɲ.'zuum	star
	'ʔa.sad	ʔu.'suud	lion
	'wa.lad	ʔu.'laad	boy
	'xa.s <sup>h</sup> am	xu.'s <sup>h</sup> um	opponent
	'ʕa.jɲ	ʕi.'juun	eye
	'ʕa.biɖ	ʕa.'biid	slave
	'ħmar	ħa.'miir	donkey
	'ʔelb	ʔi.'luub	heart
	'ʃart	ʃu.'ruut	condition (preceding state)

Further investigation is required to confirm the appearance of a short vowel in the second syllable of “opponent” and “cloud,” and to determine the significance of the vowel length discrepancy for this plural pattern. These CV.'CVC plurals are grouped with CV.'CVVC plurals because of their stress on the second syllable, vowel alternations, and overall CV template shapes that are characteristic of this group.

Although there are plural members of the groups discussed in sections 5. 2, 5. 3, and 5. 4 that have an iambic component, there is no way to describe their production uniformly. Even within the CV.'CV(V)C set, which corresponds to the iambic CV.'CV(V)C in MSA, there does not seem to be enough consistency to define this group as iambic. The CV.'CVC members of this group would not be considered iambic since word final consonants in Arabic are assumed to be extrametrical. Moreover, the notion of a CVCVV- iambic template applied to the first two morae of the singular does not predict which plural shape will necessarily surface in UJA, nor does it adequately account for the variation in iambic patterns.

### **5. 5 [ʔV-] Initial Plurals**

There are two plural templates in UJA that begin with an initial [ʔV-] sequence that is not found in the singular. These plurals correspond to the same singulars as CCVVC or CV.'CV(V)C plurals. Since the idea of a metathesis has been discredited for MSA above, and is unlikely for UJA as well, the question becomes why these singulars should correspond to [ʔV-] initial plurals rather than a CCVVC or CV.'CV(V)C template.

**5. 5. 1 The ?aC.CaaC template.** In the data set, which is admittedly limited, [ʔa-] sequences lead plurals where an initial consonant cluster is problematic in terms of acoustic perceptibility. Acoustic perceptibility is enhanced by the observance of the Sonority Sequencing principle as discussed in Wright (2004), where it is viewed in terms of acoustic cue robustness. The hierarchy of sonority may be depicted as in Figure 4, with adjustments allowed for variations based on acoustic cue robustness.

highest sonority lowest sonority

Vowels > Glides > Liquids > Nasals > Fricatives > Stops

*Figure 4.* Sonority hierarchy.

Word initial consonant clusters in UJA appear to generally abide by the restrictions of cue robustness. Additionally, sequences of stops and fricatives are acceptable in UJA, as long as their sequencing allows for robust cue encoding.

For example, according to this hierarchy, stops should generally be ordered before fricatives, and so on, because this sequencing allows for an ideal encoding of formant transitions in each following segment. Formant transitions give cues to the place of articulation of consonants, and are best encoded in more sonorous portions of the speech stream. Therefore, stops would be the worst carriers of formant transitions, and vowels the best. Sibilant fricatives may be able to precede stops however, because they have much more intense acoustic energy than other fricatives and would therefore remain perceptible (Wright, 2004, p. 45).

The plurals in example set (8) would result in reduced robustness of acoustic cues if they appeared with initial consonant clusters. I will show that there is convincing

evidence for the adoption of a plural with an initial [ʔa-], specifically **ʔaC.CaaC**, as phonologically and acoustically motivated, so that acoustic cues to the identity of the first root consonant may be encoded in the vowel preceding it. The presence of the initial [ʔa-] also places the first root consonant in the coda position syllabically, allowing it to have a more perceptible release. The release may also encode important acoustic information. This sequence is less preferable than the encoding of cues in a following vowel, but would still increase the acoustic perceptibility of the initial consonant. Unfortunately, the dataset representing this phenomenon is limited, including only 9 out of the 13 singular-plural pairs that use the **ʔaC.CaaC** template. However, the 4 singular-plural pairs in this group that are not motivated by acoustic perceptibility have internal consistency, and so may be described more adequately as a subgroup. The subgroup consists of biliteral singulars that all pluralize as **ʔaC.waaC**. For example:

(7)	SG	PL	GLOSS
	'hææɫ	ʔaḥ.'wææɫ	condition (state)
	'ruuḥ	ʔar.'waaḥ	soul
	'lon	ʔal.'waan	color
	'suug	ʔas.'waag	store

These forms do not have any acoustic cue perceptibility issues, but exhibit regular behavior and have congruent phonological shapes. They may constitute their own gang in a framework of analogical extension based on gang effects. The forms in example set (8) would exhibit poor acoustic perceptibility were they to occur as **CCVVC** plurals, without the initial [ʔa-].

(8)	SG	PL	GLOSS
	'θu.qəl	ʔaθ.'qaal (*'θqaal)	weight (lifting weights)
	'loʃ.be	ʔal.'ʃab (*'lʃab)	toy
	ħa.'fid	ʔħ.'fad (*ħfad)	grandchild

Hypothetically, this reduction in perceptibility would be more effectively remedied by adopting the **CV.'CV(V)C** template, which would allow for the most robust encoding of acoustic cues in the formant transitions into the vowel from the initial consonant. However, UJA seems to disfavor this template at 16 total forms in the data, in opposition to 24 **CCVVC** forms and 34 **Ca.Caa.CiC** forms.<sup>12</sup> Additionally, the **ʔaC.CaaC** template is more structurally analogical to the prevalent **CCVVC** template than to the less common **CV.'CV(V)C** template. Assuming a framework based on generalization, entrenchment, and gang effects, an analogy to the structurally similar **CCVVC** gang is more likely. This is also not the only plural with an initial [ʔV-] that has no corresponding phonetic material in the singular. Therefore, the availability of this type of template in general allows it to be extended to these particular singulars.

Furthermore, Wright (2004) explains that in addition to voicing, Voice Onset Time (VOT) is an important acoustic cue to voicing in stops (Wright, 2004, p. 40-41). This implies that in a voiced stop-voiceless stop sequence, acoustic cues to the identity of the initial segment might be absent, but not in voiceless stop-voiced stop sequence. In UJA, post-aspiration, which also carries durational cues to the place of articulation of the preceding closure, accompanies voiceless stops, making this implication more likely.

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<sup>12</sup> This count includes **Ca.Ca.CiiC** and **Ca.Caa.Ci** plurals.

The data follows these expectations. Without a preceding or following vowel to provide an indication of voicing through VOT, voicing assimilation of root consonants might occur, even in the case of acceptable sonority sequencing. This is avoided by the adoption of the **?aC.CaaC** plural. For example:

(9)	SG	PL	GLOSS
	'gɪ.fəl	?ag.'faal (*'gfaal)	lock
	'ba.tʰaʔ	?ab.'tʰaaʔ(*'bʔʰaaʔ)	hero

As predicted, ['kbaar], which is the plural of [ka'biir] “big,”<sup>13</sup> is permissible, while [\*'bʔʰaaʔ] as the plural for “hero” is not, since it does not provide ideal voice sequencing and poor sonority sequencing. Additionally, there are no consonant cluster onsets in the data consisting of a voiced stop preceding a voiceless stop, and only one instance of a voiced stop preceding a voiceless fricative, but it is a special case. The singular ['ba.ħar] “sea” pluralizes to ['bʔʰaar], causing the initial bilabial stop [b] to devoice. This is permissible because Arabic does not have a voiceless bilabial stop in its phonemic inventory, and so the neutralization of a voicing contrast in this case would never be ambiguous. Additionally, the sonority sequencing in ['bʔʰaar] is more accommodating of cues to the place of articulation of the initial [b] than in the hypothetical [\*'bʔʰaaʔ]. These facts allow for the choice of the **CCVVC** plural ['bʔʰaar] for the singular ['ba.ħar], and the choice of the **?aC.CaaC** plural [ʔab.'tʰaaʔ] for the singular ['ba.tʰaʔ].

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<sup>13</sup> Adjectives in UJA display agreement in number and gender, and may be used as nominals.



The immunity of sibilant fricatives to cue misperceptions is demonstrated in the plurals in example set (10).

(10)	SG	PL	GLOSS
	'ʒa.bal	'ʒbaal	mountain
	'sa.gar	'sguur	falcon
	's <sup>ʕ</sup> a.ħen	'shuun <sup>14</sup>	plate

These forms present no problems in terms of perceptibility. However, sibilant fricatives only retain their immunity if they do not occur adjacently to other sibilant fricatives, or fricatives in the same place of articulation. Previous studies have shown that if two coronal consonants of the same sonority appear adjacently in UJA, they are likely to undergo total assimilation (Zhang & Zuraiq, 2006, p. 36). In an initial consonant cluster, which is already an environment that increases the probability of cue misperception, assimilation would be even more likely. For these reasons, the forms in example set (11) also utilize the **ʔaC.CaaC** plural.

(11)	SG	PL	GLOSS
	'd̥ʒu.zoʔ	ʔaʒ.'zaaʔ (*'ʒzaaʔ)	section (part)
	'ʒi.sem	ʔaʒ.'saam (*'ʒsaam)	body

Both “section” and “body” would have coronal consonant sequences with the same sonority in their hypothetical initial consonant cluster forms. The adoption of an [ʔa-] initial template places the first consonant in a coda position, allowing it to have a

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<sup>14</sup> The uvularized [s<sup>ʕ</sup>] is most likely an acceptable initial member of this consonant cluster because the following consonant is pharyngeal, providing acoustic cues similar to those provided by uvularization.

more perceptible release and avoiding the potential loss of contrast that would occur through assimilation.

Although the consonant cluster in [ʔaq.'saam] “section” observes the sonority sequencing hierarchy and should have adequate acoustic perceptibility, it is possible that there is a preference in this case for a vowel to precede specifically the voiceless uvular stop [q]. In UJA, [q] may contrast with the velar stop [g]. Since uvularization is best expressed on an adjacent low vowel, and the uvular stop [q] does not spread uvularization to a high degree in UJA (Zawaydeh, 1997), an [ʔa-] sequence before the [q] is preferable in order to preserve its acoustic place cues. Otherwise, using the **CCVVC** template [\*'qsaam], the cues to place for the uvular stop would be more susceptible to concealment. Even if the concealment effects were not extreme, this template could surface through analogy and generalization simply because it is an established pattern in UJA, and singulars in the **CVCC** gang pluralize in this fashion. The acoustic effects of uvularization may also explain why [ʔas<sup>ʕ</sup>.'naam], rather than [\*'s<sup>ʕ</sup>naam], surfaces as the plural of the singular ['s<sup>ʕ</sup>a.nam] “sculpture.” Although the sonority sequencing of the hypothetical plural would be acceptable, there are no vowels adjacent to the uvularized [s<sup>ʕ</sup>] to maintain cues to its secondary uvularized identity. Since [s] and [s<sup>ʕ</sup>] are considered contrastive in UJA, a potential neutralization to [s] would be problematic.

Additional support for the phonological motivation of the surfacing of the **ʔaC.CaaC** plural rests in the fact that 22 out of the 24 members of the **CCVVC** plural group have ideal sonority sequencing. Meaning that if the plural is not **ʔaC.CaaC**, it does not face issues of acoustic cue misperception. The two tokens in this group that do

not have ideal sonority sequencing may also be exempt because of the acoustic intensity of their initial consonants, in a similar manner to sibilant fricatives. For example:

(12)	SG	PL	GLOSS
	'xi.tem	'xtuum	seal
	'ħa.bɪl	'ħbaal	rope

These two tokens have poor sonority sequencing upon initial examination. First, consider a spectrographic analysis of the token ['ħbaal] “rope”:

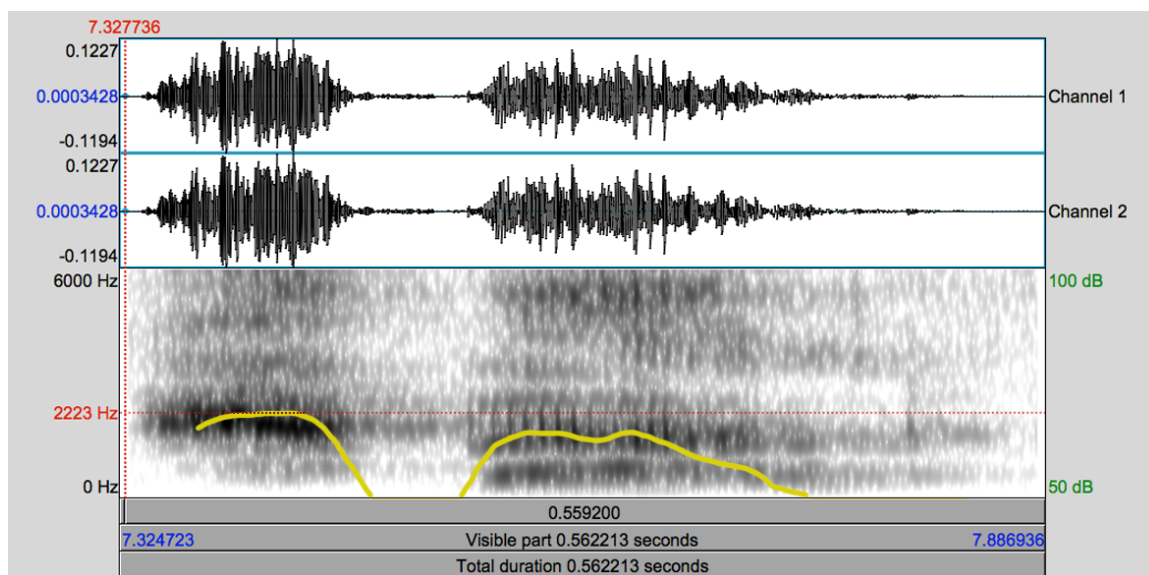


Figure 5. Spectrogram of ['ħbaal] “rope.”<sup>15</sup>

A peak in acoustic intensity is visible for the first consonant [ħ] at around 2000 HZ, the dark shading and yellow intensity line indicating more intensity than the vowel. This intensity could keep [ħ] immune from certain sequencing constraints. Likewise, The initial consonant /x/ of the token ['xtuum] “seal” displays higher acoustic intensity than a

<sup>15</sup> The intensity lines in the spectrograms in Figure 5, Figure 6, and Figure 7, have been thickened using Adobe Photoshop to improve visibility. For the original spectrograms see Appendix B.

regular voiceless velar fricative, rendering it more similar acoustically to a voiceless uvular fricative [χ]. Compare the spectrograms in Figure 6 and Figure 7, the first of which is lead by an initial lower intensity voiceless velar fricative, and the second that is lead by a higher intensity, possibly voiceless uvular fricative:

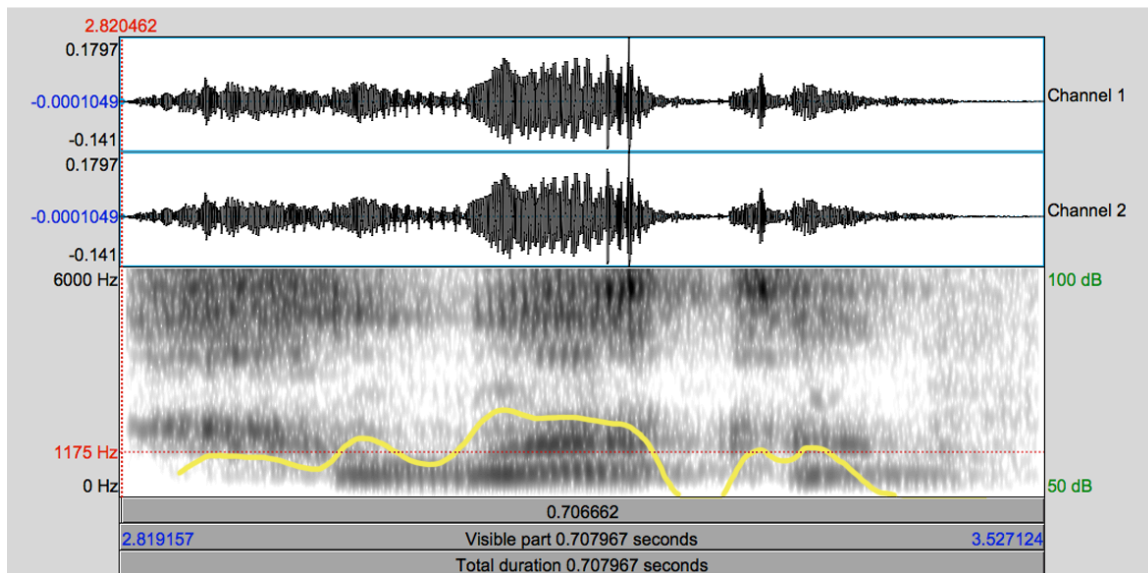


Figure 6. Spectrogram of [xa.'waa.tim] "ring."

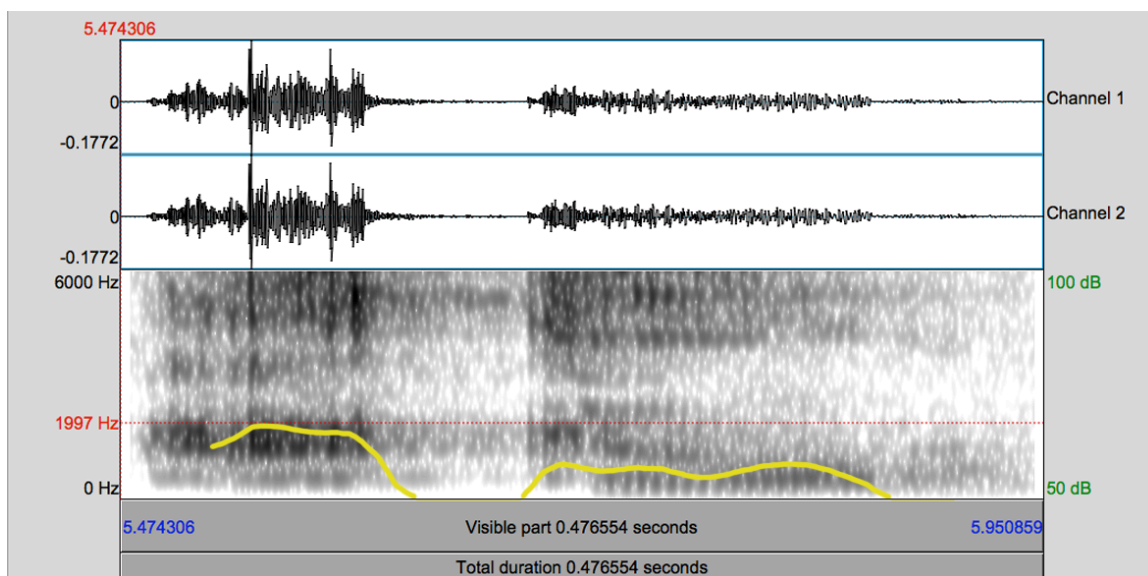


Figure 7. Spectrogram of ['xtuum] "seal."

A peak in acoustic intensity is visible for the first consonant /x/ of ['xtuum] in Figure 7 at around 1800 HZ, the dark shading and yellow intensity line indicating more intensity than the vowel. In contrast, the peak in acoustic intensity for the first consonant [x] of [xa.'waa.tɪm] in Figure 6 indicates a much lower intensity, both in comparison to the intensity of /x/ in ['xtuum] and to the vowel in [xa.'waa.tɪm]. These results indicate that the /x/ in ['xtuum] may be acoustically more similar to a uvular than a velar. Therefore, the acoustic intensity of the uvular-like /x/ and pharyngeal [ħ] may be exempting these consonants from sonority sequencing constraints, in the same manner as sibilant fricatives. These are only single examples, but their acoustic characteristics offer a possible explanation for their behavior. A more thorough examination of these and other exceptions is prudent in order to support this explanation.

The surfacing of the **?aC.CaaC** plural template is phonologically motivated, as a result of acoustic perceptibility phenomena in conjunction with analogical generalizations based on gangs. Neither analogical generalization nor perceptibility phenomena are sufficient to explain the resulting pattern independently, but together provide motivation for the application of this plural template.

**5. 5. 2 ?VC.Ci.Ca plurals.** I have defined **?VC.Ci.Ca** plurals as a separate template, because both the singulars and plurals share structural commonalities that are absent in other templates, and they exhibit behavior that would be unexpected for other templates. They also display a consistent vowel melody. There are 6 instances of this

template in the data. Interestingly, the consultant confirmed all of the singulars that correspond to this plural template as masculine.<sup>16</sup>

(13)	SG	PL	GLOSS
	'ya.tʰa	ʔay.'tʰi.ja	blanket (cover)
	'ye.bi	ʔey.'bi.ja	stupid (m.)
	'da.wa	ʔad.'wi.ja	medicine
	'ye.ni	'ʔey.ni.ja	rich (m.)
	d̥ʒe.'naḥ	ʔaʒ.'ni.ḥa	wing
	su.'ʔaal	'ʔas.ʔi.le	question

For example, the singular ['ye.me] “cloud” (see section 5. 4) is very similar in form to the singular ['ye.ni]. However, the former pluralizes in accordance with the **CV.'CV(V)C** template as [yi.'jum], while the latter pluralizes as ['ʔey.ni.ja]. Additionally, there is no reason to believe that the hypothetical plurals [\*yi.'jun] or **CCVVC** [\*'yjuun] for ['ye.ni] would be problematic. Therefore, it is more likely that ['ʔey.ni.ja] adheres to a specific and separate template, rather than providing a variation on a previously established template.

Ratcliffe (1998) associates this plural with the historically based **Cu.Ca.Caa** template (see section 5. 12. 2) for **Ca.CiiC** singulars (Ratcliffe, 1998, p. 106). However, since in UJA neither the singulars nor the plurals of this group align structurally with this classification, I am describing this plural as a separate template, also possibly historically based. Additionally, if the singulars are all masculine, there could be a basis for some type of semantic gang effect. There is also consistency in the transference of the

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<sup>16</sup> The forms ['ya.tʰa] “blanket” and ['da.wa] “medicine” are both masculine despite the final [a].

consonants of the singular stem to the plural, indicating a regular analogical pattern.

Further investigation of this group is necessary to confirm its behavior.

### 5.6 'CV.CVC Plurals

Although this plural pattern is accepted as very widely prevalent and productive in UJA and MSA, only 14 forms appear in the data. I believe that this is very likely due to the sampling method of the study, which involved drawing examples from literature discussing the broken plural. Due to the accepted default status of the iambic template, there are abundant examples of iambic plurals in the literature. Therefore, the iambic plurals may be overrepresented in this data, and other patterns underrepresented. This plural template may be defined as having a 'CV.CVC structure, with stress on the initial syllable. McCarthy and Prince (1990) define this pattern as trochaic, or consisting of two light syllables. Geminates also split in this plural template, as in “cat.”

(14)	SG	PL	GLOSS
	'ktab	'ku.tʌb	book
	'ħsan	'ħu.sən	horse
	d̤ʒa.'zii.ra	'd̤ʒu.zar	island
	'nug.tʰa	'nu.gatʰ	dot
	'xub.ze	'xu.bɪz	bread
	'yur.fe	'yu.raf	room
	'bɪs.se	'bɪ.sas	cat

Drawing conclusions about this pattern is difficult, as the analogical generalizations characterizing this group appear to be centered mostly on the plural shape itself. Interestingly, the initial vowel is high and back in 13 out of the 14 examples, but

extrapolating this fact to the entire template paradigm is risky considering the small amount of data and the occurrence of this vowel in 4 of the corresponding singulars.

Here is another instantiation of a plural template that enriches the diversity of the system and seems to be maintained by morphological generalization, analogical extension, and gang effects. The analogical application of a plural template may occur when a singular shares some characteristics with an existing gang's singulars, and in the transference of the singular stem's consonants to the plural.

There is at least some sub-regularity apparent for singulars ending with a feminine singular suffix in this group, for example ['xub.ze] "bread" and ['yur.fe] "room." More data relevant to this plural group would most likely reveal the systemic patterns and basis for gang effects. Prosodic structure would not adequately motivate the manifestation of this plural and is not a necessary factor, since the singulars are prosodically diverse.

### **5.7 Mass Nouns**

Certain words in UJA are mass nouns that have plurals in MSA, as count nouns. These mass nouns are likely an extension from the pattern of the use of the singular for nouns that occur in numbers greater than 11. The quantities of the nouns in example set (15) would conceivably occur in larger numbers than 11 more often than not, or in uncountable contexts. The more frequently this pattern is encountered, the more likely it is to become entrenched as a usage mechanism. Therefore, the plurals of these nouns in UJA are referred to with a form identical to the singular.



(15)	SG/PL (mass noun)	GLOSS
	'wa.zɳ	weight
	xe.'jal	shadow/imagination
	'he.mel	load
	'fer	poem
	'barg	lightning
	'ra.ʕad	thunder

This represents a shift in the overall plural system, since these nouns have corresponding countable plurals in MSA and historically. These nouns provide an instance of leveling, or the elimination of a certain pattern in favor of another pre-existing pattern.

### 5. 8 Multiple Plural Possibilities

On several occasions during the interviews, the consultant indicated that two different plurals are permissible for the same singular. In certain instances there is a differentiation in meaning involving the sound feminine plural (SFP) (discussed in section 5. 10), but in others the consultant insisted that the two plurals are entirely interchangeable. The plurals in example set (16) exemplify interchangeability for the same singular with the same sense.

(16)	SG	PL/PL	GLOSS
	ʕa.'muud	ʕa.wa.'miid/ ʕæm.'d aan	column
	'ʔæ.ni.se	ʔæ.ni.'saat/ 'nis.wa	young woman
	'daar	di.'raan/ 'djuur	house
	'mæg.la.me	mæg.la.'maat/ mæ.'gaa.lim	pencil case
	'nug.tʕa	nug.'tʕaat/ 'nu.gatʕ	dot
	ʔil.'san	ʔil.sa.'naat/ ʔal.si.'naʔ	tongue

In three of the above instances, the SFP is an acceptable alternative to the broken plural. The regular use of the SFP as an alternative choice throughout the entire system could be indicative of leveling, at least to some extent, in favor of the SFP. The SFP is not listed in *The Hans Wehr Dictionary of Modern Standard Arabic* (Wehr, 1994) as a possible plural for “dot” or for “tongue,”<sup>17</sup> which contributes to the argument that the SFP has become more widespread in UJA.

On the other hand, in some cases the consultant claimed that multiple plurals are impermissible in UJA, even though they occur and in some cases differentiate meanings in MSA. For example, the forms in example set (17) would be used in UJA to indicate both senses listed under “GLOSS1” and “GLOSS2.”

(17)	SG	PL	GLOSS1	GLOSS2
	'wu.ḏ̣ze	wu.'ḏ̣zuuh	faces	perspective
	'ʃa.ʒa.ra	'ʃa.ʒar	trees	group of trees
	'beet	'bjuut	houses	lines of verse

In UJA, these plural forms are polysemous, meaning that they represent both senses glossed above. In MSA however, a different plural would be used for the senses under “GLOSS2,” as in example set (18).

(18)	SG	PL	GLOSS2
	'wu.ḏ̣ze	ʔaw.'ḏ̣zuh	perspective
	'ʃa.ʒa.ra	ʔaʃ.'ʒar	group of trees
	'beet	ʔab.'jat	lines of verse

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<sup>17</sup> I was not able to find “pencil case” in *The Hans Wehr Dictionary of Modern Written Arabic* (Wehr, 1994).

An additional form, [ˈnufs] “soul” in UJA, is often cited as pluralizing in MSA either to [nu.ˈfuus] “souls,” or [ʔan.ˈfus] “themselves.” In UJA, the second pluralization [ʔan.ˈfus] is unavailable, and the plural [nu.ˈfuus], which is available, cannot be used to mean “themselves.” The connection between form and meaning is not maintained for these types in UJA. This is an example of a reduction in the complexity of the system, or leveling, since a certain pattern is being eliminated in favor of a pre-existing pattern.

Finally, there are instances of different singulars that use the same plural in UJA, seemingly for simplicity.

(19)	SG	PL	GLOSS
	ˈdɔɾɜ	ˈdruɜ	cupboard
	ˈda.raɜ	ˈdruɜ	stair
	ʃa.ˈyiil	ʃa.ˈyii.la	worker
	ˈʃaa.mel	ʃa.ˈyii.la	worker
	ne.ˈbeɸ	ʔa.na.ˈbi.ʃa	well (for water) (m.)
	ˈne.ba.ʃa	ʔa.na.ˈbi.ʃa	well (for water) (f.)

These are actually special cases in that the different pairs of singulars have essentially the same meaning, or could be construed as having the same meaning under certain circumstances. The senses of “cupboard” and “stair” in UJA were also described as somewhat overlapping by the consultant. These forms provide another instance of a reduction in the complexity of the system.

### 5. 9 Use of the Dual

The dual is a productive number marker in UJA. In addition, it appears as a plural for body parts that are paired,<sup>18</sup> while these have associated broken plurals in MSA.

Hebrew, a genetically related language, employs the same type of pluralization device for inherently paired items. The plurals in example set (20) are marked by the dual form in UJA.

(20)	SG	PL	GLOSS
	ɾ. 'ʒal	ɾɿʒ. 'leen	foot
	ʔɿ 'ʒar	ʔɿʒ. 'reen	leg
	'wi.dɿ	wɿd. 'neen	ear
	'ʔiid	ʔii. 'deen	hand

When pressed on this issue for the token for “foot,” the consultant explained that in MSA there is a plural for foot [ʔar.ʒul], but that he would never use this in speech, even if referring to the feet of multiple people. The frequency with which these items have been referred to with the dual seems to have led to the entrenchment of the dual marker as a plural pattern. This group represents a semantically based gang, especially since the singulars are phonologically and prosodically diverse.

### 5. 10 Use of Sound Feminine Plural

The sound feminine plural (SFP) seems to be available for certain singulars in UJA where it is not always available for these singulars in MSA. There are 29 applications of the SFP in the data. If a sound feminine plural and a broken plural are acceptable, the SFP is considered the more “Jordanian” version, as expressed by the

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<sup>18</sup> Except “eyes.”

consultant. This is specifically true in the case of “tongue,” “pencil case,” and “young woman,” as exemplified in section 5. 8.

The SFP is also used in certain cases to indicate a meaningful contrast. In the forms in example set (21) the consultant stated that the use of the SFP indicates a “smaller” form of a singular, while the broken plural indicates a “bigger” form of the same singular.

(21)	SG	PL	GLOSS1/GLOSS2
	'ʕa.ʒal	ʕa.ʒa.'laat/ ʕe.'ʒaal	smaller wheels/bigger wheels
	'ʃa.ʒa.ra	ʃa.ʒa.'raat/ 'ʃa.ʒar	smaller trees/bigger trees

This is evidence for a role of diminution being ascribed to the SFP. The SFP is an important component of the UJA plural paradigm, and should not be treated as merely a minor pattern in describing the system.

The feminine singular suffix may also be used as a diminutive in the singular, as in example set (22).

(22)	SG	PL	GLOSS
	'ħeet <sup>ʕ</sup>	ħI.'t <sup>ʕ</sup> aan	wall
	'ħe.t <sup>ʕ</sup> a	ħI.'t <sup>ʕ</sup> aan	wall (smaller portion of wall)

In this case the plural form is actually the same, but there is a distinction in size indicated by the feminine form in the singular.

Finally, there is also an instance of two homophonous words in the UJA data that use the SFP or broken plural depending on their meanings, shown in example set (23).

(23)	SG	PL	GLOSS
	'xa.s <sup>ʕ</sup> am	xu.'s <sup>ʕ</sup> um	opponent
	'xa.s <sup>ʕ</sup> am	xu.s <sup>ʕ</sup> u.'maat	discount

In this case the SFP maintains a semantic contrast in the plural. Clearly the SFP has multiple and significant roles in the UJA plural system and needs to be considered seriously in a comprehensive analysis of this system. Additionally, the use of the SFP in the ways detailed in this section demonstrates the benefit of including semantic generalizations as well as phonetic ones in capturing the UJA pluralization mechanisms.

### 5. 11 Use of Sound Masculine Plural

The sound masculine plural (SMP) is also used more often with male rational referents in UJA than in MSA. There are 11 applications of the SMP in the data. Certain singulars with male rational referents that would use the broken plural in MSA do not use the broken plural in UJA. Singulars that use the SMP include what are usually referred to as “nisba” or relational adjectives ending in [i], which refer to nationality. I see no reason to differentiate the plurals of these singulars from the SMP because they have the same form, affix to singulars in the same fashion, and in practice have the same meaning.

(24)	SG	PL	GLOSS
	'tur.ki	tur.ki.'jɪn	Turkish
	'ur.du.ni	,ur.du.ni.'jɪn	Jordanian
	'mɪf.t <sup>ʕ</sup> ar	mɪf.t <sup>ʕ</sup> a.'riin	fast breaker
	ʕa.'tʃaan	ʕa.'tʃaa.niin	thirsty
	'mii.jet	mii.'tiin	dead
	fa.'xur	fa.xu.'riin	lofty/proud

The sound masculine plural is clearly an active pattern in UJA as well, since it applies to a semantically related group of words more regularly in UJA than in MSA. A prosodically based description of the plural system does not adequately account for this, while a framework based on generalizations from phonetically and semantically based gangs leaves ample room for the inclusion of the SMP as a regular plural pattern.

### **5. 12 Historically Based Plurals**

There are several additional groups of plural templates that have a direct correlation with forms observed historically and in MSA, based on Ratcliffe's (1998) overview. The groups in 5. 12. 1 and 5. 12. 2 both show very regular semantic and phonetic properties, while the group in 5. 12. 3 is comprised of singulars with variable meanings, genders, and phonetic shapes. However, these forms appear in the UJA plural paradigm even when they have no immediately apparent semantic or phonological motivation, because their templates are adequately represented in the system, allowing them to maintain their status. The patterns remain generalizable across forms, and may have historical semantic significance. There are 29 tokens appearing in these groups in total.

**5. 12. 1 Collective-singular pairs.** A number of singular-plural pairs match what is described by Ratcliffe (1998) as the reflex of a process of backformation. According to Ratcliffe, in MSA there is a set of nouns that have a "collective" sense, meaning that they define a group of objects or items. An individual of one of these groups may be denoted by the addition of the feminine singular suffix (Ratcliffe, 1998, p. 69). These nouns also have a strong semantic correlation, tending to be items that naturally might occur in

groups, specifically plants and animals. UJA has a set of singular plural pairs that follow this template, with the feminine singular suffix manifesting either as [-a] or [-e]. There are 11 instances of this plural in the data. For example:

(25)	SG	PL	GLOSS
	ḍʒɪ.ˈraa.de	ḍʒɪ.ˈraad	grasshopper
	ba.sˁa.ˈle	ˈba.sˁa.l	onion
	ˈʃa.ʒa.ra	ˈʃa.ʒar	tree
	ˈḍʒa.ḍʒe	ˈḍʒaḍʒ	hen
	ˈnaħ.le	ˈna.ħal	bee

Ratcliffe also explains that in MSA, these “collective” plurals can contrast with count plurals, reinforcing their truly collective sense. For example, in MSA [baqara] “cow” may have a corresponding collective plural [baqar], and a count plural [baqaraat], in this case an SFP, “indicating a few or several cows rather than a mass of cattle” (Ratcliffe, 1998, p. 94). In UJA however, this distinction does not exist. The only form of this set that has a contrasting SFP is [ˈʃa.ʒara] “tree,” which is shown in example set (21) to pluralize either to [ˈʃa.ʒar] or [ʃa.ʒa.ˈraat]. Again however, the distinction here is not between a mass sense and a countable plural sense, but between larger and smaller trees. Although UJA still employs the singular-collective pair template, there has been a semantic shift in the plural meanings.

Additionally, though these plurals are similar to 'CV.CVC plurals in prosodic form, they consistently do not exhibit a change in vowel melody as the 'CV.CVC plurals do. They also consistently have singulars with a feminine singular suffix. For these reasons, they are not classifiable with 'CV.CVC plurals. This template is another very



clear manifestation of analogical generalizations based on phonetically and semantically oriented gangs.

### 5. 12. 2 Derived masculine nouns with rational referents (Cu.Ca.Caa).

According to Ratcliffe (1998), the plural template **Cu.Ca.Caaʔ** applies to masculine nouns with rational, or human, referents that have the singular stem shape **Ca.CiiC** (Ratcliffe, 1998, p. 106). McCarthy and Prince (1990) assign these plurals to the trochaic category, which is defined only by the prosodic structure of the plural itself. They identify the final [-aaʔ] sequence as a suffix, without a description of the meaning of this suffix (McCarthy & Prince, 1990, p. 279). Ratcliffe also suggests that this is possibly a suffix, but does not detail its history or meaning either. I believe that this plural can be viewed as another template in its own right, because of the regular shape and semantic consistency of its singulars. In UJA there is a manifestation of this pattern as **Cu.Ca.Caa** that consistently applies to any singular that meets the semantic and morphological criteria. The representation of this template only consists of 4 tokens in the data, presented in example set (26).

(26)	SG	PL	GLOSS
	ʔa.'miir	ʔu.ma.'raa	prince
	na.'biil	nu.ba.'laa	noble
	kæ.'riim	ku.ra.'maa	generous
	ba.'xiil	'bu.xa.laa	miser

A final glottal stop is not apparent for the consultant in these forms, but they adhere to the identified template in all other respects. Stress also appeared to alternate between the initial and final syllable during the interviews with the consultant.

**5. 12. 3 The /-aan/ broken plural.** The final plural group that is discussed here exhibits a change in vowel melody from the singular and the addition of a final /-aan/ sequence. Unfortunately, there is not a satisfying explanation for the source or meaning of these plurals to be found even in Ratcliffe (1998). Ratcliffe provides several different explanations for the surfacing of this form, including suffixation, leftward spreading of the final [n] from a case marking suffix, and the addition of a root consonant due to a biconsonantal root or the “weak” phonetic qualities of one of the root consonants (Ratcliffe, 1998, p. 85). However, none of these suggestions ultimately hold up, at least for UJA. There is no case marking system in UJA, and the /-aan/ plural may also occur with a variety of roots, some of which do not have weak root consonants. McCarthy and Prince treat these forms as “unproductive” Monosyllabic plurals with an /-aan/ suffix (McCarthy & Prince, 1990, p. 213). I suggest that these forms represent the application of an additional plural template, which is enforced again by gang effects. This template is possibly being extended to new singulars as well, since [ʕa.'muud] “column” does not have this plural template listed as a possibility in *The Hans Wehr Dictionary of Modern Written Arabic* (Wehr, 1994), but surfaces with this plural in UJA. This plural group was also surprisingly substantial in the data, consisting of 15 tokens. For example:

(27)	SG	PL	GLOSS
	'daar	di.'raan	house
	'wæ.di	wod.'jaan	valley
	'bal.lad	bul.'daan	country
	ʒa.'muud	ʒæm.'daan	column
	'heet <sup>f</sup>	hi.'t <sup>f</sup> aan	wall
	'hut	hi.'tææn	whale
	'naar	nii.'raan	fire
	ga.'miis	gum.'saan	shirt (button up)

According to Ratcliffe, there is a separate plural group that is similar in shape to the /-aan/ group that applies to plurals of defect, for singulars such as “blind,” “lame,” and “deaf.” Out of these three singulars, shown in example set (28), only “blind” and “lame” use the /-aan/ plural in UJA.

(28)	SG	PL	GLOSS
	'ʒa.ma	ʒem.'jaan	blind
	'ʒa.raʒ	ʒer.'zaan	lame
	'ʔat.raʃ	'tʊ.rʌʃ	deaf

Ratcliffe provides a different singular for “deaf,” but this result actually displays the consequences of phonetic gang effects. The singular ['ʔat.raʃ], which more closely resembles the singulars of “red,” “blue,” and “green”<sup>19</sup> in phonological shape, pluralizes in the same manner as they do, using a 'CV.CVC plural. For example:

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<sup>19</sup> These forms are used both as nouns and adjectives.

(29)	SG	PL	GLOSS
	'ʔaħ.mar	'ħu.mar	red
	'ʔaz.rag	'zu.rʌg	blue
	'ʔax.dar	'xu.dar	green

The plural ['tʊ.rʌʃ] follows the same 'CV.CVC pattern as these color words. A generalization was extended to the singular ['ʔat.raʃ], based on phonetic similarity to ['ʔaħ.mar], ['ʔaz.rag], and ['ʔax.dar], displaying the effects of phonetically based gangs. Besides this, the [-aan] suffix template is clearly an entrenched template that remains productive in UJA.

## 6. Conclusion and Further Research

The patterns of the UJA broken plural are visibly not identical to the MSA broken plural, emphasizing the need to examine colloquial dialects of Arabic in linguistic investigations. The broken plural also cannot be considered entirely separately from the sound plurals, since they all contribute to the plural system through their own particular roles. The plural forms that surface in UJA appear to be a product of the interactions of phonetic shape, semantic meanings, and phonological phenomena. The identified gangs, with a detailed summary of their characteristics, are presented once more in Table 12.

Table 12

*Summary of analysis of UJA broken plurals*

<b>Plural group</b>	<b>Characteristics</b>
<b>Ca.Caa.CiC</b> (Ca.waaCiC, Ca.waa.Ci, Ca.Ca.CiiC, Ca.Caa.Ci)	Some commonalities present in singular shapes. Consistency in the transference of singular properties to the plural, maintaining lexical paradigm uniformity.
<b>CCVVC</b>	Some commonalities present in singular shapes. Consistency in the transference of singular properties to the plural.
<b>CV.'CV(V)C</b>	Common initial glottal stop or pharyngeal fricative in singular.
<b>?aC.CaaC</b> (?aC.waaC)	Perceptually motivated, otherwise similar to <b>CCVVC</b> group in terms of singular correspondence.
<b>?VC.Ci.Ca</b>	Semantic commonalities and commonalities present in singular shapes.
<b>'CV.CVC</b>	Some commonalities present in singular shapes. Consistency in the transference of singular properties to the plural.
<b>stem less /-a/ (Collective-singular pairs)</b>	Semantic commonalities in addition to feminine singular suffix in the singular.
<b>Cu.Ca.Caa</b>	Semantic commonalities and commonalities present in singular shapes.
<b>stem + /-aan/</b>	Some commonalities present in singular shapes. Consistency in the transference of singular properties to the plural.

The transference of singular properties to the plural, a motivating characteristic in 4 of the 9 groups listed in Table 12, indicates the importance of analogical generalization in the plural system. This does not mean that the regular transference of properties from the singular does not occur in the other groups, but that other semantic or phonetic characteristics are more active in preserving the gangs, working alongside analogical generalizations based on the **CV** template. Notably as well, the bigger groups in the UJA data **Ca.Caa.CiC** and **CCVVC** have the transference of singular properties to the plural as their primary characteristic. This is as expected, since larger gangs are better equipped to supply analogical generalizations. Large gang-size would also be a prominent factor in the application of the sound plurals. Although it is possible to describe the broken plural forms in terms of their prosodic structure, it is not possible to motivate the high and productive variability in their shapes or account for their contrastive semantic features. A framework that accounts for the plural system using gang effects and entrenchment allows the diversity of the forms to be recognized, because it can account for pattern applicability and productivity in an irregular system. This productivity has been evidenced by previous experiments by Dawdy-Hesterberg (2014) and Dawdy-Hesterberg and Pierrehumbert (2014), and by the resilience of irregularity in the UJA plural system. An entrenchment and gang based framework also permits an analysis where the diversity of the forms is reduced in certain cases, such as leveling with the dual or SFP, or the adoption of a more prevalent template over a less prevalent one. Although the data in UJA do not exhibit any overarching regularities, as suggested for MSA in

other analyses, there are sub-regularities that are visibly a product of both phonetic and semantic pressures.

In order to continue studying the formation patterns of the UJA plural system and their productivity, I suggest expanding Dawdy-Hesterberg's (2014) "wug" style experiment, and applying it to UJA. Although she found that dialect background did not affect her study, I suspect that an experiment performed on native speakers of a single dialect for pluralization in that dialect might produce more cohesive and additionally insightful results. This type of study would need to be oral rather than written, in order to avoid spelling biases from MSA.

More research is necessary in order to produce a full picture of pluralization in UJA, and pluralization in non-concatenative morphological systems. Further investigation of how and to what extent speakers abstract across forms is also needed, in terms of both semantic and phonological generalizations. Considering these abstractions in terms of frequency distributions, and phonetic and functional similarity, is clearly a step in the right direction.

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## APPENDIX A: Singular-Plural Data Collected by Plural Groups

**SOUND FEMININE PLURAL**

GLOSS	SG	PL
dog (f)	'kel.be	kel.'baat
decision	qa.'rar	qa.ra.'raat
tongue	ʔil.'san	ʔil.sa.'naat
language	'lu.ɣa	lu.'ɣaat
telephone	te.li.fon	te.li.fo.'naat
club (nightclub)	'klɒb	klɒ.'baat
file (computer and paper)	ma.'laf	ma.la.'faat
agreement	ʔi.ti.'faaq	ʔi.ti.faa.'qaat
old woman	sa.'ji.de	sa.ji.'daat
young woman	'ʔæ.ni.se	ʔæ.ni.'saat
stupid (f)	ye.'bi.ja	ye.bi.'jaat
rich (f)	ye.'ni.ja	ye.ni.'jaat
discount	'xa.s <sup>h</sup> am	xu.s <sup>h</sup> u.'maat
difficulty	sor.'ʔu.be	sor.ʔu.'baat
wheel (smaller wheels)	'ʔa.ʒal	ʔa.ʒa.'laat
cart	ʔa.ra.'baj	ʔa.ra.ba'jaat
gate	ba.'waa.be	ba.waa.'baat
tree (smaller trees)	'ʃa.ʒa.ra	ʃa.ʒa.'raat
basket	'sal.le	sal.'laat
forest	'ɣa.be	ɣa.'baat
pencil case	'mæg.la.'me	mæg.la.'maat
blanket	'ħram	ħra.'maat
drum	't <sup>h</sup> ab.le	t <sup>h</sup> ab.'laat
cup	'kææ.se	kææ.'sææt

broom	'muk.ni.si	muk.ni.'saat
machine	ma.'kii.ne	ma.kii.'naat
glasses	nad.'dʰa.ra	nad.dʰa.'raat
hall	'qa.ʕa	qa.'ʕaat

### SOUND MASCULINE PLURAL

GLOSS	SG	PL
Roman	'ru.mi	ru.mi.'jɪn
Turkish	'tur.ki	tur.ki.'jɪn
Jordanian	'ur.du.ni	ur.du.ni.'jɪn
fast breaker	'mɪf.tʰar	mɪf.tʰa.'riin
thirsty (person)	ʕa.'tʃaan	ʕa.'tʃaa.niin
dead (person)	'mii.jet	mii.'tiin
worshipper	'muʔ.men	muʔ.mi.'niin
lofty (person, proud)	fa.'xuʊr	fa.xuʊ.'riin
seller	ba.'jaʃ	ba.ja.'ʕiin
defect (thing)	maʃ.'tʰuʊb	maʃ.tʰuʊ.'biin

### DUAL

GLOSS	SG	PL
foot	rɪ.'ʒal	rɪʒ.'leen
leg	ʔɪ.'ʒar	ʔɪʒ.'reen
ear	'wɪ.dɪ	wɪd.'neen
hand	'ʔiid	'ʔii.deen

**GROUP 1 (Ca.Caa.CiC)**

GLOSS	SG	PL
notebook	<sup>1</sup> daf.tar	da. <sup>1</sup> faa.tir
chair	kur. <sup>1</sup> sii	ka. <sup>1</sup> raa.si
grasshopper (MSA)	<sup>1</sup> ʒun.dub	ʒa. <sup>1</sup> naa.dib
finger	<sup>1</sup> ʔus.baʃ	ʔa. <sup>1</sup> saa.beʃ
shoe (formal)	<sup>1</sup> kunn.du.ra	kæ. <sup>1</sup> naa.dir
club	<sup>1</sup> nææ.di	næ. <sup>1</sup> wææ.di
mosque	<sup>1</sup> mas.ḍʒad	ma. <sup>1</sup> saa.ḍʒid
mosque	<sup>1</sup> ʒaa.meʃ	ʒa. <sup>1</sup> waa.meʃ
spider	ʃan.ka. <sup>1</sup> but	ʃa. <sup>1</sup> naa.kib
pregnant (person)	<sup>1</sup> ḥaa.mil	ḥa. <sup>1</sup> waa.mil
song	<sup>1</sup> ʔoy.ni.e	ʔa. <sup>1</sup> ʔaa.ni
scorpion	<sup>1</sup> ʃag.rab	ʃa. <sup>1</sup> gaa.rib
thunderbolt	sa. <sup>1</sup> ʃææ.qa	sa. <sup>1</sup> waa.ʃæq
sandal	<sup>1</sup> san.dal	sa. <sup>1</sup> naa.dil
spoon	<sup>1</sup> mæʃ.li.ga	mæ. <sup>1</sup> ʃaa.lig
ignorant (person)	<sup>1</sup> ʔa.ha.bal	ha. <sup>1</sup> baa.jil
sect	<sup>1</sup> tʰaa.ʃi.fe	tʰa. <sup>1</sup> waa.ʃif
letter (formal written)	ri. <sup>1</sup> saa.le	ra. <sup>1</sup> saa.ʔel
ring	<sup>1</sup> xaa.tim	xa. <sup>1</sup> waa.tim
pencil case	<sup>1</sup> mæg.la. <sup>1</sup> me	mæ. <sup>1</sup> gaa.lim
buffalo	ʒa. <sup>1</sup> muus	ʒa.wa. <sup>1</sup> miis
column	ʃa. <sup>1</sup> muud	ʃa.wa. <sup>1</sup> miid
dress	fusʃ. <sup>1</sup> tʃan	fa.sʃa. <sup>1</sup> tiin
bird	ʃas. <sup>1</sup> fuur	ʃa.sa. <sup>1</sup> fiiir
pig	xæn. <sup>1</sup> ziir	xæ.na. <sup>1</sup> ziir
defect (person)	maf. <sup>1</sup> tʃuub	ma.ʃa. <sup>1</sup> tʃiib

key	mɪf.'taaħ	ʔɪl.sa.'naat
law	qa.'nuun	qa.wa.'niin
skirt	ten.'nu.ra	te.na.'niir
window	ʃub.'bææk	ʃa.ba.'biik
knife	sak.kii.ne	sa.ka.'kiin
shop	duk.kaan	da.ka.'kiin
snake	'ħaj.je	ħa.'jaa.ja
lip	'ʃɪf.fe	ʃa.'faa.ʃɪf

## GROUP 2 (CV.'CV(V)C)

GLOSS	SG	PL
cloud	'ye.me	yi.'jum
star	'nɪʒ.me	ɲ.'ʒuum
lion	'ʔa.sad	ʔu.'suud
boy	'wa.lad	ʔu.'laad
opponent	'xa.s <sup>ʔ</sup> am	xu.'s <sup>ʔ</sup> um
wheel (bigger wheels)	'ʕa.ʒal	ʕe.'ʒaal
eye	'ʕa.jɲ	ʕɪ.'juun
slave	'ʕa.bid	ʕa.'biid
donkey	'ħmar	ħa'miir
condition (preceding state)	'ʃart	ʃu.'ruut
heart	'ʔelb	ʔɪ.'luub
science (knowledge)	'ʕɪ.ləm	ʕu.'luum
effort	'd̪ʒu.hʌd	d̪ʒu.'huud
flag	'ʔa.lam	ʔe.'laam
soul	'nufs	nu.'fuus
eagle	'nɪ.ser	ɲ.'suur

**GROUP 3 (?aC.CaaC)**

GLOSS	SG	PL
weight (lifting weights)	'θu.qəl	?aθ.'qaal
body	'ʒi.sem	?aʒ.'saam
lock	'gɪ.fəl	?ag.'faal
sculpture	's <sup>f</sup> a.nam	?as <sup>f</sup> .'naam
hero	'ba.t <sup>f</sup> əl	?ab.'t <sup>f</sup> aal
toy	'loŋ.be	?al.'ŋaab
section (part)	'd̄ʒu.zoʔ	?aʒ.'zaaʔ
section (part/department)	'qi.sɱ	?aq.'saam
grandchild	ħa.'fid	?aħ.'faad
condition (state)	'ħææɫ	?aħ.'wææɫ
soul	'ruuħ	?ar.'waaħ
color	'lon	?al.'waan
store	'suug	?as.'waag

**GROUP 4 (?VC.Ci.Ca)**

GLOSS	SG	PL
blanket (cover)	'ɣa.t <sup>f</sup> a	?aɣ.'t <sup>f</sup> i.ja
medicine	'da.wa	?ad.'wi.ja
stupid (m)	'ɣe.bi	?ey.'bi.ja
rich (m)	'ɣe.ni	'?ey.ni.ja
wing	d̄ʒe.'naħ	?aʒ.'ni.ħa
question	su.'?aal	'?as.ʔi.le



**GROUP 5 (CCVVC)**

GLOSS	SG	PL
shoe (regular)	'boot	'bwaat
heart	'gelb	'gluub
dog (m)	'kelb	'klaab
mountain	'ʒa.bal	'ʒbaal
sword	'seɪf	'sjuuf
moon	'ga.mar	'gmaar
house (living place, line of verse)	'beet	'bjuut
house	'daar	'djuur
door	'baab	'bwaab
cupboards	'dʊɹʒ	'druuʒ
stair	'da.raʒ	'druuʒ
monkey	'gɪrd	'gruud
rooster	'diik	'djuuk
big	ka'biir	'kbaar
bed	'tæ.xɪt	'txuut
plate	'sʰa.ɦen	'shuun
man	'ze.la.me	'zlaam
sea	'ba.ɦar	'b̥ɦaar
camel	'd̥ʒa.mal	'd̥ʒmaal
year	'sa.ne	'sniin
falcon	'sa.gar	'sguur
mouth	'tɪmm	'tmaam
seal	'xi.tem	'xtuum
rope	'ɦa.bɪl	'ɦbaal

**GROUP 6 (Collective-singular)**

GLOSS	SG	PL
grasshopper	ḏ̄ʒi.ˈraa.de	ḏ̄ʒi.ˈraad
onion	ba.sˈa.ˈle	ˈba.sˈa.l
tree	ˈʃa.ʒa.ra	ˈʃa.ʒar
hen	ˈḏ̄ʒa.ḏ̄ʒe	ˈḏ̄ʒad̄ʒ
bee	ˈnaħ.le	ˈna.ħəl
cow	ˈba.ga.ra	ˈba.gar
sheep	ˈʕe.na.me	ˈʕe.nam
goat	ˈmæ.ʃa.ze	ˈmæ.ʃaz
date	ˈtam.ra	ˈta.mər
egg	ˈbee.dˈa	ˈbeedˈ
twig	ˈxa.ʃa.be	ˈxa.ʃab

**GROUP 7 ('CV.CVC)**

GLOSS	SG	PL
book	ˈktab	ˈku.tʌb
horse	ˈħsaan	ˈħu.sən
island	ḏ̄ʒa.ˈzii.ra	ˈḏ̄ʒu.zar
dot	ˈnug.tˈa	ˈnu.gatˈ
loaf of bread	ˈxub.ze	ˈxu.biz
room	ˈʕur.fe	ˈʕu.raʃ
dark (person)	ˈʔas.mar	ˈsu.mar
deaf	ˈʔat.raʃ	ˈtu.rʌʃ
red	ˈʔaħ.mar	ˈħu.mar
blue	ˈʔaz.rag	ˈzu.rʌg
green	ˈʔax.dar	ˈxu.dar
grape	ˈʕun.be	ˈʕu.nʌb

cat	'bis.se	'bi.sas
alley (small place)	'zug.ga	'zu.gag

**GROUP 8 (Cu.Ca.Caa)**

GLOSS	SG	PL
prince	ʔa.'miir	ʔu.ma.'raa
noble	na.'biil	nu.ba.'laa
generous (person)	kæ.'riim	ku.ra.'maa
miser	ba.'xiil	'bu.xa.laa

**GROUP 9 (/ -aan/)**

GLOSS	SG	PL
house (daar)	'daar	di.'raan
Roman	'ru.mi	ru.'maan
valley	'wæ.di	wud.'jaan
country	'bal.lad	bul.'daan
column	ʔa.'muud	ʔæm.'daan
wall	'heetʰ	hi.'tʰaan
wall (smaller portion of a wall)	ʰe.tʰa	hi.'tʰaan
whale	'hut	hi.'tææn
fire	'naar	nii.'raan
lame	'ʔa.raʒ	ʔer.'zaan
blind	'ʔa.ma	ʔem.'jaan
lame	'ʔa.raʒ	ʔer.'zaan
neighbor	'dʒaar	zii.'raan
shirt (button up)	ga.'miis	gum.'saan

**IRREGULAR**

GLOSS	SG	PL
girl	'bmt	ba.'naat
woman	'ma.ra	nɪs.'wan
young woman	'ʔæ.nɪ.se	'nɪs.wa
worker	'ʕaa.mel	ʃa.'ʕii.la

**MASS NOUNS**

GLOSS	SG/PL
weight	'wa.zɪ
shadow/imagination	xe.'jal
load	'he.mel
poem	'ʃer
lightning	'barg
thunder	'ra.ʃad
cattle	ha.'lal
wind/air	'ha.wa

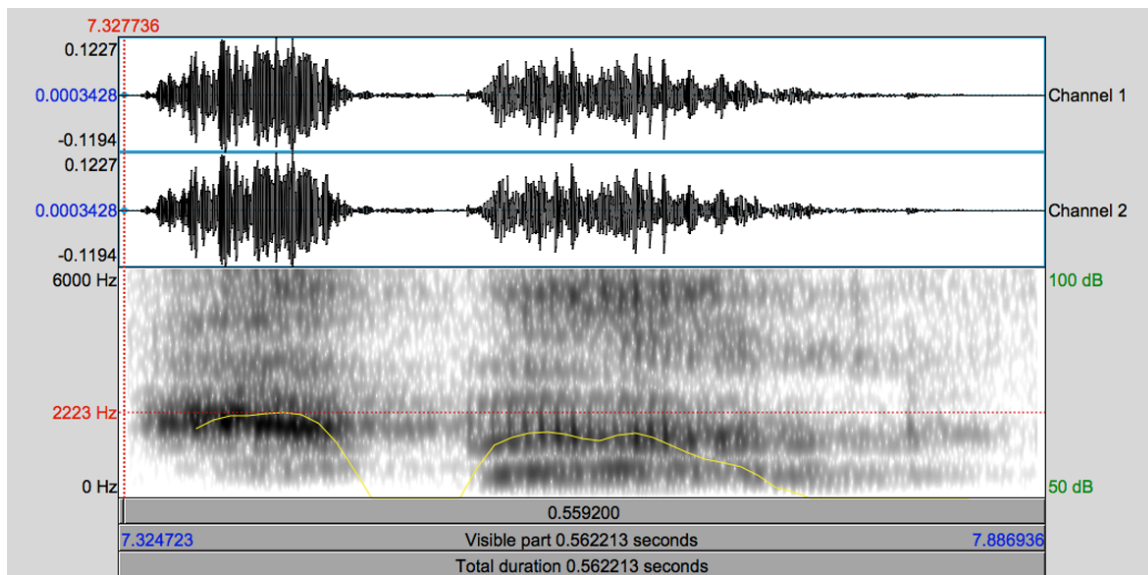
**UNSURE**

GLOSS	SG	PL
shadow	ðʕəH	ðʕə.'laal
well (for water) (m)	ne.'beʕ	ʔa.na.'bi.ʃa
well (for water) (f)	'ne.ba.ʃa	ʔa.na.'bi.ʃa
tongue	ʔɪl.'san	'ʔal.si.'naʔ
worker	ʃa.'ʕiil	ʃa.'ʕii.la
student	'tʕa.lɪb	tʕul.'laab

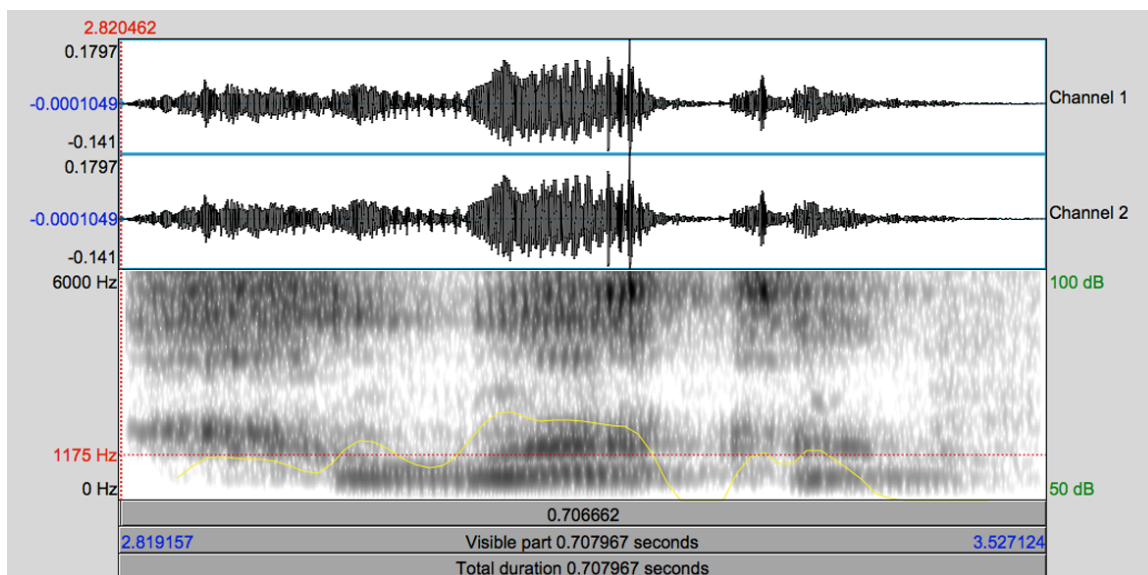
newspaper column (MSA)	ʕa.ˈmuud	ˈʕaa.mi.de
black (thing)	ˈʔas.wad	ˈsuud
white (thing/person)	ʔa.bi.ˈjadʕ	ˈbiidʕ
comb	ˈmu.ʃotʕ	mu.ˈʃaatʕ
face	ˈwu.dʒe	wu.ˈdʒuuh
elephant	ˈfiil	ˈfi.ja.la
night	ˈleɲl	le.ˈjaa.li
clothing (no singular)	----	ʔa.ˈwaa.ʕe

## Appendix B: Original Spectrograms

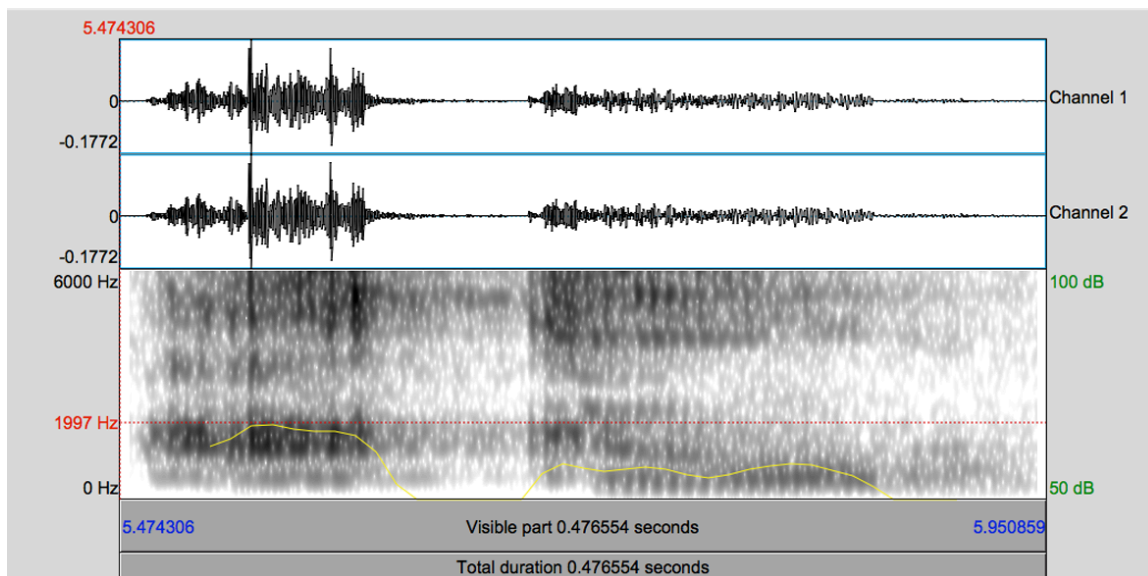
[ 'hbaal]



[xa. 'waa.tim]



['xtuum']



## Appendix C: Human Subjects IRB Approval



**SAN JOSÉ STATE  
UNIVERSITY**

**Division of Academic Affairs**

**Associate Vice President  
Graduate Studies & Research**

[www.sjsu.edu/gradstudies](http://www.sjsu.edu/gradstudies)

One Washington Square  
San José, California 95192-0025  
Voice: 408-924-2427

[www.sjsu.edu](http://www.sjsu.edu)

To: Netta Ben-Meir

From: Pamela Stacks, Ph.D.  
Associate Vice President  
Graduate Studies and Research

Date: October 9, 2014

The Human Subjects-Institutional Review Board has approved your request to use human subjects in the study entitled:

“Patterns of the Jordanian Broken Plural”

This approval is contingent upon the subjects participating in your research project being appropriately protected from risk. This includes the protection of the confidentiality of the subjects' identity when they participate in your research project, and with regard to all data that may be collected from the subjects. The approval includes continued monitoring of your research by the Board to assure that the subjects are being adequately and properly protected from such risks. If at any time a subject becomes injured or complains of injury, you must notify Dr. Pamela Stacks, Ph.D. immediately. Injury includes but is not limited to bodily harm, psychological trauma, and release of potentially damaging personal information. This approval for the human subject's portion of your project is in effect for one year, and data collection beyond October 9, 2015 requires an extension request.

Please also be advised that all subjects need to be fully informed and aware that their participation in your research project is voluntary, and that he or she may withdraw from the project at any time. Further, a subject's participation, refusal to participate, or withdrawal will not affect any services that the subject is receiving or will receive at the institution in which the research is being conducted.

If you have any questions, please contact me at (408) 924-2427.

Protocol # S1404033

cc. Daniel Silverman 0093