Studies in Arabic Linguistics

Perspectives on Arabic Linguistics XXX

Edited by Amel Khalfaoui and Matthew A. Tucker

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Studies in Arabic Linguistics

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Volume 7

Perspectives on Arabic Linguistics XXX. Papers from the annual symposia on Arabic Linguistics, Stony Brook, New York, 2016 and Norman, Oklahoma, 2017
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Papers from the annual symposia on Arabic Linguistics, Stony Brook, New York, 2016 and Norman, Oklahoma, 2017

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Acknowledgments

This volume contains nine chapters based upon contributed papers and two keynote addresses that were presented at the *Thirtieth Annual Symposium on Arabic Linguistics* held at Stony Brook University in 2016 and the *Thirty-First Annual Symposium on Arabic Linguistics* held at the University of Oklahoma in 2017. All contributed papers presented at the symposia were accepted after abstract submission and anonymous peer review. After the symposia, a call for manuscript submissions was made to all participants and all manuscripts, including those based upon invited keynote talks, were subject to anonymous peer review, revision, and resubmission. Only a subset of the initially submitted papers were selected for publication in this volume.

We are thankful to all of our anonymous reviewers for their hard work on evaluating – and in many cases greatly improving – the papers in this volume. In addition, the *Thirtieth Annual Symposium on Arabic Linguistics* was held in conjunction with the *Forty-Sixth Linguistic Symposium on Romance Languages*, and we thank the Arabic Linguistics Society board and program board of the *Linguistic Symposium on Romance Languages* for facilitating the conference and review process. We are also especially grateful to the Stony Brook University Department of Linguistics, the Stony Brook University Center of Italian Studies, the Stony Brook University Office of the Provost, the Stony Brook University College of Arts & Sciences, and the Arabic Linguistics Society, all of whom generously supported the 30th Symposium. Finally, we are grateful to the Office of the Senior Vice President and Provost of the University of Oklahoma, the College of International and Area Studies, the College of Arts and Sciences, the Department of International and Area Studies, and the Department of Modern Languages, Literatures and Linguistics at the University of Oklahoma, all of whom supported the 31st Symposium.

Introduction

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This volume contains nine anonymously peer-reviewed papers. Seven chapters of this volume are based on selected papers originally presented at the *Thirtieth Annual Symposium on Arabic Linguistics* that was held at Stony Brook University in 2016, and two chapters are based on papers presented at the *Thirty-First Annual Symposium on Arabic Linguistics* that was held at the University of Oklahoma in 2017. The chapters are theoretical and experimental explorations of a variety of linguistic topics and engage ideas ranging over three broad areas of research: phonetics and phonology, syntax, and experimental and computational linguistics. They deal with Classical and Modern Standard Arabic as well as a variety of dialects, including Iraqi, Egyptian, Moroccan, and Syrian Arabic.

Part I, Phonetics and Phonology, consists of two chapters. The first chapter by John McCarthy is entitled "How to delete". In this paper, McCarthy's paper provides several case studies which are used to argue for a particular conception of the grammatical process of deletion in the framework of Harmonic Serialism (HS), a theoretical successor to classical Optimality Theory. McCarthy shows that HS is well-suited to analyzing deletion of phonological material as gradual attrition or weakening instead of wholesale deletion in one fell swoop. As empirical confirmation of this analysis, McCarthy notes that Arabic dialects are shown to differ in the susceptibility of vowels to deletion: in some dialects, /i/ and /u/ delete, whereas /a/ does not, but in others, all three vowels are susceptible to deletion. McCarthy provides a theory of markedness which provides low vowels with more structure than high vowels and demonstrates that this differential susceptibility to deletion in certain dialects results from derivations which delete the vowels with less structure. McCarthy also shows that this conceptualization of deletion predicts that deletion and weakening contexts will be coextensive, a claim which is supported by patterns of vowel reduction and antigemination effects in Syrian Arabic, where vowel deletion for prosodic concerns cannot create a geminate by deleting a vowel between two identical consonants.

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The second chapter in Part I is by Stuart Davis and is entitled "Are There Transfer Effects in the Arabic Comparative?" In this paper, Stuart provides argumentation based on Egyptian Arabic that the comparative, unlike the broken plural (and diminutive), shows no clear transfer effects from a base word, and, consequently, constitutes a true root-based morphological process. Excluding the possible marginal exception of the comparative of [gidiid] 'new/recent' as [agdad], the phonological form of the apparent base word plays virtually no role in determining the specific phonological form that the comparative takes. Davis concludes that, assuming that the findings based on Egyptian Arabic hold for other dialects, one can conclude that the comparative in general reflects a morpheme-based process that supports the morphological status of the consonantal root. It is a root-based word formation process, as opposed to other word formation processes which may be plausibly both word- and root-based in different contexts.

Part II, Syntax, contains four chapters. The first chapter is by Yahia Aldholmi, Hamid Ouali, and Tue Trinh and is entitled "On Complex Adjectival Phrases in Standard Arabic." Aldholmi, Ouali, and Trinh start by presenting three puzzling observations concerning a class of adjectival constructions in Standard Arabic: (i) the appearance of pleonastic definiteness, where an instance of definite morphology is semantically transparent; (ii) required resumption, where the absence of a resumptive pronoun leads to deviance; and (iii) case and agreement misalignment, where the domain for structural case assignment does not coincide with the domain for agreement marking. The authors of this paper then propose a resolution for these puzzles in terms of syntax-semantics mapping. Their proposal takes seriously the idea that semantics is purely interpretive of syntactic structure insofar as syntax delivers fully-formed representations which semantics then interprets. The proposal includes two generalizations about case and agreement which turn out to concur to a large degree with widely accepted views on syntactic relations concerning these phenomena. The generalizations are (i) that arguments of transitive predicates receive accusative case and arguments of one-place predicates receive nominative case, and (ii) that sentential nodes are barriers for agreement.

Ahmad Alqassas's contribution is the second chapter in the volume and is entitled "The syntax of negative coordination in Jordanian Arabic." In this paper Alqassas describes negative coordination and puts forward an analysis for this unexplored topic in Arabic. The paper argues that laa-wala coordination is a disjunction construction distinct from the construction involving two negative phrases/clauses coordinated by wa-. The analysis projects a Disjunction Phrase (DisjP) headed by wala which coordinates two disjuncts (two DPs, two CPs… etc.), the first disjunct occupying the Spec,DisjP and the second disjunct as a complement of DisjP. The analysis shows that wala is a disjunction operator with an uninterpretable negation feature (i.e., an NCI) licensed by a negative operator.

With a postverbal DisjP, the negative operator is maa; elsewhere it is a covert negative operator that dominates DisjP. With coordinated DPs, the analysis shows that singular agreement on the verb involves clausal coordination and VP ellipsis in one disjunct.

The third chapter in Part II is by Murtadha Bakir and is entitled "*huwwa*: A Focus Operator in Iraqi Arabic." In this chapter, Bakir gives an account of the function and interpretation of the pronoun *huwwa* found in a variety of clausal constructions in Iraqi Arabic. The distribution of this element in Iraqi Arabic is observed, not only in verbless equational sentences with focused elements, but also in one type of wh-questions and in yes/no questions. The analysis of this pronominal element indicates that the clause constructions in which this element assumes a medial position are of two types. The first is wh-questions with a cleft-like structure which consist of a subject DP in the form of a headless relative clause and a predicate consisting of a wh-phrase. The second construction is that of verbless equational sentences in which the subject is a definite DP and the predicate is another definite DP. This pronominal element may also be found in a clause-initial position in yes/no questions. Bakir shows that a number of earlier accounts are untenable. This includes accounts that consider the pronominal *huwwa* as an identifying predicate, a quasi-verb, or just an agreement marker generated in INFL. Bakir puts forth an alternative account; he argues that this element could more appropriately be considered a focus operator occupying the head position in a Focus Phrase (FocP; one of the functional projections in the left periphery of the clause architecture), with the focused DP or wh-phrase occupying the specifier position of that phrase. Similarly, in yes/no questions, this element plays the same role as a focus operator and is assumed to occupy the same position as the head position of FocP. Yes/No questions, however, do not exhibit a specifically focused element that might move to the specifier of FocP.

Part III, Computational and Experimental Linguistics, consists of two chapters. The first chapter is by Matthew Tucker, Ali Idrissi, Jon Sprouse, and Diogo Almeida. This chapter contributes the results of two experiments on the grammatical status of resumptive pronouns and island violations in Modern Standard Arabic. Tucker, Idrissi, Sprouse, and Almeida argue that previous experimental work on resumptive pronouns which concluded that resumptive pronouns did not help amnesty ungrammaticalities associated with island constraint violations was focused on a small array of languages where resumptive pronouns are otherwise somewhat marginal grammatically. Using Modern Standard Arabic's more pervasive system of resumption, the authors present two Likert-style acceptability studies which cross island violation status with resumptive pronoun use for three types of islands: (i) adjunct islands, (ii) whether-islands, and (iii) Complex Noun Phrase Constraint violations. The authors argue that the results of these studies show that

island violations can be repaired by resumptive pronouns in Modern Standard Arabic, but that the strength of this repair is dependent on the particular island type being violated. The results of this study support the idea that island violations can be grammatically repaired by resumptive pronoun use, but for this result to be observable experimentally, the grammatical conditions must be sufficient to reveal that repair in quantitative studies.

Cheng-Wei Lin's contribution is the second chapter in Part III and the last chapter in this volume. It is entitled "A probabilistic approach to stress assignment in Arabic." In this chapter Lin provides a proof-of-concept analysis of a computational language model designed to acquire the stress system of Arabic as represented in the popular dictionary of Arabic. Lin argues that probabilistic language models are capable of expressing many of the generalizations central to modern theoretical linguistics work and suggests that the stress system of Arabic is one place where probabilistic models have not yet been constructed for empirical domains that are well-understood in theoretical work. Lin presents a frequency distribution of stress in Arabic analyzed along several dimensions (syllable structure, position of the stressed syllable, etc.) and a bi-gram language model stated over syllable types as a test case for a probabilistic account of stress assignment in Arabic. The paper also discusses a Monte Carlo-inspired acquisition simulation designed to assess the language model's success in capturing the stress facts of Arabic. Lin argues that the results show that even a simple language model such as a bigram model of stress can account for a large array of the stress facts of a given language. This, Lin suggests, is a conclusion which licenses further frequency-based accounts of stress-assignment in Arabic and in other languages.

The nine papers presented in this volume are diverse and highlight a myriad of different approaches currently being employed by researchers investigating numerous distinct varieties of the Arabic language. The papers contribute to both descriptive and theoretical treatments of Arabic in innovative ways, as well as offer insights into the study of human language more generally. It is our sincere hope the papers in this volume will be intellectually illuminating and will stimulate further research.

PART I

Phonetics and phonology

How to delete

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Using data from Arabic and other languages, this chapter argues that segmental deletion processes are gradual in the sense that segments are lost through attrition rather than all at once. The argument is framed within Harmonic Serialism, a derivational version of Optimality Theory that allows deletion processes to be decomposed into successive reduction steps.

Keywords: Optimality Theory, Harmonic Serialism, deletion

1. Introduction

How do segments delete? Does the entire segment disappear in a single operation? Or does the segment disappear gradually because multiple operations have taken away its structure piece-by-piece? This chapter will argue that segmental deletion is a gradual process that occurs through successive reduction operations.

This argument is set within Optimality Theory (OT; Prince & Smolensky, 1993/2004), specifically within a derivational version of OT called Harmonic Serialism (HS; McCarthy, 2010, and references cited there). In OT, the operational component is called Gen, and thus the argument of this chapter is that Gen includes an operation that deletes parts of segments, but no operation that can delete the multiple parts of a structurally complex segment simultaneously. Evidence will be drawn from Arabic and other languages.

This chapter is laid out as follows. I begin by explaining what HS is and how it offers a new perspective on deletion processes. I also review evidence that an HS approach to deletion is the right one. I then turn to Arabic, discussing various consequences of this approach for the analysis of Arabic (classical and colloquial), with occasional forays into other languages. The chapter concludes with an overview of some of the questions that have been raised by this project but not yet answered.

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2. About Harmonic Serialism

OT has been standardly understood as a parallel model of optimization. An input is submitted to Gen, which can apply multiple operations in parallel to create each of its candidates. It therefore generates candidates that can differ from each other and from the input in many ways at once. For instance, the candidate set from Classical Arabic /fsal/ 'do!' is {fsal, ifsal, ʔifsal, ʔifsil, …}. This rich, diverse candidate set is submitted to the Eval component – that is, the grammar – which selects the optimal candidate [ʔifsal] as its final output.

In HS, however, Gen can only apply one operation to form each candidate. In the Classical Arabic case, this means that the final output [ʔifsal] is not in the initial candidate set of /fsal/ because it requires two operations, epenthesis of [ʔ] and epenthesis of [i]. HS deals with this seeming limitation by looping the output back into Gen for another pass: /fsal/ → $_{\text{Gen}}$ {fsal, ifsal, fsil, …} → $_{\text{Eval}}$ [ifsal] → $_{\text{Gen}}$ {ifsal, ʔifsal, ifsil, …} → $_{\text{Eval}}$ [ʔifsal]. The derivation terminates when it *converges*: the most recent output of Eval is identical to the most recent input to Gen, so no further changes are possible. The tableaux in (1)–(3) illustrate this fact.[1] (The constraint *#CC prohibits initial clusters; Onset is violated by vowel-initial words; and Dep militates against epenthesis.)

(1) /fsal/ → [ʔifsal] in HS Step 1

/fsal/	*#CC	Onset	Dep
a. → ifsal		*	*
b. fsal	*!		

(2) /fsal/ → [ʔifsal] in HS Step 2

ifsal	*#CC	Onset	Dep
a. → ʔifsal			*
b. ifsal		*!	

(3) /fsal/ → [ʔifsal] in HS Step 3

ʔifsal	*#CC	Onset	Dep	
a. → ʔifsal				*convergence*
b. ʔifsali			*!	

From this HS perspective, the question "How do segments delete?" reduces to the question "What are the deletion operations in Gen?" I will argue that there is no

1. Omitted from (1)–(3) is the candidate [fisal]. It is ruled out by the undominated constraint I-Contig (McCarthy & Prince, 1995, 1999), which militates against internal epenthesis.

operation that can, in a single step, delete any segment regardless of its structural complexity.

3. Deletion as gradual reduction: An example[2]

It has been observed that simplification of medial consonant clusters normally deletes the first consonant rather than the second (Steriade, 2001/2008; Wilson, 2001):[3] /patka/ → [paka], *[pata]. Under standard assumptions, parallel OT has no explanation for this asymmetry. As shown in (4), deletion of [t] *or* [k] equally satisfies the constraint No-Coda, which prohibits syllable-final consonants (the period/full stop marks the syllable boundary).

(4) Parallel OT does not explain coda deletion asymmetry

/patka/		No-Coda	Max
a. →	pa.ka		*
b. →	pa.ta		*
c.	pat.ka	*!	

HS, in contrast, offers the possibility of decomposing consonant deletion into a reduction step followed by deletion of the reduced segment: /patka/ → [paʔ.ka] → [pa.ka]. This analysis can account for the asymmetry because reduction of codas is a well-attested phonological process, while reduction of onsets is not. If reduction of /t/ or /k/ is a necessary prelude to deletion, then the asymmetry follows from the fact just observed: codas reduce but onsets do not.

Formally, let us assume a simplified feature geometry (Clements, 1985; McCarthy, 1988) in which consonants are headed by their Place node. Gen provides an operation that can delete any node, including the Root node, but it cannot delete a headed (i.e., Place-bearing) Root node. From this assumption about Gen, it follows that deletion of /t/, /k/, or any other unreduced consonant must proceed in two steps: /patka/ → [paʔ.ka] → [pa.ka]; /patka/ → [pat.ʔa] → [pa.ta]. For a derivation to be possible in HS, there must be some constraint ranking under which every step of the derivation is optimal. There is a ranking that will produce the first of these derivations, but there is no ranking that will produce the second. The reason why the first derivation is possible is that codas are poor licensers of Place, an observation that is embodied in the constraint Coda-Cond, which is violated by

2. This example is based on McCarthy (2008).

3. Though see Kurisu (2012) for a different view, and Hall, Jurgec and Kawahara (to appear) for a rejoinder to Kurisu.

Place in coda position (Goldsmith, 1990: pp. 123–128; Ito, 1989). Ranked above the faithfulness constraint MAX(Place) and the markedness constraint HAVE-PLACE that is violated by Place-less consonants, CODA-COND compels deletion of Place in the coda /t/, yielding [ʔ]. This is shown in step 1 of the derivation in (5).

(5) Step 1 of /patka/ → [paʔ.ka] → [pa.ka] in HS

/patka/	CODA-COND	HAVE-PLACE	MAX (Place)	MAX (Root)
a. → paʔ.ka		*	*	
b. pat.ʔa	*!	*	*	
c. pat.ka	*!			

At Step 2 (6), the glottal stop coda then deletes, because HAVE-PLACE dominates MAX(Root), the faithfulness constraint that would protect glottal stop's remaining structure.

(6) Step 2 of /patka/ → [paʔ.ka] → [pa.ka] in HS

paʔ.ka	CODA-COND	HAVE-PLACE	MAX (Place)	MAX (Root)
a. → pa.ka				*
b. paʔ.ka		*!		

Finally, the derivation converges on [pa.ka] at Step 3 (7), since no further harmonic improvement is possible.

(7) Step 3 of /patka/ → [paʔ.ka] → [pa.ka] in HS

[pa.ka]	CODA-COND	HAVE-PLACE	MAX (Place)	MAX (Root)	
a. → pa.ka					*convergence*
b. pa.ʔa		*!	*!		

There are several important points to note about the HS derivation in (5)–(7). First, [pa.ka] and [pa.ta] are not among the candidates at Step 1, and [pa.ta] is not among the candidates at Step 2. This follows from our assumption about GEN: it does not have an operation that can perform the single-step mappings /t/ → Ø or /k/ → Ø. Assumptions like this are critical to many explanations in HS. Second, the Step 1 tableau shows that [pat.ʔa] is harmonically bounded by [pat.ka]. Harmonic bounding means that [pat.ʔa] can never win under any ranking, and so a derivation that transforms /patka/ into [pa.ta] is impossible. Harmonic bounding of [pat.ʔa] follows from an assumption about the constraint component CON: it does not have a constraint "ONSET-COND" parallel to CODA-COND. This asymmetry is

a substantive fact about the phonology of codas and onsets, for which see Steriade (2001, 2001/2008). Third, the fact that deletion of [ʔ] requires just a single step (Step 2 in (5)) predicts that there should be languages in which only [ʔ] (or [h]) is deleted from coda position. In Classical Arabic, for example, there is a dissimilation process affecting /ʔVʔ/: /ʔa-ʔθar-a/ → [ʔa:θara] 'he preferred'. Other segments do not delete in a similar context: /ta-truk-u/ → [tatruku], *[ta:ruku] 'she relinquishes'. One way to analyze this phenomenon is to assume a general dissimilatory pressure (cf., the root co-occurrence constraints studied by Greenberg (1950) and others), but only [ʔ] can be deleted in a single step.

4. Discussion

The ideas about consonant cluster simplification in HS developed in the previous section have four interesting consequences for phonology in general.

First, segments with less structure are more susceptible to deletion than more complex segments. This follows from our assumption about Gen: its operations are limited to deleting pieces of structure one at a time, until the remnant is so reduced in complexity that it can be deleted all at once. Hence, /t/ is less susceptible to deletion than /ʔ/, as shown by the /ʔa-ʔθar-a/ example at the end of the last section (compare the notion of "cheap segments" in Gouskova, 2003).

Second, every context in which structurally complex segments are observed to delete is also a context in which these segments may reduce but not delete.[4] This is a claim about language typology: deletion contexts in language A may be reduction contexts in language B. In A, Have-Place dominates Max(Root), as in (6), but the ranking is the other way around in B.

Third, deletion of complex segments entails deletion of simpler segments. A grammar like (5) that produces the derivation /patka/ → [paʔ.ka] → [pa.ka] will also produce the derivation /paʔ.ka/ → [pa.ka].

Fourth, segments have internal structure that differs in complexity. This assumption has been pervasive throughout the discussion thus far. It is practically a truism of contemporary phonological theory, but still worth noting.

The balance of this chapter will be devoted to exploring these four consequences of HS in greater detail.

4. An anonymous reviewer notes that English instantiates this prediction: vowels reduce in more contexts than they delete. See for example Zwicky (1972).

5. Structure and deletability

Segments with more internal structure are predicted to be more resistant to deletion than segments with less internal structure. This follows from our assumptions about HS's Gen: it cannot delete all of a complex segment's structure at once. Any constraint ranking that will yield a derivation that deletes a complex segment will also yield a derivation that deletes a simpler one, because the simpler segment is a step along the way of the derivation that deletes the complex segment. (Recall the point about how a grammar that produces /patka/ → [paʔ.ka] → [pa.ka] will also produce the derivation /paʔ.ka/ → [pa.ka].)

This aspect of the theory offers a new insight into a well-known problem in Arabic dialect typology: the distinction between the differential and non-differential dialects (Angoujard, 1990; Broselow, 1992; Cantineau, 1939; Farwaneh, 1995; Gouskova, 2003). There is even evidence that Classical Arabic was differential: loss of medial short vowels *metri causa* in verse appears to have been limited to /i/ and /u/ (Wright, 1971: pp. 384–385) and there is some reason to think that the loss of final short vowels in the development of modern Arabic dialects affected /i/ and /u/ first (Birkeland, 1940).

In differential dialects, such as Cairene in (8), the high vowels /i/ and /u/ are susceptible to syncope, but the low vowel /a/ is not. In non-differential dialects, such as Yemeni in (9), all three vowels are susceptible to syncope.

(8) Differential Dialect: Cairene (J. Watson, 2002: p. 74)

/tˤardi k*i*bi:r/	tˤardi kbi:r	'my parcel is big'
/ʕandi ħ*u*ma:r/	ʕandi ħma:r	'I have a donkey'
/tˤardi tˤ*a*wi:l/	tˤardi tˤ*a*wi:l	'my parcel is long'

(9) Non-differential Dialect: Yemeni (J. Watson, 2002: p. 78)

/tiʃti t*i*si:r/	tiʃti tsi:r	'she wants to go'
/gadu k*u*bur/	gadu kbur	'he has grown up'
/ʕa:di r*a*ɟamat/	ʕa:di rɟamat	'she has just thrown'

Following many particle, element, and underspecification theories of vowel representation (e.g., Archangeli, 1988; Clements, 1991; Schane, 1984; van der Hulst, 1989), we may assume that low vowels have more structure than high vowels, and the reduced vowel [ə] has no internal structure at all. For concreteness, I will adopt the representations in (10), though no details are truly crucial except that [a] has more structure than [i] or [u], and [i] and [u] have more structure than [ə].

(10) Vowel Representations

/a/	[Color], [Open]
/i, u/	[Color]
/ə/	[ ] (bare Root node)

As usual in OT, it is not enough to have explicit assumptions about representations; assumptions about constraints are also necessary. Reduction processes like syncope are an effect of constraints against structure, which may be contextual or non-contextual. To avoid a digression into questions about the syncope context (for which see Gouskova (2003) and McCarthy (2007), *inter alios*), I will simply refer to it as "Weak" in formulating the syncope constraints. There are two constraints that militate against the vowel features [Color] and [Open] in the Weak context. Categorical *V_{Weak}-Cat in (11) is violated once if a vowel in the Weak context bears the features [Color], [Open], or both. It is therefore violated once by each of the vowels in (10) except for [ə].

(11) *V_{Weak}-Cat
Assign a violation mark to every vowel in the Weak context that bears the features [Color] and/or [Open].

There is also a gradient version of this constraint in (12) that assigns two violation marks to [a] because it has both [Color] and [Open], but only one violation mark to the high vowels and none to [ə].

(12) *V_{Weak}-Grad
Assign a violation mark for every instance of [Color] or [Open] in the Weak context.

In addition to these constraints against featural structure, there is also a constraint against the total absence of featural structure in a vowel (12). It is violated by the vowel [ə].

(13) *[ ]
Assign a violation mark for every instance of the featureless vowel [ə].

In HS, far more so than in standard OT, it is important to be explicit about the assumptions about Gen, because the typology that emerges from a constraint set in HS is as dependent on the operations in Gen as it is on the constraints in Con. I assume that Gen includes an operation that deletes vowel features and bare vowel root nodes, but only one at a time. From this assumption, it follows that the only way to delete /a/ is with the three-step derivation /a/ → [i] → [ə] → Ø. The vowels /i/ and /u/ can be deleted in two-step derivations /i/ → [ə] → Ø. The vowel schwa deletes in a single step, because it has no internal featural structure, only a bare root node. Any step in which structure is deleted violates the faithfulness constraint Max.

We now have the resources in place to analyze the distinction between differential and non-differential dialects. In non-differential dialects, the feature-counting constraint *V_{Weak}-Grad dominates both the markedness constraint *[ ] and the

faithfulness constraint Max. The tableaux in (14) and (15) show the steps in the derivation of /i/ syncope in a non-differential dialect (throughout this discussion, the vowels are assumed to be in the Weak context that conditions reduction and syncope). At Step 1, /i/ reduces to [ə] because *V_{Weak}-Grad dominates both *[ ] and Max. Further reduction to Ø is not an option at this step – it is not even a candidate – because Gen is limited to deleting a single structural element at a time, while /i/ has two structural elements, [Color] and a root node (the categorical constraint *V_{Weak}-Cat is shown as separated from the rest of the tableau because it is not visibly active in the non-differential dialects and hence is unrankable with respect to the other constraints).

(14) Non-differential dialect deletion of high vowels Step 1

i	*V_{Weak}-Grad	*[ ]	Max	*V_{Weak}-Cat
a. → ə		*	*	
b. i	*!			*

At Step 2 in (15), however, Ø is a candidate, because schwa's bare root node can be deleted in a single step. The candidate Ø is optimal because the constraint that schwa violates, *[ ], dominates Max.

(15) Non-differential dialect deletion of high vowels Step 2

ə	*V_{Weak}-Grad	*[ ]	Max	*V_{Weak}-Cat
a. → Ø			*	
b. ə		*!		

The derivation in (14) and (15) converges at Step 3 because Ø perfectly satisfies *V_{Weak}-Grad, so no further harmonic improvement is possible.

The tableaux in (16)–(18) show how the vowel /a/ is deleted in a non-differential dialect. At the first step (16), /a/ loses its [Open] feature, reducing to [i]. This is required by *V_{Weak}-Grad, which is violated once for every feature that a vowel bears. Further reduction to [ə] or Ø is not yet an option at Step 1, given our assumptions about the operations in Gen.

(16) Non-differential dialect deletion of low vowels Step 1

a	*V_{Weak}-Grad	*[ ]	Max	*V_{Weak}-Cat
a. → i	*		*	*
b. a	**!			*

At Step 2 (17), *V_{Weak}-Grad is still active, compelling deletion of [i]'s remaining feature, [Color]. The optimal candidate is therefore [ə]. As in tableau (14), total

deletion remains out of reach, however, because under our assumptions GEN cannot simultaneously delete a feature and the root node that contains it. Rather, the root node must be entirely depleted of features before it can delete.

(17) Non-differential dialect deletion of low vowels Step 2

i		*V_{WEAK}-GRAD	*[ ]	MAX	*V_{WEAK}-CAT
a. →	ə		*	*	
b.	i	*!			*

At Step 3 (18), the empty root node that represents schwa deletes, thereby satisfying *[ ]. The situation is the same as tableau (15). The derivation then converges at Step 4.

(18) Non-differential dialect deletion of low vowels Step 3

ə		*V_{WEAK}-GRAD	*[ ]	MAX	*V_{WEAK}-CAT
a. →	Ø			*	
b.	ə		*		

In differential dialects, the ranking is different. The constraint *V_{WEAK}-CAT rather than *V_{WEAK}-GRAD dominates *[ ] and MAX, and *V_{WEAK}-GRAD is ranked below MAX. As a result of this ranking, the high vowels are subject to deletion because their featural structure can be removed in a single derivational step, thereby satisfying *V_{WEAK}-CAT, as shown in tableau (19):

(19) Differential dialect deletion of high vowels Step 1

i		*V_{WEAK}-CAT	*[ ]	MAX	*V_{WEAK}-GRAD
a. →	ə		*	*	
b.	i	*!			*

This derivation then continues (20) with deletion of schwa, because *[ ] dominates MAX. The derivation then converges at Step 3.

(20) Differential dialect deletion of high vowels Step 2

ə		*V_{WEAK}-CAT	*[ ]	MAX	*V_{WEAK}-GRAD
a. →	Ø			*	
b.	ə		*!		

Differential and non-differential dialects are distinguished by their treatment of low vowels. As we saw in (16)–(18), non-differential dialects reduce (and eventually delete) /a/ because of high-ranking *V_{WEAK}-GRAD. In the differential dialects, however, *V_{WEAK}-GRAD is low-ranking, and the reduction of high vowels is a

consequence of high-ranking *V_{WEAK}-Cat. But *V_{WEAK}-Cat cannot compel reduction of low vowels: low vowels have two features, [Open] and [Color], that can only be deleted one at a time, but *V_{WEAK}-Cat is satisfied only if both are deleted. The derivation therefore converges at Step 1, as shown in (21).

(21) Differential dialect non-deletion of low vowels Step 1

a	*V_{WEAK}-Cat	*[ ]	Max	*V_{WEAK}-Grad
a. → a	*			**
b. i	*		*!	*

HS in general and our assumptions about Gen in particular are essential to this explanation for the immunity of low vowels from deletion in differential dialects. Because Gen can delete only one structural element at a time, it cannot fully deplete /a/ of its features [Open] and [Color] in a single derivational step. In other words, [ə] is not a candidate – it is inaccessible – when the input is /a/. But [ə] is the only vowel that satisfies *V_{WEAK}-Cat, so this constraint cannot cause /a/ to reduce. It does compel reduction of /i/ or /u/, however, because they are just one derivational step away from [ə].

In this way, HS offers a different perspective on phonological mappings of reduction and deletion. Markedness constraints can be thought of as goals, and improvement in performance on a markedness constraint is progress toward the goal that it establishes. If progress toward a goal is possible in a single derivational step, and if faithfulness is low-ranked, then an unfaithful candidate will win, the derivation will not have converged, and another pass through Gen and the grammar will occur. But if progress toward the goal requires multiple steps, there will be no progress at all. This is an important difference between HS and standard OT, because in standard OT the effects of multiple operations in Gen are evaluated simultaneously.

At the beginning of this section, I offered the premise that segments with more structure are less likely to delete than segments with less structure, all else being equal. This premise can be derived from the structure of HS, following the reasoning in the preceding paragraph. We have seen how this premise is instantiated in the distinction between differential and non-differential dialects of Arabic, and I have provided an HS analysis of this distinction. In the next section, we will examine this claim from a broader cross-linguistic perspective.

6. Deletion of fuller segments implies deletion of more reduced segments

HS, under the assumption that Gen can delete only one structural element in a single derivational step, predicts an implicational hierarchy of susceptibility to deletion. Under the assumptions about the representation of vowels in (10), the implicational hierarchy is the one in (22). Languages that delete /a/ must also delete /i/ and /ə/, and languages that delete /i/ must also delete /ə/. This follows from the fact that /a/ has a proper superset of /i/'s structure, and /i/ has a proper superset of /ə/'s structure. Gen cannot remove more than one element of that structure at a time, so the loss of structure from /a/ changes it into [i] and then [ə] on the way to Ø. Likewise, the loss of structure from /i/ changes it into [ə] on the way to Ø.

(22) Implicational hierarchy of susceptibility to deletion
/a/ → Ø implies
/i/ → Ø implies
/ə/ → Ø

This implicational hierarchy is, of course, the whole point of the distinction between differential and non-differential dialects. Non-differential dialects start at the top of the hierarchy, with both /a/ and /i/ deleting. Differential dialects are located at the middle of the hierarchy: /i/ deletes, but not /a/.

What about /ə/? It is often said that Arabic dialects, other than Maghrebi varieties, do not have underlying /ə/. This is claimed because the dialects either lack surface [ə] entirely or have it only in predictable contexts. In Optimality Theory, however, the standard assumption of *richness of the base* is that there are no language-particular restrictions on underlying representations (Prince & Smolensky, 1993/2004). All phonological generalizations must emerge from the grammar, without assistance from prior restrictions on the inputs to the grammar. A prohibition on /ə/ in the underlying representations of Arabic is exactly the sort of restriction that richness of the base was intended to rule out. It follows, then, that the phonological grammar of Arabic must dispose of any /ə/s in hypothesized underlying representations. The mapping /ə/ → Ø will do exactly that.

The implicational hierarchy in (22) appears to be consistent with the facts of other Semitic languages. The two with which I am most familiar, Akkadian and Tiberian Hebrew, both follow the non-differential pattern, with both non-low and low vowels subject to deletion (Gesenius, 1910; Greenstein, 1984; Huehnergard, 2005). Examples of non-Semitic languages that follow the non-differential pattern are Hopi (Jeanne, 1982), Tonkawa (Hoijer, 1933, 1946), Aguaruna (Payne, 1990), and Macushi Carib (Hawkins, 1950).

Historical developments in the history of Romance clearly followed the differential pattern, with low vowels not yielding to the deletion process that took medial non-low vowels (Hartkemeyer, 1997, 2000). There is also evidence that high vowels were less resistant to deletion than mid vowels (Lief, 2006), a further refinement of the implicational hierarchy in (22).

The Salish language Lushootseed presents a possible counterexample (Gouskova, 2003; Urbanczyk, 1996); Gouskova also mentions Georgian and Estonian.

A final possibility implied by (22) is a differential language where only /ə/ deletes. As I hinted earlier in the discussion of richness of the base, these are languages without any general process of vowel deletion but where schwa has a predictable distribution, from which it follows that the grammar maps /ə/ to Ø in some contexts. Though Maghrebi dialects of Arabic are sometimes described in these terms, the contrast between [ktəb] 'he wrote' and [kətb] 'writing' challenges the claim of complete predictability. A better example is the Salish language Lillooet (St'át'imcets), in which surface [ə] does not occur unless it is needed to satisfy one of the following three requirements (Gouskova, 2003; van Eijk, 1997): (i) there are no vowelless words, (ii) there are no sonorant consonants unless adjacent to a vowel, and (iii) clusters of three consonants are prohibited. In this language, the markedness constraint that [ə] violates, *[ ], dominates Max, but is itself dominated by the markedness constraints that embody the conditions in (i)–(iii).

In summary, I have shown how the distinction between differential and non-differential dialects, as well as similar distinctions in language typology, follows from the architecture of HS, a minimal assumption about Gen, and current views on the representation of segments. If a segment ς deletes in some context, then all segments with a proper subset of ς's structure must also delete in that context. This follows because deletion of ς proceeds by way of intermediate stages with subset structure, given the assumption that Gen's operations remove one structural element at a time.

We will now turn from the effects of reduction and deletion to the contexts in which they occur, developing further evidence for the HS analysis proposed here.

7. Every deletion context is also a reduction context

As we saw in the previous sections, deletion of a non-schwa vowel requires one or more reduction steps along the way. In the non-differential dialects, underlying /a/ must reduce to [i] and then [ə] on its way to Ø. In both types of dialects, underlying /i/ and /u/ must first reduce to [ə] on their way to Ø. From this it follows

that the contexts in which deletion of non-schwa (hereafter, "full") vowels occurs must be a (possibly improper) subset of the contexts in which reduction of these vowels occurs.

Before proceeding to investigate this prediction, let us first clarify what exactly is being predicted. There are two main predictions, one intralinguistic and the other interlinguistic. The intralinguistic prediction is this: the reduction contexts in some language may be a proper subset of the deletion contexts in that same language. In other words, there may be situations where a full vowel reduces but deletion of [ə] is blocked in some contexts by, say, restrictions on syllable structure. The interlinguistic prediction is this: if in some language full vowels are observed to *delete* in some context X, then full vowels may be observed to *reduce* in the same context in other languages. This prediction follows from ranking permutation: the final deletion step that eliminates [ə] is required only when *[ ] dominates MAX. With the opposite ranking of these constraints, [ə]s derived by reduction will not delete. OT's inherently typological character is responsible for this entailment.

The intralinguistic prediction can be exemplified with antigemination effects (Baković, 2005; McCarthy, 1986). In Syrian Arabic, vowel deletion is blocked between identical consonants, as shown by the second example in (23). The first example shows that in the same context, except that the surrounding consonants are non-identical, the vowel is indeed deleted. Importantly, and consistent with our prediction, the vowel that is not deleted nonetheless reduces to [ə] in Syrian Arabic.

(23) Antigemination in Syrian Arabic (Cowell, 1965)

/j-sakkir-u/	jsakkru	'they close'
/j-sabbib-u/	jsabbəbu	'they cause'

I will present an analysis of Syrian Arabic under the assumption that the Obligatory Contour Principle (OCP) blocks syncope between identical consonants (following McCarthy, 1986). Syrian is a differential dialect, so the ranking is the same as (19), except for the addition of the OCP ranked above *[ ]. At Step 1 in (24), the vowel /i/ reduces to [ə], thereby satisfying *V_{WEAK}-CAT. If the surrounding consonants were non-identical, the derived [ə] would go on to delete at Step 2, exactly as it did in tableau (20). But because the OCP dominates *[ ], deletion is blocked at Step 2 (25), and the derivation converges.

(24) Antigemination in Syrian Arabic Step 1

bib	*V_{WEAK}-CAT	OCP	*[ ]	MAX	*V_{WEAK}-GRAD
a. → bəb			*	*	
b. bib	*!				*

(25) Antigemination in Syrian Arabic Step 2

bəb	*V_{Weak}-Cat	OCP	*[ ]	Max	*V_{Weak}-Grad
a. → bəb			*		
b. bb		*!		*	

This example nicely illustrates the intralinguistic prediction about the relationship between reduction and deletion contexts. Deletion of full vowels proceeds by way of a reduction step, so if the deletion step is blocked, as it is in the antigemination cases, the vowel will nonetheless reduce. In other words, the antigemination effect allows us to probe the otherwise invisible reduction step of the HS derivation.

The interlinguistic prediction is a claim about language typology. Because reduction is an unavoidable step along the way to deletion of full vowels, and because the final deletion step is controlled by a different markedness constraint than the reduction step(s), it follows that contexts in which deletion is observed in one language can be contexts in which reduction is observed in another.[5]

Variation among the Arabic dialects often presents excellent opportunities to study language typology (Broselow, 1992; Farwaneh, 1995; Kenstowicz, 1983; McCarthy, 1979), but unfortunately not in this case. The historical development of the dialects almost surely involved a reduction stage before the vowels were deleted entirely, but the shift from reduction to deletion was carried through almost universally in the dialects, except for occasional vestiges of reduction like the antigemination effect discussed above. Reduction and deletion of the reduced vowel have been historically "telescoped" (Wang, 1968), so that all that remains visible is deletion.

We can, however, find the necessary typological evidence in languages other than Arabic. One common context for both reduction and deletion is post-tonic – that is, after the stressed syllable. The post-tonic region of the word is often associated with a greater degree of vowel reduction than the pre-tonic region. This distinction is the focus of Maiden (1995) and Walker (2016); also see Crosswhite (2004) and Hyman (2002: pp. 23–24). Yiddish is a good example (N. G. Jacobs, 2005: p. 103). The data in (26) show that post-tonic reduction of full vowels to [ə] is observed both in alternations and in assimilation of loanwords. Vowels in pre-tonic position do not reduce, however.

5. An anonymous reviewer asks about cases where the antigemination effect does not lead to reduction when deletion is blocked. An example is Afar (Bliese, 1981; McCarthy, 1986): /digib-é/ → [digbé] 'she/I married' vs. /danan-é/ → [danané], *[danəné] 'I/he was hurt'. It may be that the OCP effect in this case is not a prohibition on adjacent identical segments, but rather tier-adjacent identical Place nodes. Reduction of a full vowel between identical consonants renders the consonants Place nodes tier-adjacent.

(26) Post-tonic Reduction in Standard Yiddish

a. Post-tonic reduction alternations

	Singular	Plural	
/talmid/	ˈtalməd	talˈmidəm	‘pupil’
/ganov/	ˈganəf	gaˈnovəm	‘thief’
/ʃabos/	ˈʃabəs	ʃaˈbosəm	‘Sabbath’

b. Post-tonic reduction in loanwords (variably)

ˈpejdə	‘wages (< *pay day*)’
ʃiˈkago ~ ʃiˈkagə	‘Chicago’
ˈgumi ~ ˈgumə	‘rubber (< German *Gummi*)’,
ˈblotə	‘mud (< Polish *błoto*)’

c. No reduction pre-tonically

niˈgunəm	‘melodies’
ekˈran	‘screen’
uˈkraynə	‘Ukraine’

Post-tonic reduction can also be found in some southern Italian dialects (Maiden, 1995: pp. 116–117). In Southern Lucanian, for instance, the pre-tonic vowel system consists of [a], [u], and [ə], while the post-tonic system is just [ə] (see (27)).

(27) Southern Lucanian vowel reduction (Lausberg, 1939)

a. Post-tonic vowel system

ˈfikətə	‘liver’
ˈfumə	‘smokes’
ˈpreβətə	‘priest’
ˈpartənə	‘they leave’

b. Pre-tonic vowel system

naˈta	‘to swim’
məsuˈra	‘to measure’
suɲˈɲa	‘to dream’
βəˈde	‘to see’

The post-tonic region of the word is also a context for vowel deletion. In the Modern South Arabian language Jibbāli (Hayward, Hayward, & Al-Tabūki, 1988), post-tonic vowels are highly reduced or deleted entirely, leading to alternations like those in (28). The fleeting superscripted schwa optionally breaks up clusters that would otherwise be problematic because the second consonant is [r] or a guttural (Hayward et al., 1988: p. 243). Post-tonic syncope is also found in Late Latin/early Romance (for recent discussion, see H. Jacobs (2004), Mester (1994), and Wheeler (2007)).

(28) Post-tonic deletion in Jibbāli

	‘he’	‘she’	
/feðer/	ˈfeðr ~ ˈfeðᵊr	feðeˈrɔt	‘shivered’
/ðeker/	ˈðekr ~ ˈðekᵊr	ðekeˈrɔt	‘remembered’
/sʔedef/	ˈsʔedf	sʔedeˈfɔt	‘was dented’

As in Jibbāli, cluster conditions can limit the effect of post-tonic syncope. For example, the reflex of Classical Latin [ˈjuweneːs] ‘youths’ in Catalan is [ˈʤovəns] because conditions on clusters and syllabification rule out alternatives like *[ˈʤovnəs] and *[ˈʤovns] (Wheeler, 2007).

An even more extreme case of post-tonic deletion – deletion of *all* post-tonic segments, both vowels and consonants – is characteristic of certain quasi-morphological truncation processes. Examples include central Italian vocatives (29), English *totesing* (30), and truncation in Coeur d’Alene/Montana Salish (31).

(29) Central Italian vocatives (Maiden, 1995: p. 118)

[avvoˈkatu]	[avvoˈka]	‘lawyer!’
[miˈkele]	[miˈke]	‘Michele!’
[doˈmeniko]	[doˈme]	‘Domenico!’

(30) English *totesing* (Spradlin, 2016)

tótally	tótes
atrócious	atró[ʃ]
demócracy	demóc
inappróp̀riate	inappróp
clarificátion	clarificá[ʃ]

(31) Truncation in Coeur d’Alene (Doak, 1990; Thomason & Thomason, 2004)

stʔʃástq	stʔʃá	‘huckleberries’
stsʔɛwʔɛníneʔ	stsʔɛwʔɛní	‘giant’
stʔmʔáltmʃ	stʔmʔá	‘buffalo’
tkʷarʷaŕéqɛʔst	tkʷarʷaŕé	‘orange’

Tableaux (5)–(6) showed how the reduction-deletion chain can affect consonants as well as vowels. In these three examples, weakness in the post-tonic region causes reduction and deletion of both vowels and consonants. Post-tonic consonant reduction without deletion can also be observed, as our theory would predict. For example, in the Liverpool dialect of English (known as Scouse), coda /t/ lenites to [h] or [ʦ] depending on context (see (32)). In a stressed prepausal syllable, lenition to [ʦ] is the only option. But in an unstressed prepausal syllable /t/ optionally reduces even further, debuccalizing to [h]. This example shows that reduction of consonants can be stress-conditioned in much the same way that reduction of vowels is, establishing a parallel between vowel and consonant reduction. Indeed,

one might suppose that the reduced consonants [h] and [ʔ] are to full consonants what [ə] is to full vowels: the segment that remains when most or all featural structure is absent.

(32) Scouse prepausal /t/ allophones (K. Watson, 2002)
  a. [h] ~ [ʦ] in unstressed codas
     clíma[h~ ʦ]
     pílo[h~ ʦ]
     búdge[h~ ʦ]
     pérmi[h~ ʦ] (noun)
  b. [ʦ] but not [h] in stressed codas
     uppercú[ʦ]
     acrobá[ʦ]
     permí[ʦ] (verb)

In summary, we have seen evidence for two consequences of the HS approach to vowel deletion developed in this paper, in which reduction is a necessary step along the way toward deletion of full vowels. The antigemination effect in Syrian Arabic establishes this linkage within a single language: when deletion is blocked under specific conditions, reduction nevertheless occurs. The evidence of weakening processes in the post-tonic domain confirms this linkage cross-linguistically: the post-tonic environment triggers segmental reduction in some languages and segmental deletion in others. The reduction/deletion connection is confirmed.

We turn now from the contexts of reduction and deletion to the consequences of this theory for segmental representation.

8. Consequence: Segments have internal structure

This analysis of vowel reduction and deletion processes has relied on the assumption that vowels are collections of objects, and reduction is removal of one of those objects. Distinctive features are objects, with a relationship to segments that is analogous to the relationship of atoms to molecules.

This "molecular" view of segmental representation might seem hardly worth remarking upon, since it has been practically a truism of phonological theory since the advent of autosegmental phonology (Goldsmith, 1976). Still, there are reasons not to take it for granted. After all, the original theories of distinctive features (Chomsky & Halle, 1968; Jakobson, Fant, & Halle, 1952) assigned to features a purely classificatory role: they are attributes of segments rather than the objects out of which segments are made. The IDENT constraints of Correspondence Theory (McCarthy & Prince, 1995, 1999) continue that tradition. Lately, an emergentist

theory of distinctive features (Mielke, 2008) has dealt exclusively with their classificatory function. So, what might seem to go without saying actually needs to be said and supported with evidence.

To that end, I will review some of the evidence that Arabic offers for features as objects of phonological representation rather than mere attributes of segments. The evidence involves situations where features are alienable properties of segments, capable of moving from one segment to another. To be alienable properties, features must be objects that can exist apart from the segment that originally bore them. Attributes (that is, purely classificatory features) are inalienable properties, and hence cannot be transferred from one segment to the next. To cite an analogy from my previous administrative position as dean of the graduate school, there is a difference between a diploma (an object) and a degree (an attribute). I can sell or throw away my PhD diploma, but my PhD degree is an inalienable quality.

Segmental coalescence combines the features of two input segments into a single output segment. Vowel-glide coalescence in Arabic, exemplified in (33), combines the Color features of the glide with a compromise on the height features of the vowel and glide, changing /aj/ into [e:] and /aw/ into [o:]. This is a thorough rearrangement of the feature-objects that make up the two input segments, with only the weight of the input segments (their moras) remaining unchanged.

(33) Vowel-glide coalescence in Tripoli, Lebanon (el-Hajjé, 1954; McCarus, 1955)

/bajt/	be:t	bajti	'(my) house'
		be:tak	'your house'
/lawn/	lo:n	lawnu	'(his) color'

A similar phenomenon has also been described for Classical Arabic (Owens, 2009: pp. 210–211; Versteegh, 2005: p. II:233; Wright, 1971: pp. I:71, I:84). In the passive of hollow verbs, there is coalescence of the medial vowel-glide-vowel sequence into a single long vowel: /quwila/ → [qi:la] 'it was said'. Though written as [i:], this vowel is described as *al-'išmām* 'the scent' of *kasra* (the Arabic word for the vowel [i]), probably the front rounded vowel [y], hence [qy:la]. If indeed this vowel was high front rounded [y], then it is combining color features of both /uw/ and /i/, much as the coalescence process in (33) combines the height features of the original segments. This reshuffling of features from two distinct segments to create a new one is further evidence that features are entities rather than mere categories.

Apparent assimilation to a deleted segment can also be seen as evidence that features are alienable from the segments that originally bore them. In Bedouin Arabic (34), the color of underlying /i/ remains on a preceding velar even though the /i/ deletes. In Cairene Arabic (35), the color of underlying /u/ remains as labialization of the preceding consonant even when the /u/ has been deleted. For a feature to be transferred from one segment to another, remaining behind as a kind

of phantom limb even after the segment that bore it has been deleted, it must be an alienable property of the original segment, rather than an intrinsic quality of it.

(34) Palatalization in Bedouin Arabic (Al-Mozainy, 1981: pp. 49f., 73ff.)

/ħaːkim-iːn/	ħaːkʲmiːn	'ruling (m. PL.)'
/kitib-t/	kʲtibt	'you (m. SG.) were written'

(35) Labialization in Cairene Arabic (Mitchell, 1956: p. 114)

/ʕandi ħumaːr/	ʕandi ħʷmaːr	'I have a donkey'

Classical Arabic had a similar phenomenon to Cairene, for which the term *'išmām, "mixing/blending"* was also used. When a word ending in the nominative suffix /u/ occurred in pause, where deletion of final short vowels is required, "in place of a final *u* the lips might be inaudibly rounded after the preceding consonant (*'išmām*)" (Hoberman, 2005: p. III:566). Owens (2009: pp. 22, 210) proposes that pausal /u/ is devoiced rather than deleted (e.g., [al-kitaːb-u̥], though that is difficult to reconcile with Sibawaih's report that a blind person cannot detect it – that is, it is truly inaudible.

Finally, the most striking evidence in Arabic that features are independent entities comes from a secret language. One major source of evidence for the independence of tone from segments came from transpositional secret languages (Bagemihl, 1988; Coupez, 1969; Hombert, 1973, 1986). In Bakwiri (36), the L(ow)-H(igh) word [mɔ̀kɔ́] remains L-H even as the segments of the two syllables are swapped. Likewise, the H-L word [kwélì] remains H-L. Evidence like this, which is abundant in Bantu languages, shows very clearly that tones are independent entities rather than attributes of particular segments.

(36) Bakwiri language game (Hombert, 1986: p. 178)

Normal	Game	
mɔ̀kɔ́	kɔ̀mɔ́	'one person'
kwélì	líkwè	'death'

A similar point can be made about vowel length, as in the Sanga language game exemplified in (37). When the segments are transposed, both tone and vowel length are left behind. It is now a standard assumption of phonological theory that tone and segmental quantity are represented on separate tiers from the segments themselves, and thus they are clearly not inalienable properties of segments.

(37) Sanga language game (Coupez, 1969: p. 33)[6]

Normal	Game
múkwè̀ːtù	mútù̀ːkwè
bá́ːkólwè̀ː	bá́ːlwékò̀ː

Evidence of this sort for non-tonal features is not terribly common, but there is a striking example in Moroccan Arabic. The feature that remains behind even as segments are transposed is pharyngealization (also known as emphasis or *tafxīm*). In the *sin* secret language of Oujda, a word of the form C_1 … is transformed into *s* …*sin*C_1*a*, as shown in by the examples in (38a). When the initial consonant is pharyngealized or geminated (38b), however, the pharyngealization and gemination remain behind and are transferred to the [s] that is supplied by the language game. This treatment of gemination is unsurprising in view of how vowel length is behaving in the Sanga secret language (37). But the treatment of pharyngealization provides compelling evidence that is an alienable entity rather than an inalienable property of the segment /dˤ/.[7]

(38) Moroccan *sin* language (Youssi, 1976, 1977)

	Normal	Secret	
a.	ktab	stabsinka	'book'
	qallu	sallusinqa	'he spoke to him'
	waʃ	saʃsinwa	question particle
	mnin	sninsinma	'whence'
b.	dˤar	sˤarsinda	'house'
	dˤdˤar	sˤsˤarsinda	'the house'

In summary, this chapter's central thesis – that deletion of whole segments is the end result of a sequence of deletions affecting individual pieces of segmental structure – entails that segments have internal structural elements that a deletion operation in Gen can address individually. We have seen independent evidence for that entailment from segmental coalescence, phantom-limb effects, and a secret language. Distinctive features are entities rather than attributes. Hence, they can be deleted, preserved, or moved independently of the segments that originally bore them. This view of what features are is consistent over the range of phenomena discussed not only in this section but also throughout this chapter.

6. Coupez does not gloss individual words, only entire sentences rendered in their language game form.

7. See also Broselow's (1979) proposal that pharyngealization is a property of syllables rather than segments in Cairene Arabic.

9. Conclusion

Harmonic Serialism offers a new perspective on familiar phonological processes, deletion among them. The possibility of decomposing a seemingly unitary process into a sequence of smaller steps – and doing so in a principled way, under an explicit theory of Gen and Con – may have interesting empirical consequences. As we have seen in this chapter, the empirical consequences of decomposing deletion in this way may very well be correct.

This project raises as many questions as it answers, if not more. One class of questions involves the general theory of Gen and Con in which the deletion operation and constraints like $*V_{Weak}$-Grad are embedded. Ideally, Gen and Con would be more than just lists of operations and constraints, respectively. It would be preferable if the existence of a single-element deletion operation and the non-existence of multi-element deletion operations followed from a general theory of operations. Similarly, we would like to understand better how this more granular view of operations affects the kinds of constraints that Con requires, just as $*V_{Weak}$-Grad makes sense in a theory where segments delete by gradual attrition.

The proposal that vowel deletion happens gradually leads to an obvious vice-versa question: is epenthesis also gradual? Is [ə] the first and sometimes the last step in epenthesis, with epenthetic [i] or [a] derived from it? There is some reason to think that this is correct. Farwaneh (1995: p. 126ff.) observes that the two varieties of Arabic with epenthetic [a] only ever epenthesize it into an open syllable:[8] /kalb-kum/ → [kalbakum] 'your (pl.) dog'; /bank-na/ → [bankana] 'our bank'. Moreover, they are both differential dialects. In other words, epenthetic [a] occurs in a context where epenthetic [i] would violate the same markedness constraint that is responsible for deletion of /i/. These observations about the contextual and typological limitations on epenthetic [a] hint at a derivation in which epenthetic [i] is an intermediate step toward epenthetic [a]. This is what we would expect if derivational epenthesis of [a] is derivational deletion of /a/, reversed.

Finally, what can be said about the kind of wholesale segmental deletion that can occur in template-mapping morphology? We have already seen hints of this in the discussion of post-stress truncation processes in (28)–(31), but what of processes like the formation of the templatic hypocoristics in (39)? In this pattern, root consonants are mapped to a C*a*CC*u:*C template. The template acts as the licensor, and segments that are unlicensed because they are not associated with the template are deleted. Since the features making up the unlicensed segments are

8. The dialects with epenthetic [a] are Sudanese (Hamid, 1984; Trimingham & Gairdner, 1946) and Saudi (Abu-Mansour, 1987, 1991).

also unlicensed, gradual attrition, deleting the unlicensed features one at a time, is certainly a possibility.[9]

(39) Colloquial Arabic hypocoristics (Davis & Zawaydeh, 2001: p. 515)

Name	Hypocoristic	Root
muħammed	ħammu:d	√ħmd
ʔamʒad	maʒʒu:d	√mʒd
ʔibtisa:m	bassu:m	√bsm
marja:m	marju:m	√mrjm

These, then, are some of the questions to which this exploration of deletion and reduction processes in OT has led us.

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References

Abu-Mansour, M. H. 1987. A nonlinear analysis of Arabic syllabic phonology, with special reference to Makkan. (Ph.D. dissertation), University of Florida.

Abu-Mansour, M. H. 1991. Epenthesis in Makkan Arabic: Unsyllabifiable consonants versus degenerate syllables. In M. Eid & J. J. McCarthy (Eds.), *Perspectives on Arabic linguistics III: Papers from the Third Annual Symposium on Arabic linguistics* (pp. 137–159). Amsterdam: John Benjamins. https://doi.org/10.1075/cilt.80.10abu

Al-Mozainy, H. Q. 1981. Vowel alternations in a Bedouin Hijazi Arabic dialect: Abstractness and stress. (Ph.D. dissertation), University of Texas, Austin.

Angoujard, J.-P. 1990. *Metrical structure of Arabic*. Dordrecht: Foris. https://doi.org/10.1515/9783110862959

Archangeli, D. 1988. Aspects of underspecification theory. *Phonology* 5, 183–208. https://doi.org/10.1017/S0952675700002268

Bagemihl, B. 1988. Alternate phonologies and morphologies. (Ph.D. dissertation), University of British Columbia.

Baković, E. 2005. Antigemination, assimilation and the determination of identity. *Phonology* 22(3), 279–315. https://doi.org/10.1017/S0952675705000631

Birkeland, H. 1940. *Altarabische Pausalformen*. Oslo: Jacob Dybwad.

9. For an approach to reduplicative template mapping in HS, see McCarthy, Kimper, & Mullin (2012).

Bliese, L. F. 1981. *A generative grammar of Afar*. Dallas: The Summer Institute of Linguistics and the University of Texas at Arlington.

Broselow, E. 1979. Cairene Arabic syllable structure. *Linguistic Analysis* 5, 345–382.

Broselow, E. 1992. Parametric variation in Arabic dialect phonology. In E. Broselow, M. Eid & J. J. McCarthy (Eds.), *Perspectives on Arabic linguistics* (Vol. 4, pp. 7–45). Amsterdam and Philadelphia: John Benjamins. https://doi.org/10.1075/cilt.85.04bro

Cantineau, J. 1939. Remarques sur les parlers sédentaires syro-libano-palestiniens. *Bulletin de la Societé de Linguistique de Paris* 40, 80–88.

Chomsky, N., & Halle, M. 1968. *The sound pattern of English*. New York: Harper and Row.

Clements, G. N. 1985. The geometry of phonological features. *Phonology Yearbook* 2, 225–252. https://doi.org/10.1017/S0952675700000440

Clements, G. N. 1991. Vowel height assimilation in Bantu languages. In K. Hubbard (Ed.), *BLS 17S: Proceedings of the special session on African language structures* (pp. 25–64). Berkeley: Berkeley Linguistic Society.

Coupez, A. 1969. Une leçon de linguistique. *Africa-Tervuren* 15, 33–37.

Cowell, M. 1965. *A reference grammar of Syrian Arabic*. Washington, DC: Georgetown University Press.

Crosswhite, K. 2004. Vowel reduction. In B. Hayes, R. Kirchner & D. Steriade (Eds.), *Phonetically based phonology* (pp. 191–231). Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511486401.007

Davis, S., & Zawaydeh, B. A. 2001. Arabic hypocoristics and the status of the consonantal root. *Linguistic Inquiry* 32(3), 512–520. https://doi.org/10.1162/002438901750372540

Doak, I. 1990. Truncation, í-suffixation, and extended vowel length in Coeur d'Alene. *Papers for the 25th international conference on Salish and neighbouring languages*. Vancouver, BC: University of British Columbia.

el-Hajjé, H. 1954. *Le parler de Tripoli (Liban)Le parler de Tripoli (Liban)*. Paris: Klincksieck.

Farwaneh, S. 1995. Directionality effects in Arabic dialect syllable structure. (Ph.D. dissertation), University of Utah.

Gesenius, W. 1910. *Gesenius' Hebrew grammar, as edited and enlarged by the late E. Kautzsch*. Oxford: The Clarendon Press.

Goldsmith, J. 1976. Autosegmental phonology. (Ph.D. dissertation), MIT.

Goldsmith, J. 1990. *Autosegmental and metrical phonology*. Oxford and Cambridge, MA: Blackwell.

Gouskova, M. 2003. Deriving economy: syncope in Optimality Theory. (Ph.D. dissertation), University of Massachusetts Amherst.

Greenberg, J. 1950. The patterning of root morphemes in Semitic. *Word* 6, 162–181. https://doi.org/10.1080/00437956.1950.11659378

Greenstein, E. L. 1984. The phonology of Akkadian syllable structure. *Afroasiatic Linguistics* 9(1), 1–71.

Hall, E., Jurgec, P., & Kawahara, S. (to appear). Opaque allomorph selection in Japanese and Harmonic Serialism: A reply to Kurisu 2012. *Linguistic Inquiry*.

Hamid, A. H. M. 1984. A descriptive analysis of Sudanese Colloquial Arabic phonology. (Ph.D. dissertation), University of Illinois at Urbana-Champaign.

Hartkemeyer, D. 1997. Romancing the vowels: An optimality-theoretic account of vowel loss from Vulgar Latin to early Western Romance. *Studies in the Linguistic Sciences* 27(1), 99–118.

Hartkemeyer, D. 2000. *V: An Optimality-Theoretic examination of vowel loss phenomena, with special reference to Latin, Early Western Romance, and Basque. (Ph.D. dissertation), University of Illinois at Urbana-Champaign.

Hawkins, W. N. 1950. Patterns of vowel loss in Macushi (Carib). *International Journal of American Linguistics* 16, 87–90. https://doi.org/10.1086/464069

Hayward, K. M., Hayward, R. J., & Al-Tabūki, S. B. 1988. Vowels in Jibbāli verbs. *Bulletin of the School of Oriental and African Studies* 51, 240–250. https://doi.org/10.1017/S0041977X00114557

Hoberman, R. 2005. Pausal forms. In C. H. M. Versteegh & M. Eid (Eds.), *Encyclopedia of Arabic language and linguistics* (Vol. III). Leiden and Boston: Brill.

Hoijer, H. 1933. Tonkawa. An Indian language of Texas. In F. Boas & H. Hoijer (Eds.), *Handbook of American Indian languages*. New York: J.J. Augustin.

Hoijer, H. 1946. Tonkawa. In H. Hoijer (Ed.), *Linguistic structures of Native America* (pp. 289–311). New York: Viking Fund.

Hombert, J.-M. 1973. Speaking backwards in Bakwiri. *Studies in African Linguistics* 4, 227–236.

Hombert, J.-M. 1986. Word games: Some implications for analysis of tone and other phonological constructs. In J. J. Ohala & J. J. Jaeger (Eds.), *Experimental phonology* (pp. 175–186). Orlando: Academic Press.

Huehnergard, J. 2005. *A grammar of Akkadian (second edition)*. Winona Lake, IN: Eisenbrauns.

Hyman, L. 2002. Is there a right-to-left bias in vowel harmony? Paper presented at *9th International Phonology Meeting, Vienna*.

Ito, J. 1989. A prosodic theory of epenthesis. *Natural Language & Linguistic Theory* 7, 217–259. https://doi.org/10.1007/BF00138077

Jacobs, H. 2004. Rhythmic vowel deletion in OT: Syncope in Latin. *Probus* 16, 63–90. https://doi.org/10.1515/prbs.2004.004

Jacobs, N. G. 2005. *Yiddish: A linguistic introduction*. Cambridge: Cambridge University Press.

Jakobson, R., Fant, G., & Halle, M. 1952. *Preliminaries to speech analysis*. Cambridge, MA: MIT Press.

Jeanne, L. 1982. Some phonological rules of Hopi. *International Journal of American Linguistics* 48, 245–270. https://doi.org/10.1086/465734

Kenstowicz, M. 1983. Parametric variation and accent in the Arabic dialects. In A. Chukerman, M. Marks & J. F. Richardson (Eds.), *Papers from CLS 19* (pp. 205–213). Chicago: Chicago Linguistic Society.

Kurisu, K. 2012. Fell-swoop onset deletion. *Linguistic Inquiry* 43(2), 309–321. https://doi.org/10.1162/LING_a_00088

Lausberg, H. 1939. *Die Mundarten Südlukaniens*. Halle: Niemeyer.

Lief, E. 2006. Syncope in Spanish and Portuguese: The diachrony of Hispano-Romance phonotactics. (Ph.D. dissertation), Cornell University.

Maiden, M. 1995. Evidence from the Italian dialects for the internal structure of prosodic domains. In J. C. Smith & M. Maiden (Eds.), *Linguistic theory and the Romance languages* (pp. 115–131). Amsterdam: John Benjamins. https://doi.org/10.1075/cilt.122.05mai

McCarthy, J. J. 1979. On stress and syllabification. *Linguistic Inquiry* 10, 443–466.

McCarthy, J. J. 1986. OCP Effects: Gemination and antigemination. *Linguistic Inquiry* 17, 207–263.

McCarthy, J. J. 1988. Feature geometry and dependency: A review. *Phonetica* 43, 84–108. https://doi.org/10.1159/000261820

McCarthy, J. J. 2007. *Hidden generalizations: Phonological opacity in Optimality Theory*. London: Equinox Publishing.
McCarthy, J. J. 2008. The gradual path to cluster simplification. *Phonology* 25, 271–319. https://doi.org/10.1017/S0952675708001486
McCarthy, J. J. 2010. An introduction to Harmonic Serialism. *Language and Linguistics Compass* 4(10), 1001–1018. https://doi.org/10.1111/j.1749-818X.2010.00240.x
McCarthy, J. J., Kimper, W., & Mullin, K. 2012. Reduplication in Harmonic Serialism. *Morphology* 22(2), 173–232. https://doi.org/10.1007/s11525-012-9203-3
McCarthy, J. J., & Prince, A. 1995. Faithfulness and reduplicative identity. In J. Beckman, L. Walsh Dickey & S. Urbanczyk (Eds.), *University of Massachusetts occasional papers in linguistics 18* (pp. 249–384). Amherst, MA: GLSA Publications.
McCarthy, J. J., & Prince, A. 1999. Faithfulness and identity in Prosodic Morphology. In R. Kager, H. van der Hulst & W. Zonneveld (Eds.), *The prosody-morphology interface* (pp. 218–309). Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511627729.008
McCarus, E. N. 1955. Review of Hassan El-Hajjé *Le parler arabe de Tripoli (Liban)*. *Language* 31(4), 580–584.
Mester, A. 1994. The quantitative trochee in Latin. *Natural Language & Linguistic Theory* 12, 1–61. https://doi.org/10.1007/BF00992745
Mielke, J. 2008. *The emergence of distinctive features*. Oxford; New York: Oxford University Press.
Mitchell, T. F. 1956. *An introduction to Egyptian Colloquial Arabic*. Oxford: Oxford University Press.
Owens, J. 2009. *A linguistic history of Arabic*. Oxford and New York: Oxford University Press.
Payne, D. 1990. Accent in Aguaruna. In D. L. Payne (Ed.), *Amazonian linguistics: Studies in lowland South American languages* (pp. 161–184). Austin, TX: University of Texas Press.
Prince, A., & Smolensky, P. 1993/2004. *Optimality Theory: Constraint interaction in generative grammar*. Malden, MA and Oxford, UK: Blackwell.
Schane, S. 1984. The fundamentals of particle phonology. *Phonology* 1, 129–155. https://doi.org/10.1017/S0952675700000324
Spradlin, L. 2016. OMG the word-final alveopalatals are cray-cray prev(alent): The morphophonology of totes constructions in English. *University of Pennsylvania Working Papers in Linguistics*:, 22(1), Article 30.
Steriade, D. 2001. Directional asymmetries in place assimilation. In E. Hume & K. Johnson (Eds.), *The role of speech perception in phonology* (pp. 219–250). San Diego: Academic Press.
Steriade, D. 2001/2008. The phonology of perceptibility effects: The P-map and its consequences for constraint organization. In K. Hanson & S. Inkelas (Eds.), *The nature of the word: Studies in honor of Paul Kiparsky* (pp. 151–180). Cambridge, MA: MIT Press.
Thomason, L., & Thomason, S. 2004. Truncation in Montana Salish. In D. B. Gerdts & L. Matthweson (Eds.), *Studies in Salish linguistics in honor of M. Dale Kinkade* (pp. 354–376). Missoula, MT: University of Montana Occasional Papers in Linguistics 17.
Trimingham, J. S., & Gairdner, W. H. T. 1946. *Sudan colloquial Arabic*. London: Oxford University Press G. Cumberlege.
Urbanczyk, S. 1996. Patterns of reduplication in Lushootseed. (Ph.D. dissertation), University of Massachusetts, Amherst.
van der Hulst, H. 1989. Atoms of segmental structure: Components, gestures and dependency. *Phonology* 6, 253–284. https://doi.org/10.1017/S0952675700001020
van Eijk, J. P. 1997. *The Lillooet language: Phonology, morphology, and syntax*. Vancouver, BC: University of British Columbia Press.

Versteegh, K. 2005. Ḥaraka. In C. H. M. Versteegh & M. Eid (Eds.), *Encyclopedia of Arabic language and linguistics* (Vol. II). Leiden; Boston: Brill.

Walker, R. 2016. Positional prominence and consonantal interactions in metaphony and post-tonic harmony. In F. Torres-Tamarit, K. Linke & M. van Oostendorp (Eds.), *Approaches to metaphony in the languages of Italy* (pp. 301–332). Berlin/Boston: Walter de Gruyter.

Wang, W. S.-Y. 1968. Vowel features, paired variables, and the English vowel shift. *Language* 44, 695–708. https://doi.org/10.2307/411892

Watson, J. C. E. 2002. *The phonology and morphology of Arabic*. Oxford: Oxford University Press.

Watson, K. 2002. The realization of final /t/ in Liverpool English. *Durham Working Papers in Linguistics* 8, 195–205.

Wheeler, M. 2007. *Syncope and apocope in the history of Catalan: An Optimality Theory approach*. University of Sussex. Falmer, Brighton.

Wilson, C. 2001. Consonant cluster neutralization and targeted constraints. *Phonology* 18, 147–197.

Wright, W. 1971. *A grammar of the Arabic language*. Cambridge: Cambridge University Press.

Youssi, A. 1976. *Les parlers secrets: quelques réflexions sur la fonction de dissimulation du langage*. Paper presented at the Linguistique et sémiotique, Rabat.

Youssi, A. 1977. Les parlers secrets au Maroc. *La linguistique* 13(1), 135–143.

Zwicky, A. M. 1972. Note on a phonological hierarchy in English. In R. Stockwell & R. Macaulay (Eds.), *Linguistic change and generative theory* (pp. 275–301). Bloomington, IN: Indiana University Press.

Are there transfer effects in the Arabic comparative?

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A contentious issue in Arabic linguistics concerns whether Arabic morphology is root-based or stem-/word-based. In a root-based approach, derivation depends on the consonantal root, which is understood as constituting a morpheme. This contrasts with the stem-/word-based view where derivation is based on a stem/word that includes a vowel. The strongest evidence for the stem-/word-based approach comes from morphological processes like the plural and diminutive. Based on this, Ratcliffe (1998) makes the strong claim that all Arabic morphology is word-based. In this paper I argue that the Arabic templatic comparative is a root-based process since unlike the plural and diminutive it witnesses no transfer effects from a supposed base. I conclude that Arabic allows both word-based and root-based derivation.

Keywords: Arabic, comparative, consonantal root, root-based morphology, transfer effects, word-based morphology

1. Introduction

One of the most contentious issues in contemporary Arabic linguistics concerns whether Arabic morphology is root-based or stem-/word-based. In a root-based approach to Arabic morphology, as in McCarthy (1979, 1981) and Prunet et al. (2000), derivation is based on the consonantal root, which is understood as constituting a morpheme. This can be contrasted with the stem-/word-based view as in McOmber (1995), Benmamoun (1996, 1999, 2016), and Ratcliffe (1997, 1998, 2013) where derivation is based on a stem that includes a vocalic element or on whole words. In such a view, the consonantal root has no morphological status. The contrast between these two approaches can be seen in the different analyses of the familiar Arabic root-and-pattern verbal morphology as indicated in the partial paradigm in (1) for the verb meaning 'write'.

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(1)	Active		Passive	
a.	*katab*	'wrote (past)'	*kutib*	'was written'
b.	*kattab*	'dictate'	*kuttib*	'was dictated'
c.	*kaatab*	'corresponded'	*kuutib*	'was corresponded with'

In the root-based approach of McCarthy (1981) the consonants and vowels form separate morphemes independent of one another. The vowel pattern provides grammatical meaning (e.g., the *u-i* pattern in the right hand column of (1) indicates passive), the consonants provide the lexical meaning, and the word shape itself seems to add meaning as well. For example, the causative (traditionally referred to as "Measure" or "Form" II in studies on Arabic) has the pattern CVCCVC as in (1b) while the reciprocal (traditionally referred to as "Measure" or "Form III) has the shape CVVCVC as in (1c)). In McCarthy's (1981) analysis, the root-and-pattern system is captured by representing each morpheme on a separate tier, as shown in (2) for the Measure III verb [kaatab].

(2) Root-based approach – [kaatab] 'he corresponded'

```
k     t  b     ←  'write'
|     |  |
C VVCVC        ←  Measure III template (reciprocal)
  \\  /
    a          ←  past, active

→ kaatab       'he corresponded with'
```

The analysis in (2) is both templatic and root-based. It is templatic because it analyzes the Measure III verb as being expressed by a templatic shape and it is root-based because root consonants formally constitute a morpheme represented on their own tier.

The analysis in (2) should be contrasted with the word-based analysis in (3) whereby the Measure III reciprocal [kaatab] 'he corresponded' is formed based on the word [katab] 'he wrote' by the affixation of a vocalic mora (μ_v) which is the exponence of the reciprocal. The analysis in (3) reflects that of Ratcliffe (1997) and Davis and Ueda (2006).

(3) Word-based approach (Ratcliffe, 1997; Davis & Ueda, 2006)

```
μv +  μ  μ              μv μ μ
      |  |      →         \/ |
   k a t a b             k a t a b
          output = [kaatab]      'he corresponded'
```

In (3), the affixation of the vocalic mora marking the reciprocal results in the lengthening of the first stem vowel. There is no templatic morpheme for the reciprocal and the consonantal root does not comprise an independent morpheme.

While one can analyze Arabic verbal morphology as either being templatic (2) or non-templatic (3), various other constructions in Arabic morphology are clearly templatic. Such cases include the broken plural, the diminutive, the comparative, and various hypocoristic (nickname) patterns. The issue that arises in the analysis of such templatic morphology is what exactly maps onto a template. Does the mapping of phonemes onto a template assume a full word base such that the broken plural is based on the singular noun, the diminutive on the corresponding non-diminutive word, the comparative on the positive form of the adjective, and the hypocoristic on the full name? Or might the mapping to the template just be based on a consonantal root so that, for example, the comparative or the hypocoristic are not based on a corresponding word form? The main way that one can tell if templatic mapping is word-based or not is by the occurrence of 'transfer effects' (Clements, 1985; Hammond, 1988).

In the literature on templatic morphology, the term 'transfer effects' refers to the situation where aspects of templatic realization are dependent on the phonological form of a base word. The notion was first formally discussed by Clements (1985) in his analysis of templates in reduplication. As an example, in one type of reduplication in the Austronesian language Mokilese, if the word begins with a CVCV sequence the initial CVC reduplicates as a prefix, but if the first syllable of the word has a long vowel (CVV) then that CVV reduplicates as a prefix. This is then a transfer effect because the vowel length that surfaces in the reduplicative prefix is dependent on the vowel length of the first syllable of the base word. If transfer effects occur in templatic morphology, then it is a diagnostic that the derivation is word-based.

The issue becomes important in Arabic because of the controversy concerning whether Arabic morphology is root-based or word-based. Previous work that addresses the issue of transfer effects in Arabic (nonverbal) templatic morphology (Hammond, 1988; McCarthy & Prince, 1990; Ratcliffe 1997, 1998) have focused on the broken plural and the diminutive showing the existence of transfer effects, thus supporting a word-based approach. In this paper, after reviewing the role of transfer effects in the Arabic broken plural in Section 2, I will discuss the Arabic comparative in Section 3 providing argumentation that the Arabic comparative, unlike the broken plural (and diminutive) shows no transfer effects from a base word, and, consequently, constitutes a root-based morphological process. In Section 4, I briefly discuss the implication of our finding concluding in agreement with Watson (2006), Idrissi et al. (2008) and Benmamoun (2016) that Arabic allows for both word-based and root-based morphological derivation.

2. The Arabic broken plural and transfer effects

An example of a derivational word formation process in Arabic that is templatic and clearly operates on words is the Arabic broken plural, insightfully analyzed by McCarthy and Prince (1990) and further elaborated on by Ratcliffe (1998). The Arabic broken plural is a pattern of plural formation that applies to canonical nouns in a regular way though certain aspects of the plural form are idiosyncratic. Consider the representative data in (4), which are Standard Arabic, but similar forms are just as common in the dialects (a period marks a syllable boundary and a dash indicates a prefix boundary. The transcription symbol [ǰ] is used to represent the voiced palato-alveolar affricate phoneme /dʒ/ so as to make clear its patterning as a single consonant)

(4)		Singular	Plural	Gloss
	a.	nafs	nu.fuus	soul
	b.	ra. ǰul	ri. ǰaal	man
	c.	ta-q.diir	ta.qaa.diir	calculation
	d.	ma-k.tab	ma.kaa.tib	office
	e.	mi-f.taaħ	ma.faa.tiiħ	key
	f.	xaa.tim	xa.waa.tim	signet-ring
	g.	qaa.nuun	qa.waa.niin	law
	h.	ǰud. ǰud	ǰa.daa. ǰid	cricket (insect)
	i.	zal.za.la	za.laa.zil	earthquake

While there are certain idiosyncrasies to the broken plural, such as the specific vowel pattern for words like (4a) and (4b), McCarthy and Prince (1990) point out the striking templatic regularity, namely that the first two syllables of the plural comprise an iambic sequence of a light syllable (CV) followed by a heavy one (CVV). One can view this iambic sequence as a template that indicates the exponence of the plural morpheme. Furthermore, as first observed by Hammond (1988) and elaborated on by McCarthy and Prince (1990), various properties of the plural are dependent on the form of the singular noun suggesting that the plural is based on the singular word form. That is, there are numerous transfer effects between the singular word and the corresponding plural that helps to determine the exact phonological form of the broken plural.

First, as noted by McCarthy and Prince (1990), the length of the broken plural as either being two syllables or three syllables is dependent on the length of the singular word. If the singular word is monosyllabic (4a) or bisyllabic where the initial syllable is light (4b), then the broken plural consists of two syllables; otherwise, it consists of three syllables (4c)–(4i).

Second, as noted by Hammond (1988), in trisyllabic plural forms as in (4c)–(4i), the vowel length in the final syllable of the plural corresponds to that of the final syllable of the singular. That is, there is a transfer effect with respect to vowel length. Specifically, if the last vowel of the singular is short, then the last vowel of the plural is also short (e.g., (4d) and (4f)); but if the last vowel of the singular is long then the last vowel of the plural is long as well (e.g., (4e) and (4g)).

Third, the second consonant of the plural form is the same as the second consonant of the singular unless the first syllable of the singular has a long vowel, as in (4f) and (4g); and in this case, the second consonant of the plural is [w]. McCarthy and Prince (1990) observe that it is only the consonants that are in the first trochaic foot of the singular (i.e., the initial CVC, CVV, or CVCV sequence of the singular form) that can map onto the iambic template of the plural. If the first syllable of the singular is CVV then the second consonant of the plural will be a default [w] as in (4f) and (4g).

Fourth, as observed in McCarthy and Prince (1990), if the singular consists of a reduplicated root as in (4h) and (4i) then the plural will also show a reduplicated root. For example, in (4i) the root of the singular word [zalzala] 'earthquake' is /*zl*/. If the broken plural were based on the root, one would expect the output form of the broken plural to be [zalaalil], but the actual plural form, [zalaazil], reflects the occurrence of the reduplicated root in the singular form.

Finally, as observed by McCarthy and Prince (1990), prefixal elements that are not part of the consonantal root of the singular are not ignored in the broken plural, but instead participate in the mapping. As can be observed by the singular forms in (4c)–(4e) that begin with a prefixal consonant, it does not matter whether the first consonant of the singular is part of the prefix or part of a consonantal root: both consonant types can map onto the iambic plural template.

Given the five types of transfer effects witnessed in the formation of the broken plural that I have just discussed, it is quite apparent that the broken plural is based on the singular word form and not on an abstract consonantal root. Such a clear case of word-base derivation has led some researchers like Ratcliffe (1998: p. 50) to the strong view that all of Arabic morphology is word-based.

> Since the theory now recognizes that some derivations must operate on words, it is preferable to assume that derivational rules are in all cases operations on words. This would imply that (phonologically possible) words rather than three-consonant roots are the primitive lexical entries of the Arabic lexicon.

In further support of Ratcliffe's view one can point to diminutive formation in Standard Arabic. The diminutive is templatic in a way that is similar to the broken plural: the first two syllables of the diminutive constitute an iambic sequence but with the shape Cu.Cay. While I will not detail the diminutive here, the examples

in (5) are sufficient to show instances of transfer effects from the non-diminutive noun base to the diminutive form that closely resemble those found with the broken plural.

(5)	Noun	Diminutive	Gloss
a.	qidħ	qudayħ	arrow
b.	ʕi.nab	ʕu.nayb	grape
c.	xaa.tam	xu.way.tim	signet-ring
d.	ǰaa.muus	ǰu.way.miis	buffalo

First, as shown in (5a) and (5b), if the base noun is either one syllable or two syllables beginning with a CVCV sequence then the diminutive is two syllables; otherwise it is three syllables. Second, if the base noun begins with a CVV sequence as in (5c) and (5d) then the second consonant of the diminutive form is [w]. And third, in (5c) and (5d) one can observe a transfer effect with respect to the vowel length of the final syllable of the diminutive. In (5d), the diminutive has a long vowel in the final syllable since there is a long vowel in the base noun; in (5c) the final syllable of the diminutive has a short vowel reflecting that of the base noun.

Given the documentation of transfer effects in the broken plural and the diminutive where aspects of the derived templatic word is dependent on various phonological features of the base, and given the strong claim of Ratcliffe (1998 p. 50) cited above that Arabic derivation is word-based, one could ask if there are any clear cases of templatic morphology in Arabic where the templatic word form is derived from the consonantal root in a way that is not dependent on a base word thus showing no transfer effects. One can ask this, because as noted by Shimron (2002) and Davis (2016), the strongest evidence for the morphemic status of the consonantal root in Arabic does not come from word formation but from the psycholinguistic evidence as discussed by Prunet et al. (2000) and Boudelaa and Marslen-Wilson (2001, 2005), among others. In the following section I will consider the templatic comparative in Arabic, largely based on the Egyptian dialect. I will argue that the comparative is a root-based process that is not always clearly related to an adjectival base word. Specifically, I will maintain that the consonants that map onto the comparative template are the underlying root consonants and that the comparative (unlike the broken plural and diminutive) shows no transfer effects from an apparent base word. If such can be maintained, then it would pose a problem for a strictly word-based view of Arabic morphology as in Ratcliffe (1998).

3. The Arabic comparative and the lack of transfer effects

The comparative in Arabic seems to be a quintessential case of templatic morphology, though it has been rarely discussed in the literature on templatic morphology (but see Davis, 2017, for a broad description of the comparative). In most dialects of Arabic, the comparative is formed by taking an apparent base adjective and matching it to the templatic shape aCCaC where the C-slots represent the three root consonants that comprise many Arabic words. In Section 3.1 I present this basic templatic pattern of the comparative as instantiated in the Egyptian dialect and depict two instances of predictable templatic allomorphy. In Section 3.2 I will present the evidence that templatic mapping in the Arabic comparative is root-based showing no transfer effects from a base adjective. This will be contrasted with the broken plural discussed in Section 2. In Section 3.3, I will present two instances where a dialectal comparative seems to show a transfer effect from a base adjective. On further scrutiny, I will suggest that these instances do not manifest a transfer effect but instead reflect a reanalysis of the consonantal root, hence maintaining the root-based analysis of the templatic comparative with no real transfer effects.

3.1 The comparative template

In this section I offer a descriptive analysis of the Arabic comparative and its allomorphs as found in the Egyptian dialect (though very similar if not identical data can be found in many other varieties of Arabic). The data come from Lehn and Abboud (1965), Hassanein and Kamel (1980), Badawi and Hinds (1986), and Youssef (2013), as well as native speaker consultation. The comparative is illustrated below in (6). As can be observed in (6), all the comparative word forms have the same templatic pattern, aCCaC, which represents the primary template. Two predictable templatic allomorphs of the comparative will be discussed shortly.

(6) The Templatic Comparative – Egyptian Arabic (Note: The epenthetic initial glottal stop of the comparative forms is not indicated)

	Adj. (m. sg.)	Comparative	Gloss
a.	kibiir	akbar	big
b.	ʃaatˁir	aʃtˁar	clever
c.	wiħiʃ	awħaʃ	bad
d.	waasiʕ	awsaʕ	wide
e.	dayyaʔ	adyaʔ	narrow
f.	tixiin	atxan	fat
g.	tˁawiil	atˁwal	long

h.	sˤaʃb	asˤʕab	difficult
i.	faʔiir	afʔar	poor
j.	biʃiid	abʃad	far
k.	latˤiif	altˤaf	pleasant
l.	gamiil	agmal	beautiful
m.	rixiisˤ	arxasˤ	cheap
n.	ʕariidˤ	aʃradˤ	broad
o.	sariiʃ	asraʃ	quick
p.	ʔadiim	aʔdam	old
q.	sahl	ashal	easy
r.	wisix	awsax	dirty
s.	zaħma	azħam	crowded
t.	zaayid	azyad	excessive
u.	yasiir	aysar	easy
v.	gadiir	agdar	worthy

The data in (6) show that the formation of the comparative seems rather straightforward. Given that many Arabic words consist of three (root) consonants as attested by the adjectival forms in the left column of (6), the corresponding comparative in the middle column appears to be formed by extracting the three consonants of the base adjective and putting them into the templatic frame aCCaC where the three C-slots correspond to the three consonants of the base. The stress is on the initial syllable of the comparative in (6) in accordance with the stress pattern of Egyptian Arabic (see Watson, 2002). The vowel pattern and syllable structure of the base adjective is irrelevant in determining the form of the comparative. (6) may lead us to the simple generalization that the templatic shape of aCCaC plays the central role in expressing the exponence of the comparative.

While most comparatives have the templatic shape aCCaC, there are two additional templatic allomorphs found in Egyptian Arabic as well as in most other dialects of Arabic. The comparative forms in (7), where the final consonant is a glide, instantiates the templatic allomorph aCCa. For these adjectives, both the masculine and feminine forms are shown since for most of these words the glide only surfaces in the feminine.

(7) Comparatives of adjectives with final glides: Template allomorph aCCa

	Adj. (m. sg.)	Adj. (f. sg.)	Comparative		Gloss
a.	ħilw	ħilw-a	aħla	(*aħlaw)	sweet
b.	waatˤi	watˤy-a	awtˤa	(*awtˤay)	low
c.	ʕaali	ʕaly-a	aʃla	(*aʃlay)	high
d.	haadi	hady-a	ahda	(*ahday)	calm

The final glide /w/ in the adjectival form (7a) does not surface in its comparative counterpart. The masculine forms in (7b), (7c), and (7d) are underlyingly /waatˤiy/, /ʕaaliy/, and /haadiy/, respectively, with the final glide deleting resulting in [waatˤi], [ʕaali] and [haadi]. However, the glide /y/ does not appear in the corresponding comparative forms. As observed by Broselow (1976) and Youssef (2013), content words in Egyptian Arabic do not have vowel-glide sequences in word-final position, so the absence of the glide in the comparative forms in (7) is phonologically conditioned. It suggests that the templatic representation of aCCa serves as a full-fledged allomorph of the aCCaC pattern that is phonologically predictable.

Yet more complicated allomorphy of the comparative in Egyptian Arabic occurs when the adjective form ends in two identical root consonants or when the final root consonant is a geminate. Here, the comparative typically takes the pattern aCaCC where the last two consonant slots comprise a geminate, and word stress is on the final syllable in compliance with the regular Egyptian Arabic stress rules. Sample data are in (8).

(8) Comparatives of adjectives ending in two identical consonants: aCáC$_i$C$_i$

	Adj. (m. SG.)	Comparative	Gloss
a.	ʃidiid	aʃadd	strong
b.	xafiif	axaff	light
c.	laziiz	alazz	delicious
d.	taamm	atamm	complete
e.	ħaadd	aħadd	sharp
f.	gidiid	agadd/agdad	recent/new

Instead of following the templates of aCCaC or aCCa, the comparatives in (8) are framed in the aCáCC pattern where the final CC is a geminate. The form of the allomorph aCáCC is not phonologically predictable in the sense that it cannot be derived from the áCCaC templatic pattern. As a consequence, the templatic comparative is not prosodic in the way that the diminutive or broken plural template is (i.e., beginning with an iambic sequence). Despite the occurrence of templatic allomorphy in the comparative, one can see that the comparative word forms are predictable from the consonantal root: words with three (different) root consonants take the pattern áCCaC and words where the last two root consonants are identical take the pattern aCáCC. In the following Section 3.2, I will present the evidence that the precise form of the comparative displays no transfer effects from the adjectival base. Possible counterexamples will be discussed in Section 3.3. including the unexpected form [agdad] in (8f).

3.2 Evidence against transfer effects in the Arabic comparative

The comparative formation as outlined above in Section 3.1 can be understood as reflecting a root-based mapping of consonants to the construction-specific comparative template, thus supporting the consonantal root as a morphological entity. In order to defend this conclusion, it is incumbent to show that there are no transfer effects from the supposed base adjective onto the comparative. In this section I will present several arguments for the lack of transfer effects and for the view that the comparative formation is a root-based process.

As a first argument for the lack of transfer effects in the Arabic comparative is the contrast with the Arabic broken plural discussed in Section 2. For example, as seen by the plural forms in (4c), (4e) and (4g), if the second syllable of the singular form has a long vowel then a long vowel appears in the final syllable of the plural. That is, with the broken plural there is a transfer effect from the singular to the plural concerning vowel length. In contrast, as can be seen by the comparative forms in (6)–(8), vowel length never transfers to the comparative: the comparative always surfaces with short vowels. Second, the length of the broken plural as either being two syllables (4a)–(4b) or three syllables (4c)–(4i) was determined by the length of the singular. If the singular is either monosyllabic as in (4a) or bisyllabic beginning with CVCV as in (4b) then the broken plural is two syllables; otherwise it is three syllables. On the other hand, the comparative is always two syllables regardless of the length of the supposed base adjective and this includes comparatives of three syllable adjectival forms that will be shown in (9). Thus, the phonological properties of vowel length and word length do not transfer or have influence on the specific form of the comparative.

A further observation that distinguishes the comparative with the broken plural and that supports a root-based mapping of the comparative comes from the behavior of affixal consonants. As was observed with the broken plural forms in (4c)–(4e) affixal consonants participate in the mapping of the broken plural. To the contrary, affixal consonants occurring in adjectives in Egyptian Arabic do not map onto the consonantal slots of the comparative template aCCaC or its templatic allomorphs. In (9), one can see examples of comparatives of adjectives that contain affixal consonants (underlined in (9)).

(9) Comparatives of adjectives with affixal consonants

	Adj. (m. sg.)	Comparative	Gloss
a.	mu-naasib	ansab	appropriate
b.	mu-himm	ahamm (*amham)	important
c.	ma-gnuun	agann	crazy
d.	mu-ħibb	aħabb	loving
e.	kaslaan	aksal	lazy

f.	taʃbaan	atʃab	tired
g.	rufayyaʃ	arfaʃ	thin
h.	ʔusˁayyar	aʔsˁar	short
i.	ʔurayyib	aʔrab	near
j.	ʔulayyil	aʔall	few
k.	ħinayyin	aħann	kind/affectionate

The adjectives in (9a)–(9d) have a derivational prefix, while the adjectives in (9e)–(9f) have a final derivational suffix. The adjectival base in (9g)–(9k) resembles a diminutive form with the infixal geminate glide [-yy-] between the second and third root consonants. None of these affixal consonants participate in the mapping to the comparative template. Instead the comparative template (aCCaC/aCaCC) exclusively takes the three root consonants of the base. Most revealing is the comparison between the derivational prefixes in (9a)–(9d) with the derivational prefixes of the broken plural in (4c)–(4e). The prefixal consonant maps to the initial iambic template of the broken plural in (4c)–(4e) but it fails to participate in the mapping to the comparative template. If one considers the word form [magnuun] 'crazy' in (9c), its comparative form (i.e., [agann]) exhibits mapping of the root consonants only, but its broken plural form [magaaniin] shows the mapping of the prefixal consonant /m/ onto the initial iambic template of the plural. This is consistent with the root-based nature of the comparative versus the word-base mapping of the broken plural.

Further support of the root base mapping of the comparative and the lack of transfer effects comes from the comparative of adjectives where a root glide has undergone some phonological change in the adjectival word. In the comparative of such words, the underlying root glide resurfaces in the templatic comparative and not as it appears in the adjectival base. Consider the four Egyptian Arabic forms given in (10), all containing an underlying root glide that does not surface as such in the actual adjective.

(10) Comparatives with root glides that undergo change

	Adj. (m. SG.)	Comparative	Root	Gloss
a.	mu-fiid	afyad (*[afda])	fyd	beneficial
b.	baayiz	abwazˁ (ʔ[abyazˁ])	bwzˁ	spoiled
c.	baayix	abwax	bwx	unpleasant
d.	hayyin	ahwan	hwn	trivial

The root consonants that appear in the comparative counterpart are those that are part of the underlying root although they are not manifested in the adjectival base. For example, the underlying form of the adjective in (10a) is /mu-fyid/ where /mu/ is a derivational prefix. A regular phonological rule that assimilates the glide /y/ to a front vowel converts underlying /mufyid/ to [mufiid]. Accordingly, there

is no glide [y] in the base adjective [mufiid]. However, the comparative is not *[afda] or *[amfad] but [afyad] with the reappearance of the root consonant /y/ in the comparative template. Similarly, in (10b), the underlying form is /baawizˤ/ (one can know that the root glide is underlyingly /w/ and not /y/ because of the verbal form [bawwazˤ] "to spoil"). The underlying form /baawizˤ/ is subject to a morphophonological rule that converts /w/ to [y] before /i/ (which also applies to (10c)–(10d)). Yet in (10b)–(10d) the comparative surfaces with the underlying glide, and not the glide that appears in the apparent base form. Consequently, each of the contrasts between the adjectival base word and the corresponding comparative forms in (10) confirms that the underlying root consonants are visible in the formation of the comparative rather than the consonants as they surface in the actual base adjective word form.

A final piece of evidence against the occurrence of transfer effects in the comparative and consistent with the root-based mapping is the observation that some comparatives in Egyptian Arabic do not have any obvious corresponding adjectival form as their derivational source. That is, native speakers disagree or are uncertain on what the possible base might be. Five examples are given in (11) with an explanation after each example as to why it does not seem to have an adjectival base.

(11) Comparatives in Egyptian Arabic where the base does is unclear
   a. [asˤwab] 'more correct' – The base should be [sˤaayib], but this word does not seem to occur in the Egyptian dialect.
   b. [azwaʔ] 'more polite' – The suggested base is [zooʔ], but [zooʔ] is a noun, not an adjective.
   c. [aħaʔʔ] 'more entitled' – The base is not clear. One possible base is the adjective [ħaʔiiʔi] 'genuine' but the meaning of the comparative does not match the meaning of the possible base.
   d. [anwar] 'more luminous' – The base is not clear. It could be [minawwar] 'luminous' or [nuur] 'light'.
   e. [awadd] 'more desirable' – The base could be [widdi] 'amicable, friendly' but adjectives that are derived by the productive adjectival (nisba) suffix -i are not supposed to take the templatic comparative; the base might be [widd] 'affection', but [widd] is a noun

The presence of isolated or independent comparative forms without clear corresponding non-comparative adjectival bases as in (11) follows from the templatic comparative reflecting a root-based word formation process where there are no transfer effects. This makes the templatic comparative quite different from the broken plural. In the following section I consider some potential (minor) instances of transfer effects in the comparative arguing that they really do not constitute clear cases of non-root mapping.

3.3 Possible marginal instances of transfer effects in the comparative

In this section, I discuss two cases of possible transfer effects in the Arabic comparative, one based on Egyptian Arabic that involves the comparative of [gidiid] 'new' in (8f) as [agadd] or [agdad] and the other involving an unusual templatic allomorph containing four consonant slots that is found in some varieties of southern Levantine Arabic. One other marginal case of a possible transfer effect that I will not discuss but will note here concerns the form in (10b). As noted in Section 3.2 the comparative of [baayiz$^{\varsigma}$] 'spoiled' in (10b) in Egyptian Arabic is [abwaz$^{\varsigma}$] which reflects the underlying root /b,w,z$^{\varsigma}$/. However, in some other dialects of Arabic the preferred comparative of [baayiz$^{\varsigma}$] 'spoiled' is [abyaz$^{\varsigma}$]. This could reflect a transfer effect if indeed the root of [baayiz$^{\varsigma}$] 'spoiled' is /b,w,z$^{\varsigma}$/ as based on other derived forms and not /b,y,z$^{\varsigma}$/. Along these lines, I will suggest that the potential cases of transfer effects in the comparative may instead involve a reanalysis of what comprises the underlying root.

3.3.1 *The comparative of [gidiid] 'new'/'recent'*

One of the most intriguing potential instances of a transfer effect in the Egyptian Arabic comparative concerns the adjective [gidiid] 'new/recent' in (8f). The authoritative Badawi and Hinds's (1986) *A Dictionary of Egyptian Arabic* gives both [agadd] and [agdad] as the comparative forms with no difference in meaning indicated. These forms reflect two different templatic allomorphs of the comparative. The expected form for the comparative of [gidiid] is [agadd]. This follows the pattern in (8), repeated below for convenience, in which the last two root consonants are identical.

(8) Comparatives of adjectives ending in two identical consonants: aCáC$_i$C$_i$

	Adj. (m. sg.)	Comparative		Gloss
a.	ʃidiid	aʃadd	*aʃdad	strong
b.	xafiif	axaff	*axfaf	light
c.	laziiz	alazz	*alzaz	delicious
d.	taamm	atamm	*atman	complete
e.	ħaadd	aħadd	*aħdad	sharp
f.	gidiid	agadd/agdad		recent/new

As seen in (8), any adjective whose base ends in two identical consonants, whether those two consonants are split by a vowel as in (8a)–(8c) or appear as a geminate as in (8d)–(8e) (as well as in (9b)), takes the templatic shape aCaCC and not the predominant templatic allomorph aCCaC which applies to forms where the second and third root consonants are different as exemplified in (6). The one exception to this is the adjective [gidiid] 'new' whose more common comparative form is,

in fact, the unexpected [agdad]. Note that none of the other adjectives in (8) have a comparative of the pattern [aCCaC], and as far as I am aware, the comparative [agdad] for [gidiid] is the only exception to the pattern in (8) in Badawi and Hinds (1986) among adjectives whose last two root consonants are identical (Elijah Reynolds, personal communication).

One can posit that the common use of [agdad] for the comparative of [gidiid] reflects a transfer effect in the sense that, in the adjective [gidiid], the two instances of the phoneme /d/ are separated by a vowel and in the comparative [agdad] they are also separated by a vowel as well. In support of this, informal consultations with native Egyptian Arabic speakers on degrees of ungrammaticality seem to suggest that the potential acceptability of the aCCaC allomorph for adjectives in (8) and (9b)–(9c) is far worse when the final two consonants of the base adjective form a geminate than when those two consonants are separated by a vowel. As an example, while both [ahmam] for the comparative of the adjective [mu-himm] 'important' in (9b) and [axfaf] for the comparative of [xafiif] 'light' in (8b) are considered ungrammatical, [axfaf] for [xafiif] sounds somewhat better to the native speakers that I consulted than [ahmam] for [mu-himm]; and this nuanced judgment in terms of degree of ungrammaticality may reflect a transfer effect in that in both [axfaf] and [xafiif] the two identical root consonants are separated by a vowel. Thus, one can argue that the common use of the comparative [agdad] for [gidiid] 'new/recent' reflects a transfer effect from the adjectival base.

In light of the possible transfer effect in the formation of the comparative [agdad] for the adjective [gidiid], it is interesting to try to trace the recent dialectal history of the two forms. Our contention is that the emergence of [agdad] for the comparative of [gidiid] in Egyptian Arabic is historically recent (within the last 50 years) and that in current Egyptian Arabic [agdad] and [agadd] have very different meanings such that these different forms may not actually reflect a transfer effect.

With respect to the claim put forward here, that the use of [agdad] for the comparative of [gidiid] is recent in Egyptian Arabic, I first note that the historically expected templatic form of the comparative of adjectives ending in two identical consonants (based on Classical Arabic) is aCaCC as seen by all the adjectives in (8) other than [gidiid]. Perhaps more noteworthy is that the grammars of Egyptian Arabic written before 1970, such as Tewfik and Harrell (1957) and Lehn and Abboud (1965), only indicate the expected [agadd] for the comparative of [gidiid]. However, by the 1980s the sources were either indicating both [agadd] and [agdad] for the comparative of [gidiid] as in Badawi and Hinds (1986) or just [agdad] as in Hassanein and Kamel (1980). In current spoken Egyptian Arabic, [agdad] is used consistently as the comparative of [gidiid], although, based on native speaker consultation, there does seem to be a minority of speakers who interpret [agadd] as 'new' in a temporal sense (i.e., 'recent') thus distinguishing [agadd]

from [agdad]. However, for most contemporary speakers of Egyptian Arabic the form [agadd] is understood to be the comparative of a different adjective, namely [gadd] 'serious'. Given this, I suggest that the emergence of the use of [agdad] 'newer' over the last fifty years has come about as a result of homophony avoidance with the comparative [agadd] 'more serious'. While in a sense the choice of the comparative [agadd] for the adjective [gadd] 'serious' and the comparative [agdad] for the adjective [gidiid] 'new'/'recent' reflects a transfer effect in that [agadd] preserves the final geminate of the base [gadd] 'serious' and [agdad] has the two consonants separated by a vowel as in the base [gidiid], there may also be a difference as to what constitutes the root consonants of these adjectives. As discussed by McCarthy (1986), Arabic roots where the last two consonants are identical could be represented as having either two root consonants underlyingly or three. For example, [gidiid] could be interpreted as either having two root consonants, /g,d/, or three root consonants /g,d,d/. While the OCP favors the interpretation of two root consonants, it could be that in cases of potential semantic ambiguity, one meaning could be interpreted as consisting of two root consonants and another as having three root consonants. Thus, I suggest from an analytic perspective that in contemporary Egyptian Arabic the word [gidiid] 'new/recent' consists of three root consonants /g,d,d/ whereas the word [gadd] 'serious' has two root consonants /g,d/. Most words where the last two root consonants are identical conform to the OCP along the lines argued for by McCarthy (1986) in having just two root consonants and this is consistent with most of the words in (8). However, there is the potential to analyze such roots as having three root consonants and this potential may be realized in situations where it helps to distinguish ambiguity as in the case of the comparative [agdad] 'newer' versus [agadd] 'more serious'. Consequently, if [gidiid] is analyzed as having the three root consonants [g,d,d] then the derivation of the comparative [agdad] may not necessarily entail a transfer effect.

3.3.2 *Comparatives of forms with four root consonants in southern Levantine Arabic*

In some varieties or southern Levantine Arabic that include subdialects of northern rural Jordanian Arabic, Palestinian Arabic and varieties spoken in northern Israel there is a templatic allomorph for comparatives of adjectives having four root consonants: $aC_1aC_2C_3aC_4$ (i.e., a three-syllable comparative). While such seems impossible in Egyptian Arabic and in many other dialects (where comparatives of adjectives consisting of four root consonants would be expressed periphrastically), the following comparative forms in (12) are acceptable in various varieties of southern Levantine Arabic.

(12) The templatic comparative aCaCCaC in southern Levantine Arabic

	Adj. (m. sg.)	Comparative	Gloss
a.	maskiin	amaskan	unfortunate
b.	ʕunsˤuri	aʕansˤar	prejudiced
c.	m-xarbatˤ	axarbatˤ	messy
d.	m-farqaʕ	afarqaʕ	cracking [sound]
e.	m-zaʕbar	azaʕbar	talkative
f.	ma-ǰnuun	amaǰnan	crazy

The examples in (12a)–(12b) show two adjectival forms each consisting of four root consonants. These consonants unproblematically map onto the aCaCCaC template. The adjectives in (12c)–(12e) each contain five consonants: a prefixal consonant and four root consonants. It is the root consonants that map onto the aCaCCaC template. The comparative form in (12) that seems to show transfer effects is [amaǰnan] 'crazier' in (12f). This should be compared with the cognate comparative in Egyptian Arabic, [agann] in (9c). The southern Levantine form [amaǰnan] 'crazier' shows two different transfer effects from the base [ma-ǰnuun] 'crazy': the two [n] sounds that are separated in the base adjective ([ma-ǰnuun]) are separated in the comparative and the prefixal [m] of the base is incorporated into the templatic comparative. This seems to be an unusual case where a prefix maps onto the comparative template. However, from consultation with several southern Levantine speakers, one can propose that the base for the comparative [amaǰnan] is not [ma-ǰnuun] 'crazy' with the root consonants /ǰ,n/, but a dialectal derivative of [ma-ǰnuun] where the prefixal /m/ is incorporated into a new root meaning 'acting crazy'. Derived words such as [mit-maǰnin] and [bit-maǰnin] 'you are acting crazily' strongly suggest that the comparative [amaǰnan] is analytically based on the four root consonants /m, ǰ,n,n/ and thus does not really witness any transfer effects. This is because prefixes like [bit-] '2nd pers. masc. present' prefix to a root-initial consonant. Thus, a form like [bit-maǰnin] 'you are acting crazily' implies that the /m/ has been reanalyzed as part of the root and that the comparative form [amaǰnan] displaying the templatic shape aCaCCaC reflects a mapping of only root consonants.

It goes without saying that the occurrence of comparatives with the shape aCaCCaC needs to be further investigated, especially to observe whether the existence of the comparative templatic allomorph aCaCCaC is restricted to rural Levantine varieties or is more widespread throughout the Arabic speaking world. I am unaware of previous discussion about this templatic comparative, though see Davis (2017).

4. Conclusion

In this paper I have provided argumentation based on Egyptian Arabic that the Arabic comparative, unlike the broken plural (and diminutive), shows no clear transfer effects from a base word, and, consequently, constitutes a root-based morphological process. Excluding the possible marginal exception of the comparative of [gidiid] 'new/recent' as [agdad] in (8f), the phonological form of the apparent base word plays virtually no role in determining the specific phonological form that the comparative takes. Assuming that our findings based on Egyptian Arabic hold for other dialects, one can conclude that the comparative in general reflects a morpheme-based process that supports the morphological status of the consonantal root. It is a root-based word formation process. This seems to argue against a strictly stem or word-based view of Arabic morphology as in Benmamoun (1999) or Ratcliffe (1997, 1998, 2013). On the other hand, other instantiations of Arabic templatic morphology, such as the broken plural discussed in Section 2, are word-based since their realization shows transfer effects from a base. There may be an emerging view that Arabic morphology can be both word-based and root-based (Watson, 2006; Idrissi et al., 2008; Benmamoun, 2016) and the question is what types of morphology are likely to be word-based showing transfer effects and which are likely to be root-based. I leave these matters for future research.

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References

Badawi, E.-S., & Hinds, M. 1986. *A dictionary of Egyptian Arabic*. Beirut: Librairie Du Liban.

Benmamoun, E. 1996. The derivation of the imperative in Arabic. In M. Eid (Ed.), *Perspectives on Arabic linguistics IX* (pp. 151–164). Amsterdam: John Benjamins. https://doi.org/10.1075/cilt.141.11ben

Benmamoun, E. 1999. Arabic morphology: The central role of the imperfective. *Lingua* 108, 175–201. https://doi.org/10.1016/S0024-3841(98)00045-X

Benmamoun, E. 2016. Verbal and nominal plurals and the syntax-morphology interface. In S. Davis & U. Soltan (Eds.), *Perspectives on Arabic linguistics XXVII* (pp. 59–74). Amsterdam: John Benjamins. https://doi.org/10.1075/sal.3.03ben

Boudelaa, S., & Marslen-Wilson, W. 2001. Morphological units in the Arabic mental lexicon. *Cognition* 81, 65–92. https://doi.org/10.1016/S0010-0277(01)00119-6

Boudelaa, S., & Marslen-Wilson, W. 2005. Discontinuous morphology in time: Incremental masked priming in Arabic. *Language and Cognitive Processes* 20, 207–260. https://doi.org/10.1080/01690960444000106

Broselow, E. 1976. The phonology of Egyptian Arabic (Doctoral dissertation). University of Massachusetts, Amherst.

Clements, G. N. 1985. The problem of transfer in nonlinear phonology. *Cornell Working Papers in Linguistics* 5, 38–73.

Davis, S. 2016. The Arabic comparative and the nature of templatic mapping in Arabic. In L. Körtvélyessy, P. Stekauer & S. Valera (Eds.), *Word-Formation Across Languages* (pp. 73–90). Newcastle, UK: Cambridge Scholars Press.

Davis, S. 2017. Some issues for an analysis of the templatic comparative in Arabic with a focus on the Egyptian dialect. In H. Ouali (Ed.), *Perspectives on Arabic Linguistics XXIX* (pp. 129–150). Amsterdam: John Benjamins. https://doi.org/10.1075/sal.5.06dav

Davis, S., & Ueda, I. 2006. Prosodic vs. morphological mora augmentation. *Lexicon Forum* 2, 121–143.

Hammond, M. 1988. Templatic transfer in Arabic broken plurals. *Natural Language & Linguistic Theory* 6, 247–170. https://doi.org/10.1007/BF00134231

Hassanein, A., & Kamel M. 1980. *Yalla ndardish sawa*. Cairo, Egypt: Arabic Language Unit, American University of Cairo.

Idrissi, A., Prunet, J.-F., & Béland, R. 2008. On the mental representation of Arabic roots. *Linguistic Inquiry* 39, 221–259. https://doi.org/10.1162/ling.2008.39.2.221

Lehn, W., & Abboud, P. 1965. *Beginning Cairo Arabic*. Austin: University of Texas Press.

McCarthy, J. 1979. Formal problems in Semitic phonology and morphology (Doctoral dissertation), Massachusetts Institute of Technology, Cambridge.

McCarthy, J. 1981. A prosodic theory of nonconcatenative morphology. *Linguistic Inquiry* 12, 373–348.

McCarthy, J. 1986. OCP effects: Gemination and antigemination. *Linguistic Inquiry* 17, 207–263.

McCarthy, J., & Prince, A. 1990. Foot and word in prosodic morphology: The Arabic broken plural. *Natural Language & Linguistic Theory* 8, 209–282. https://doi.org/10.1007/BF00208524

McOmber, M. 1995. Morpheme edges and Arabic infixation. In M. Eid (Ed.), *Perspectives on Arabic linguistics VI* (pp. 173–189). Amsterdam: John Benjamins. https://doi.org/10.1075/cilt.130.15mco

Prunet, J.-F., Beland, R., & Idrissi, A. 2000. The mental representation of Semitic words. *Linguistic Inquiry* 31, 609–648. https://doi.org/10.1162/002438900554497

Ratcliffe, R. 1997. Prosodic templates in a word based morphological analysis of Arabic. In M. Eid & R. Ratcliffe (Eds.), *Perspectives on Arabic linguistics X* (pp. 147–171). Amsterdam: John Benjamins. https://doi.org/10.1075/cilt.153.10rat

Ratcliffe, R. 1998. *The "broken" plural problem in Arabic and comparative Semitic: Allomorphy and analogy in non-concatenative morphology*. Amsterdam: John Benjamins. https://doi.org/10.1075/cilt.168

Ratcliffe, R. 2013. Morphology. In J. Owens (Ed.), *The Oxford handbook of Arabic linguistics* (pp. 71–91). Oxford: Oxford University Press.

Shimron, J. 2002. Semitic languages: Are they really root-based? In J. Shimron (Ed.), *Language processing and acquisition in languages of Semitic, root-based morphology* (pp. 1–28). Amsterdam: John Benjamins.

Tewfik, L., & Harrell, R. 1957. *Lessons in colloquial Egyptian Arabic*. Washington D.C.: Georgetown University Institute of Language and Linguistics.

Watson, J. C. E. 2002. *The phonology and morphology of Arabic*. Oxford: Oxford University Press.

Watson, J. C. E. 2006. Arabic morphology: Diminutive verbs and diminutive nouns in San'ani Arabic. *Morphology* 16, 189–204. https://doi.org/10.1007/s11525-006-9103-5

Youssef, I. 2013. Place assimilation in Arabic: Contrasts, features, and constraints (Doctoral dissertation). University of Tromsø, Tromsø, Norway.

Gemination in Rural Jordanian Arabic

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This study provides a detailed acoustic description of gemination in Rural Jordanian Arabic (RJA), measuring the duration of geminate and singleton consonants across the full range of consonants and positions in an understudied variety of Arabic: RJA, a Levantine dialect spoken by village dwellers in the northern part of Jordan. The results show that position plays a role in phonetic gemination, with medial geminates substantially longer than those in final position. Vowels adjacent to medial consonants were also measured, and when adjacent to a geminate consonant, short vowels are found to be shorter, and long vowels are found to be longer than when adjacent to a singleton consonant.

Keywords: phonetics, gemination, geminate consonants, Arabic, Jordanian Arabic

1. Introduction

Arabic is of particular interest to studies of gemination due to the fact that it has both word-medial, and the much more typologically rare, word-final geminates. Despite a good amount of studies of gemination across Arabic varieties and across languages (cf. Esposito and di Benedetto, 1999; Cohn, et al., 1999; Ridouane, 2003; Hirose and Ashby, 2007; Ridouane, 2007; Kraehenmann, 2008; Hamzah, 2013; Khattab and Al-Tamimi, 2014), acoustic study of the myriad of Arabic varieties is incomplete, and there is much to learn about the patterning of gemination across languages, even across varieties of Arabic. This study addresses this gap by investigating both word-medial and word-final gemination in an understudied variety of Arabic, Rural Jordanian Arabic (RJA), a Levantine dialect spoken by village dwellers in the northern part of Jordan.

Phonologically, a geminate refers to a long or doubled consonant that contrasts phonemically with a shorter version counterpart that is referred to as a singleton (Davis, 2011). In Standard Arabic as well as other spoken varieties, consonants

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and vowels can both contrast for length. All Arabic consonants can be geminated word-medially, but word-finally there are restrictions, such as the impossibility of glottal stop /ʔ/ and the glottal fricative /h/ as geminates. It is worth pointing out here that word-medial geminates are more salient perceptually than word-final, as the intervocalic position offers a clear beginning and end point of the target consonant (cf. Pajak, 2013; Dmitrieva, 2012).

The organization of this paper is as follows: in section one we provide an overview of Jordanian Arabic dialects and show the distinction among them. In section two we outline phonetic correlates of gemination and give an overview of the phonetic analyses of geminate consonants from the literature. In section three we outline our methods for data collection and analysis. In section four we provide our results, and in section five we discuss some of the most important findings.

2. An overview of Jordanian Arabic dialects

There are three basic sub-dialects of spoken Jordanian Arabic distributed according to the geographical areas (Al-Sughayer, 1990; Sakarna, 1999; Al-Deaibes, 2015; Al-Deaibes, 2016).[1] These sub-dialects are classified into Urban Jordanian Arabic (UJA), Bedouin Jordanian Arabic (BJA), and Rural Jordanian Arabic[2] (RJA; Suleiman, 1985). UJA functions as a lingua franca and is considered more prestigious than other Jordanian Arabic (JA) dialects (see Abd-El-Jawad, 1987; Al-Wer, 2002). UJA is mainly spoken in the big cities by those who moved from other locations in Jordan and those who are originally Palestinians or Syrians who migrated to Jordan in the past two centuries due to wars, expulsion, and political unrest whether due to the British colonization, the Ottoman ruling, or the Israeli-Palestinian conflict. According to Al-Wer (2007), Palestinians who migrated to Jordan between 1948 and 1967 were mostly from rural areas in Palestine and did not have any political, economic or social influence on Jordanian society, as opposed to Palestinians who moved to Jordan in earlier years. Therefore, the latter Palestinian immigrants' dialects did not influence the dialect of Amman, namely the Urban dialect. Bedouin Jordanian Arabic, on the other hand, is spoken by the desert dwellers who are descendants of nomadic tribes and live in settled communities in the northern-estern, center and southern parts of Jordan in the districts of Mafraq, Kerak, Ma'an, Al-Balqa and Al-Badiya Al-Shamaliya. However,

1. For more thorough and in-depth information about these dialects, see Palva (1994, 2008); Al-Wer (2002, 2007, 2015), among others.

2. The term RJA is used in this study to refer to the Horani dialect spoken in the suburbs of the City of Irbid in northern part of Jordan.

these Bedouin dialects emerged due to the migration of the nomadic tribes from the Arabian Peninsula to the Desert of Ash-Sham in the past centuries (see Al-Sughayer, 1990). The tribes that speak the Bedouin dialect primarily live in the northern part of Jordan, which include, but not limited to, Bani Hasan, Bani Khaled, Bani Sakher, and Ahld il-Jabal (also known as Jbiliya or Badu il-Jabal). The Bedouin dialect spoken in the central part of Jordan represents the tribes of Bani Sakher, Al-Ajarma, Al-Da'aja, to mention a few. The Bedouin dialects spoken in the south of Jordan are referred to as 'Northwest Arabian Arabic' (Palva, 2008: 400). The dialects are spoken by, but not limited to, Al-Huwaitat, Al-Adwan, Al-Majali. Lastly, RJA is mainly spoken by villagers or Horani People (hence called Horani dialect) who live in the suburbs and the countryside of north Jordan, for example in the districts of Al-Ramtha, Bani Kanana, Bani Ebeid, and Al-Koura and the city of Der'aa and its villages in Syria. This variety is also spoken by city dwellers who are originally from the suburbs but moved to the city. For example, the people who moved from Tafileh to Amman still live in one area or neighborhood in Amman that is called Hay Al-Tafaileh (meaning the neighborhood of Tafileh people) and still speak their own dialect. It is also worth highlighting that the name Horan comes from the Plains of Horan, which extends from the north of Dera'a in Syria to the the 'outskirts of the city of Karak in southern Jordan' (Al-Wer et al. 2015: 75). The distinction between the three dialects is primarily phonetic, although there are also lexical and syntactic differences. Table 1 shows some examples of the consonantal differences in the three dialects of JA. For example the MSA phoneme /k/ in (a) becomes affricate [t͡ʃ] in the vicinity of a front vowel in Rural and Bedouin varieties, while it is realized as [k] in UJA across the board, as shown in Table 1, (see Al-Wer 2007; Palva 1994).

Table 1. Examples of phonetic differences between the JA varieties

	Word in MSA	**RJA**	**BJA**	**UJA**	**Gloss**
a.	/**k**/ kalb	[t͡ʃ] /t͡ʃalib/	[t͡ʃ] /t͡ʃalb/	[k] /kalb/	dog
b.	/**q**/ qalb	[g] /gałub/	[g] /gałb/	[ʔ] /ʔalb/	heart
c.	/**dˤ**/dˤarab	[ðˤ] /ðˤarab/	[ðˤ] /ðˤarab/	[dˤ] /dˤarab/	Hit.past
d.	/**ð**/ iða	[ð] /iða/	[ð] /iða/	[z] /iza/ or[d] /ida/	if

The MSA voiceless uvular plosive phoneme /q/ in (b) is realized as [g] in the Rural and Bedouin varieties and [ʔ] in the urban variety. Moreover, /dˤ/ in (c) is realized as [ðˤ] in RJA and BJA but in UJA, it is realized as [dˤ]. Similarly, /ð/ in (d) surfaces as [ð] in RJA and BJA while in UJA it is either the stop [d] or the fricative [z].

More importantly, and particularly when talking about gemination in JA, little attention has been given to the acoustic investigation of gemination in RJA, and

this attention has been limited to the study of the word-medial position (see Al-Tamimi, 2004). The word-final position has been nearly ignored in the literature on JA except for the study of Al-Tamimi et al., 2010. The present work addresses this gap in the literature, with the added typological interest of investigating the rare phenomenon of final gemination alongside medial gemination.

3. Acoustic correlates of gemination

In this section, we discuss the acoustic correlates of gemination which will be investigated in this study.

Consonant duration

A number of studies on dialects of Spoken Arabic have investigated gemination word-medially (see however Al-Tamimi, Abu-Abbas, and Tarawneh, 2010). Some of these studies have concluded that fricatives are the longest geminate consonants when compared with other geminate consonants (Khattab and Al-Tamimi, 2009; Khattab and Al-Tamimi, 2014), while other studies have reported that trills are the longest (Aldubai, 2015), a state of affairs which poses a question about which consonants are the longest and which consonants are the shortest when they undergo gemination. This also raises the question of whether all consonants undergo gemination in the same way and whether the length is affected in the same way. It has been reported that there is no evidence of a temporal compensation between medial geminates and the vowels preceding them (Ghalib, 1984; Zeroual, et al., 2008; Khattab and Al-Tamimi, 2009).

The most salient acoustic correlate differentiating geminate consonants from singletons is consonant duration, with geminates being longer than singletons. It is interesting to note however that the duration ratio for geminate as compared to singleton consonants is not consistent cross-linguistically (Khattab and Al-Tamimi, 2014). For example, Finnish and Berber have a 3:1 ratio while in Japanese, Italian, and Turkish the ratio is 2:1. Hamzah (2013) lists sixteen languages which range in ratios from 1.38:1 for Norwegian, (Fintoft, 1961; cited in Hamzah, 2013) to 3.4:1 for Malayalam (Local and Simpson, 1999; cited in Hamzah, 2013). This shows that geminates are viewed and characterized by the durational length they have when contrasted with singletons.

It has been further stated in the literature that manner of articulation (Aoyama and Reid, 2006), place of articulation (Local and Simpson, 1999), and voicing (Blevins, 2004) play an important role in affecting the singleton/geminate duration ratio. For example, according to Khattab and Al-Tamimi (2014), sonorants

show a clearer distinction in singleton/geminate ratios than sibilants because sibilants are 'intrinsically' long. Bilabials and alveolars are longer than consonants with other places of articulation (e.g., palatals, velars, and pharyngeals), while voiced obstruents are shorter than voiceless ones (Gussenhoven, 2000). Thus, cross-linguistically, the most reliable and robust acoustic parameter that distinguishes a geminate consonant from a singleton consonant is the duration of the target consonants (See Malayalam (Local and Simpson, 1999); Levantine Arabic, Hungarian, Madurese (Ham, 2001); Arabic and Swedish (Hassan, 2002); Italian (Payne, 2005); Tashlhiyt Berber (Ridouane, 2007); among others).

Vowel duration

There is some disagreement over whether vowels preceding a geminated consonant are originally long or short. For example, Al-Tamimi, Abu-Abbas, and Tarawneh (2010) posit that vowels preceding singletons are longer than those preceding the geminates, whereas Zeroual et al. (2008) argue that geminates do not induce shortening of their preceding vowel. However, all previous studies agree that geminated consonants, regardless of the manner of articulation, are distinctively longer than their singleton counterparts (Al-Tamimi, Abu-Abbas, and Tarawneh, 2010), with geminates being generally twice as long as singletons (Aldubai, 2015).

The vowel immediately preceding the target consonant is often an important acoustic correlate of gemination (See Cypriot and Standard Greek, (Arvaniti, 2001); Levantine Arabic, Hungarian, Madurese (Ham, 2001); Arabic and Swedish (Hassan, 2002); Italian (Payne, 2005); Tashlhiyt Berber (Ridouane, 2007); among others). That said, the exact correlation differs cross-linguistically. Pajak (2013) reports that vowels in Polish are shorter preceding geminated consonants than preceding singletons. On the other hand, vowels in Turkish, Finnish, Sinhala, and Persian are longer before geminates (Letterman, 1994; Hansen, 2004). Vowels following geminates have been reported on much less frequently, but Khattab and Al-Tamimi (2008) show that vowels following a geminate consonant in Lebanese Arabic are shorter than vowels following a singleton consonant. This tells us that while vowels are fairly consistently affected and worth examining, as there is no consistent pattern that could be expected to apply to RJA. We might, however, expect RJA to follow the pattern in Lebanese Arabic, given that this is the closest language studied.

4. Methods

Participants

Participants of the study were four male and two female native speakers of RJA with no known history of either speech or hearing impairment, all of whom had English as their L2 but RJA was the only language used at home. They were all born and raised in Jordan. They were all graduate students at the University of Manitoba within the same age range (mean age = 33.6 years) and had been living in Canada between four to six years, residing in Winnipeg at the time of recordings.

Data

Following Khattab and Al-Tamimi (2009) and Khattab and Al-Tamimi (2014), participants were provided a written list of minimal pairs and near-minimal pairs. Participants were asked to read the randomized words at a normal rate. Each stimulus was read once for the participants to become familiar with the word and its orthography. Then, participants read each stimulus three times, in order to allow for more natural productions as speakers got used to the task, as well as to provide several tokens for analysis. Words were presented to participants in the Arabic orthography supplemented with diacritic markings where needed. Target word pairs were recorded in the carrier phrase [*ʔiħki___kaman marra*] ("Say____ again"). The participants were not informed about the specific purpose of the study. The recordings were performed with a Marantz PMD-660 solid state recorder and an Audix OM 2 microphone in the anechoic chamber in the linguistics lab at the University of Manitoba, made at 44,100 Hz and then down-sampled to 22,050 Hz for acoustic analysis. The first author, a native speaker of RJA, confirmed that the pronunciations were as they would be in RJA (and not in MSA, for example).

The stimuli consisted of 204 words used in minimal and near-minimal pairs, for a total of 1224 analyzed words given the number of participants (6 × 204 = 1224; see Appendix A). Consonants were excluded where they did not occur naturally in a given position, i.e. the glottal stop /ʔ/, which does not occur as a geminate word medially or finally in RJA. It is worth noting here that the glottal stop in the word medial position in RJA is sporadically dropped, with the preceding vowels lengthened due to temporal compensation. The minimal pairs contrasted words that have singleton consonants with words that have geminate consonants as follows.

(1) Group 1: CVCVC words vs. CVC:VC words, 27 each, totaling 54, e.g., *katab* 'he wrote' vs. *kat:ab* 'he made someone write'.

(2) Group 2: CVCV:C words vs. CVC:V:C words, 27 each, totaling 54, e.g., *sˁafa:r* 'yellowness' vs. *sˁaf:a:r* 'whistling pot'

(3) Group 3: CVC words vs CVC: words, 24 each, totaling 48, e.g., *fan* 'art', vs. *fan:* 'tossed a coin'

(4) Group 4: CV:C words vs. CV:C: words, 24 each, totaling 48, e.g., *ba:t* 'slept over' vs. *ba:t:* 'decisive'

Words in Group (1) have initial stress while those in Group (2) have final stress. The items in Groups (3) and (4) are monosyllabic, and the vowel is stressed. Forms with a long vowel preceding a word-medial singleton/geminate are rare in RJA, and hence it is impossible to use the entire consonant inventory with a preceding long vowel. The full word list used is given in Appendix A.

Acoustic analysis

Praat (version 5.4.09) Boersma and Weenink (2009) was used to perform the acoustic measurements of the experiments. The following three measurements were taken: (i) duration of the target consonant (geminate or singleton), (ii) duration of the vowel preceding target consonant, and (iii) duration of vowel following the word-medial target consonants. Following Ham (2001); Turk, Nakai, and Sugahara (2006); and Khattab and Al-Tamimi (2014), the boundaries of vowels and consonants were determined through simultaneous evaluation of the waveform, spectrogram, and amplitude envelope. The beginning of the vowel boundary was determined based on the rise in amplitude from the preceding consonant and appearance of formant structure, and the end of the vowel boundary based on the decrease in amplitude and disappearance of or abrupt change in formants. The beginning of the stop closure was marked at the end of the second formant structure of the preceding vowel, which typically coincides with a significant drop in amplitude of vocal fold vibration (Jessen, 1998). The end of the closure was marked at the left-edge of the release burst for final stops. It is worth mentioning here that stops word-final in the data studied had clear release bursts. For medial stops the end of closure was marked before the beginning of the formant structure and voicing of the following vowel. For nasal stops, closure duration was determined based on the beginning of the offset of F2 to the 'reappearance' of F2 for medial consonants, or the offset of nasal murmur for medial consonants (Ham, 2001: 33). The beginning of the fricative boundaries was determined based on the onset and offset of visible and/or audible frication, including any period of silence which sometimes precedes the start of the following vowel for medial fricatives (Khattab and Al-Tamimi, 2014: 246). The boundaries for nasals, laterals, and approximants

were determined based on the decrease in amplitude and beginning and/or end of transitions in the surrounding vowels (depending on the consonant position), as well as the absence of higher formants for approximants. Trill boundaries were determined based on the beginning of the decrease in amplitude and/or cessation of formants in the preceding vowel (but not formant shadows) to the rise in amplitude indicating the release of tongue contact and start of formants in the following vowel. The segments were manually marked for boundaries using Praat. Extraction of duration measurements was done via Praat script.

5. Results

Because different independent variables affected the medial versus the final geminates, we ran three separate linear regression statistical models in R-studio (Version 0.99.473) with the *lm* function (Chambers, 1992): one for word-final geminates, one for word-medial geminates, and one for all geminates. A number of dependent variables were investigated: consonant duration, preceding vowel duration, and following vowel duration (for word-medial position). Independent variables investigated included: consonant type (geminates and singletons), place of articulation, manner of articulation, pharyngealization, voice, and gender. A third linear regression model was carried out to compare the duration of geminates word-medially and word-finally. Following Cotton (2013), when an independent variable turned out to be non-significant, it was removed, and the same test was run again in order to obtain a model with the best fit.

Word-medial consonants

Unsurprisingly, linear regression tests reveal that the mean duration of the consonant in the geminate position (M = 185, SD = 34) is significantly longer than the mean duration of the consonant in the singleton position (M = 87, SD = 33), by a mean of 98 ms. This indicates that the geminate duration is almost twice the length of its singleton counterpart and that the ratio of a medial geminate to a medial singleton is 2.1:1, as shown in Figure 1.

As mentioned above, independent variables gender, place of articulation, manner of articulation, voice, and pharyngealization were also used in the statistical analysis to check if they play any role in the consonant duration. Independent variables that turned out to be insignificant were removed one by one and the statistical test was performed again in order to guarantee the best fit, coefficients for which are shown in Table 2.

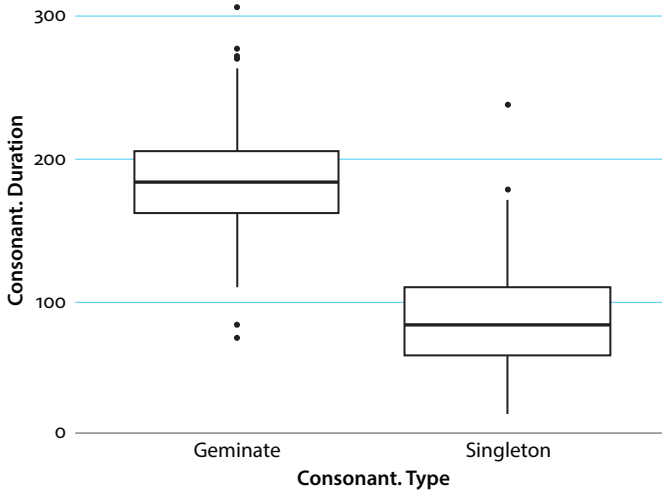

Figure 1. Overall mean duration of geminates and singletons word-medially across all speakers

Table 2. Statistical results from singleton and geminate duration

	Estimate	**Std. Err.**	***t*-value**	**Pr(>|*t*|)**
(Intercept)	177.5	7.1	24.	<2e-16***
Con.Type: Single	−97.5	2.0	−47.1	<2e-16***
Voice: Voiceless	37.7	2.5	14.5	<2e-16***
Place: Glottal	−23.1	6.0	−3.8	0.00***
Manner: Trill	−42.9	8.9	−4.8	1.73e-06***

The statistical analysis results indicate that only the glottal consonants affected the consonant mean duration, where glottal consonants are shorter than other consonants. Furthermore, voicelessness significantly affected the consonant mean duration, where voiceless obstruents are surprisingly shorter than voiced obstruents. Finally, the trill consonant /r/ was also shorter than other consonants. Table 3 shows the mean duration for each of the consonant types, based on place of articulation in the word-medial position and also shows the duration ratio (not absolute duration) of geminates to singletons for each type of consonant.

Table 4 shows the mean duration for each of the consonant types based on place of articulation in the word-medial position and shows the duration ratio (not absolute duration) of geminates to singletons for each type of consonant.

Table 3. Word-medial geminate-singleton contrast based on place of articulation

Cons. Type	Place	Cons. Duration (ms)	Difference (ms)	Ratio
geminate	Labial	177	104	1:2.4
singleton	Labial	73		
geminate	Alveolar	183	104	1:2.3
singleton	Alveolar	79		
geminate	Glottal	187	104	1:2.3
singleton	Glottal	83		
geminate	Palatal	173	90	1:2.1
singleton	Palatal	83		
geminate	Pharyngeal	190	96	1:2.0
singleton	Pharyngeal	94		
geminate	Interdental	181	92	1:2.0
singleton	Interdental	89		
geminate	Labio-dental	205	95	1:1.9
singleton	Labio-dental	110		
geminate	Velar	184	87	1:1.9
singleton	Velar	97		
geminate	Palato-Alv	197	90	1:1.8
singleton	Palato-Alv	107		

Table 4. Word-medial geminate-singleton contrast based on manner of articulation

Cons. Type	Manner	Cons. Duration (ms)	Difference (ms)	Ratio
Geminate	Trill	141	111	1:4.1
Singleton	Trill	30		
Geminate	Lateral	172	114	1:2.9
Singleton	Lateral	58		
Geminate	Nasal	177	115	1:2.8
Singleton	Nasal	62		
Geminate	Plosive	189	100	1:2.1
Singleton	Plosive	89		
Geminate	Glide	173	90	1:2.1
Singleton	Glide	83		
Geminate	Fricative	189	94	1:2.0
Singleton	Fricative	95		
Geminate	Affricate	192	88	1:1.8
Singleton	Affricate	104		

Preceding short vowel duration

The duration of the short vowel /a/ before all geminate and singleton consonants in the medial position was measured, and it was found that the mean duration of /a/ before geminates is 64 ms whereas the mean duration before singletons is 77 ms, which is a statistically significant difference. The results also show that preceding short vowel mean duration was also affected by place of articulation, manner of articulation, voicing and gender as shown in Table 5, where only significant results are reported.

Table 5. Statistical results of pre short vowel in singleton and geminate contexts

	Estimate	**Std. Er**	***t*-value**	**Pr(>|*t*|)**
(Intercept)	80.8	3.8	21.2	< 2e-16***
Con.Type: Single	13.0	1.07	12.0	< 2e-16***
Place: Labial	−17.6	2.5	−6.9	6.73e-12***
Place: Labio-den	−9.8	3.1	−3.0	0.002**
Place: Palato-alv	−11.4	3.1	−3.6	0.000***
Place: Pharyng	−9.8	2.4	−4.0	5.01e-05***
Place: Velar	−4.0	1.7	−2.2	0.022*
Manner: Lateral	−15.6	4.6	−3.3	0.000***
Manner: Nasal	−17.2	4.3	−3.9	7.45e-05***
Voice: Voiceless	−10.6	1.3	−7.9	9.45e-15***
Gender: Male	−3.5	1.1	−3.1	0.001**

Following short vowel duration

The mean duration of the short vowel /a/ after geminates versus singletons is not significant, with only a 1 ms difference obtaining between conditions. The results show that the mean duration of the vowel following a geminate is more affected by place of articulation, voicing, and gender as shown in Table 6, with only significant results reported.

With regards to voicing, voicelessness was found to significantly affect the vowel mean duration by -9 ms. Similarly, gender significantly affected the vowel mean duration by −14 ms. This result is consistent with that for the short vowel mean duration preceding geminates.

Table 6. Statistical results of post long vowel in singleton and geminate contexts

	Estimate	Std. Err.	*t*-value	Pr(>|*t*|)
(Intercept)	96.8	3.6	26.6	< 2e-16***
Place: Inter-den	10.4	4.8	2.1	0.03*
Place: Labio-den	36.3	7.9	4.5	7.56e-06***
Place: Palato-alv	10.2	4.9	2.0	0.03*
Voice: Voiceless	−8.6	3.2	−2.6	0.007**
Gender: Male	−14.4	3.0	−4.8	2.45e-06***

Following long vowel duration

The duration of the long vowel /a:/ after medial consonants was measured, and it was found that the mean duration of /a:/ after geminates is 189 ms as compared to 178 ms after singletons, which is a statistically significant result. The statistical results also show that mean duration of the long vowel following a geminate is not affected by place of articulation, manner of articulation, or voicing, and that only gender significantly affected the duration of the vowel; see Table 7.

Table 7. Statistical results of post short vowel in singleton and geminate contexts

	Estimate	Std. Err.	*t*-value	Pr(>|*t*|)
(Intercept)	217.5	5.0	42.9	< 2e-16***
Con.Type: Single	−10.8	5.0	−2.1	0.033*
Gender: Male	−41.7	5.0	−7.7	1.1e-13***

This result is similar to those for the short vowels before and after geminates. Our results then show that overall, females speakers tend to have slightly longer vowels that male speakers.

Word-final consonants

This section reports on the results of the consonant duration in the final position of tautosyllabic words CVC, CVC:, CV:C and CV:C:, e.g., *fan* 'art', *fan:* 'tossed a coin', *ba:t* 'slept over', and *ba:t:* 'decisive', respectively. Linear regression models indicate that the mean duration of geminates (M = 198, SD = 55) is significantly longer than the mean duration of singletons position (M = 141, SD = 45), and that the ratio of the final geminate consonant to its singleton counterpart is 1.4:1, as shown in Figure 2.

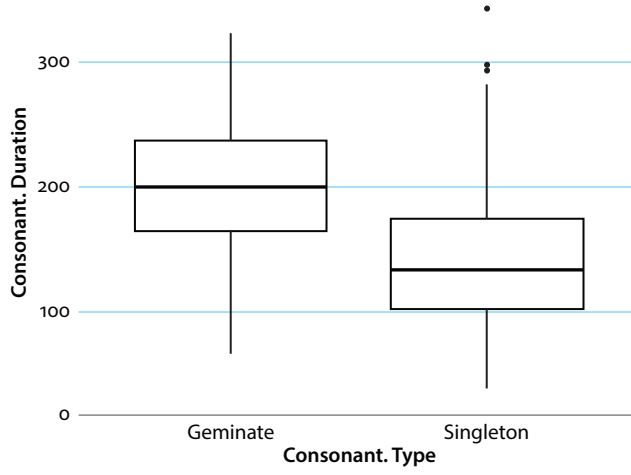

Figure 2. Mean duration of geminates and singletons word-finally

The statistical analysis indicates that the place of articulation, gender, and pharyngealization did not play a significant role in the duration of the consonants word-finally, whereas the other independent variables did have a significant effect, as shown in Table 8.

Table 8. Statistical results from singleton and geminate duration

	Estimate	**Std. Err.**	***t*-value**	**Pr(>|*t*|)**
(Intercept)	210.1	10.0	20.8	< 2e-16***
Con.Type: Single	−57.0	4.0	−14.1	< 2e-16***
Voice: Voiceless	37.1	4.6	7.9	1.24e-14***
Manner: Fricative	−21.8	10.6	−2.0	0.040*
Manner: Glide	−33.0	13.9	−2.3	0.01*
Manner: Lateral	−42.5	13.9	−3.0	0.002**
Manner: Nasal	−35.2	12.0	−2.9	0.003**
Manner: Plosive	−26.4	10.9	−2.4	0.015*
Manner: Trill	−86.7	13.9	−6.2	9.68e-10***

Table 9 shows the mean duration for each of the consonant types, based on place of articulation in the word-final position and shows the duration ratio (not absolute duration) of geminates to singletons for each type of consonant.

Table 10 shows the mean duration for each of the consonant types, based on place of articulation in the word-final position and shows the duration ratio (not absolute duration) of geminates to singletons for each type of consonants.

Table 9. Word-final geminate-singleton contrast based on manner of articulation

Cons. Type	Manner	Cons. Duration (ms)	Difference (ms)	Ratio
Geminate	Trill	120	51	1:1.7
Singleton	Trill	69		
Geminate	Affricate	213	68	1:1.5
Singleton	Affricate	145		
Geminate	Fricative	212	61	1:1.4
Singleton	Fricative	151		
Geminate	Plosive	202	57	1:1.4
Singleton	Plosive	145		
Geminate	Glide	174	51	1:1.4
Singleton	Glide	123		
Geminate	Nasal	171	50	1:1.4
Singleton	Nasal	121		
Geminate	Lateral	152	27	1:1.2
Singleton	Lateral	125		

Table 10. Word-final geminate-singleton contrast based on place of articulation

Cons. Type	Place	Cons. Duration (ms)	Difference (ms)	Ratio
Geminate	Pharyngeal	191	121	1:2.7
Singleton	Pharyngeal	71		
Geminate	Interdental	208	68	1:1.5
Singleton	Interdental	140		
Geminate	Alveolar	195	63	1:1.5
Singleton	Alveolar	132		
Geminate	Palato-Alv	230	71	1:1.4
Singleton	Palato-Alv	159		
Geminate	Labio-dental	219	61	1:1.4
Singleton	Labio-dental	158		
Geminate	Palatal	174	51	1:1.4
Singleton	Palatal	123		
Geminate	Labial	168	46	1:1.4
Singleton	Labial	122		
Geminate	Velar	207	42	1:1.3
Singleton	Velar	165		

Preceding short vowel duration

Linear regression tests found the durational difference of short vowels before final geminates and singletons to be statistically significant, with a mean duration of 77 ms before word-final geminates and 82 ms before word-final singletons. The results also show that mean vowel duration is affected by place of articulation, manner of articulation, voicing, and gender as shown in Table 11, where only significant results are reported.

Table 11. Statistical results of pre short vowel in singleton and geminate contexts

	Estimate	**Std. Err.**	***t*-value**	**Pr(>|*t*|)**
(Intercept)	114.3	7.9	14.3	< 2e-16***
Con.Type: Single	5.410	2.0	2.5	0.009**
Place: Inter-den	−13.1	4.0	−3.2	0.001**
Place: Labial	−21.4	4.6	−4.6	5.81e-06***
Place: Labio-den	−19.3	5.8	−3.3	0.001**
Place: Palatal	−36.0	9.2	−3.8	0.000***
Place: Pharyng	−29.5	4.4	−6.5	2.41e-10***
Manner: Lateral	−35.5	9.2	−3.8	0.000***
Manner: Plosive	−16.7	8.2	−2.0	0.045*
Manner: Trill	−21.0	9.2	−2.2	0.02*
Voice: Voiceless	−8.5	2.6	−3.2	0.001**
Gender: Male	−27.4	2.2	−12.4	< 2e-16***

Again, we see that male speakers have shorter vowels than female speakers.

Preceding long vowel duration

Turning to long vowels preceding word-final consonants, linear regression tests again found statistically significant differences between the long vowels found before geminates as compared to before singletons, with a mean duration of 206 ms before geminates and 179 ms before singletons. The statistical results also show that the mean duration of the long vowel preceding a geminate in the final position is affected by place of articulation whereas manner of articulation, pharyngealization and voicing did not significantly affect the mean duration of the vowel, as shown in Table 12.

Table 12. Statistical results of pre-long vowel in singleton and geminate contexts

	Estimate	Std. Err.	*t*-value	Pr(>|*t*|)
(Intercept)	233.6	6.7	34.5	< 2e-16***
Con.Type: Single	−26.7	5.8	−4.6	6.26e-06***
Place: Inter-den	−19.7	9.3	−2.1	0.035773*
Place: Labial	−38.4	11.0	−3.4	0.000***
Place: Labio-den	−30.3	14.9	−2.0	0.04*
Place: Palatal	−38.5	14.9	−2.5	0.010*
Place: Pharyng	−39.3	11.0	−3.5	0.000***
Gender: Male	−18.7	6.1	−3.0	0.002**

Table 12 shows that long vowels are significantly shorter before pharyngeals, palatals, labials, labio-dentals, and inter-dentals as compared to alveolars, palate-alveolars and velars. Likewise, men were found to have significantly shorter mean durations for the long vowel than female speakers.

Based on Table 13, it is clear that short vowels are shorter preceding geminates than singletons in both positions, but show no difference following the target consonants. Long vowels are longer preceding and following geminates.

Table 13. Mean durations for vowels in geminate and singletons contexts

Vowel duration	Singleton		Geminate	
	Short	Long	Short	Long
preceding, word-medial	77		64	
preceding, word-final	82	179	77	206
following, word-medial	88	178	87	189

In this section, we have outlined the results of the vowel and consonant measurements and the statistical tests conducted. Overall, we found that geminates were always statistically significantly longer than singletons, that word-final geminates are shorter than word-medial geminates, that the duration of the vowel preceding a consonant is a secondary cue to the geminate status of the consonant, and that the males in the study consistently used shorter vowels than the females. We now turn in the next section to the discussion of the most interesting results to come out of this study.

6. Discussion

In this section, we highlight two particularly interesting results emerging from the study which contribute to our descriptive knowledge of Arabic and RJA specifically.

One of the more interesting findings to come out of this study relates to the proportional differences between geminates and singletons based on word position. In medial position, we see a duration ratio of 2.1:1 of the geminate as compared to the singleton, whereas in final position we see a ratio of 1.4:1. The durational contrast between word-medial geminates and singletons is particularly robust, with geminates over twice as long as singletons in that position, but although there is a statistically significant durational difference between word-final geminates versus singletons, this becomes less obvious, with geminates less than 50% longer than singletons. This positional contrast demonstrates the methodological importance of analyzing segments in different positions to obtain a complete picture of the facts. This study shows that that word-medial geminates in RJA are more than one and a half times longer than those in word-final position.

It was found that phonologically short vowels preceding geminates are significantly shorter than those preceding singletons, while phonologically long vowels preceding geminates are significantly longer than those preceding singletons. These findings for RJA are contrary to Khattab and Al-Tamimi (2008) for Lebanese Arabic, where post-geminate vowels were unaffected by the previous consonant and for Khattab and Al-Tamimi (2014) where only long vowels were affected, and phonologically short vowels were not. On the other hand, our results are similar to Nakai et al. (2009) for Finnish, who found that vowels following coda geminates are shorter when the vowels preceding coda geminates are long. While these interesting phonetic findings may be related to the moraic nature of Arabic, we leave this investigation to further (morpho-) phonological study.

Vowel duration was found to be a robust acoustic correlate (except for the following short vowel) throughout the investigation of both word-medial and word-final positions. Short vowels were found to be shorter when adjacent to geminates whereas long vowels were, somewhat surprisingly, longer when adjacent to geminates. This is also in line with what Al-Tamimi (2004) found for Jordanian Arabic when he investigated intervocalic singleton and geminate sonorants.

7. Conclusion

In this paper, we have examined the acoustic durational correlates of gemination across the spectrum of RJA consonants, both word-medially and word-finally. The

results showed that consonant duration of geminates is longer than that in singleton consonants, and substantially longer in medial position than in final position. This result corroborates what has been reported in the literature by Ladefoged and Maddieson (1996) insofar as the duration of the geminate consonants is one and a half to three times longer than their singleton counterparts. The consonant duration was also found to be the most reliable acoustic correlate to distinguish between a geminate and a singleton in RJA, which follows findings of other studies in the literature (e.g. Ham, 2001; Hassan, 2002; Ladd and Scobbie, 2003; Payne, 2005; Ridouane, 2007). Short vowels were found to be shorter in the geminate context than in the singleton one. By contrast, long vowels are longer in the geminate context than in the singleton one. This is similar to Hindi (Ohala, 2007), Dogri (Ghai, 1980) and Bengali (Lahiri and Hankamer, 1988). Unlike consonant duration, vowel duration appears to be language/dialect-specific, as some languages tend to have longer vowel durations before geminates and shorter vowel durations before singletons, as opposed to what has been found in the current study.

References

Abd-El-Jawad, H. 1987. Cross-dialectal variation in Arabic: Competing prestigious forms. *Language in Society* 16(3), 359–367. https://doi.org/10.1017/S0047404500012446

Al-Deaibes, M. 2016. The phonetics and phonology of assimilation and gemination in Rural Jordanian Arabic. University of Manitoba PhD Dissertation.

Al-Deaibes, M. 2015. The morpho-syntax of sentential negation in Rural Jordanian Arabic. *Journal of Advances in Linguistics* 5: 3, 750–760.

Aldubai, N. 2015. The impact of geminates on the duration of the preceding and following vowels in Ta'zi dialect'. *Arab World Journal* 6(1), 335–358. https://doi.org/10.24093/awej/vol6no1.26

Al-Sughayer, K. 1990. Aspects of comparative Jordanian and modern standard Arabic phonology. PhD dissertation, Michigan State University, Michigan.

Al-Tamimi, F. 2004. An experimental phonetic study of intervocalic singleton and geminate sonorants in Jordanian Arabic. *Al-Arabiyya* 29, 37–52.

Al-Tamimi, F., Abu-Abbas, K., and Tarawneh, R. 2010. Jordanian Arabic final geminates: An experimental clinical phonetic study. *Poznań Studies in Contemporary* 46(2), 111–125.

Al-Wer, E. 2002. Jordanian and Palestinian dialects in contact: Vowel raising in Amman. In M. C. Jones, and E. Esch (eds.), *Language change: The interplay of internal, external and extra-linguistic factors*, 63–80. Mouton de Gruyter. https://doi.org/10.1515/9783110892598.63

Al-Wer. E. 2007. The formation of the dialect of Amman. In: Catherine Miller, Enam Al-Wer, Dominique Caubet, and Janet Watson (eds.). *Arabic in the city: issues in dialect contact and language variation*. 55–76. New York: Routledge.

Al-Wer, E., Horesh, U., Herin, B., and Fanis, M. 2015. How Arabic regional features become sectarian features. Jordan as a Case Study. *Zeitschrift Für Arabische Linguistik*, (62), 68–87.

Aoyama, K., and Reid, L. 2006. Cross-linguistic tendencies and durational contrasts in geminate consonants: An examination of Guinaang Bontok geminates. *Journal of the International Phonetic Association* 36(2). 145–157. https://doi.org/10.1017/S0025100306002520

Arvaniti, A. 2001. Comparing the phonetics of single and geminate consonants in Cypriot and Standard Greek. *Proceedings of the 4th International Conference on Greek Linguistics*, 37–44. Thessaloniki: University Studio Press.

Boersma, P. and Weenink, D. 2009. Praat: doing phonetics by computer (Version 4.6.09) [Computer program]. Retrieved November 19, 2014, from http://www.praat.org/.

Broselow, E., Chen, S., and Huffman, M. 1997. Syllable weight: convergence of phonology and phonetics. *Phonology* 14 (1), 47–82. https://doi.org/10.1017/S095267579700331X

Chambers, J. M. 1992. *Linear models. Chapter 4 of Statistical Models in* S. J. M. Chambers and T. J. Hastie (eds.), Wadsworth and Brooks/Cole.

Cohn, A., Ham, W., and Podesva, R. 1999. The phonetic realization of singleton-geminate contrasts in three languages of Indonesia. In John J. Ohala, Yoko Hasegawa, Manjari Ohala, Daniel Granville, and Ashlee C. Bailey (eds.), *Proceedings of the 14th International Congress of Phonetic Sciences*, 587–590. San Francisco, CA.

Cotton, R. 2013. *Learning R*. O'Reilly Media, Inc.

Blevins, J. 2004. *Evolutionary phonology: The emergence of sound patterns*. Cambridge: CUP. https://doi.org/10.1017/CBO9780511486357

Boersma, P. and Weenink, D. 2009. Praat: doing phonetics by computer (Version 4.6.09) [Computer program]. Retrieved November 19, 2014, from http://www.praat.org/.

Davis, S. 2011 Geminates. In Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume and Keren Rice (eds.), *The Blackwell Companion to Phonology* 2, 837–859, Malden, MA and Oxford: Wiley-Blackwell. https://doi.org/10.1002/9781444335262.wbctp0037

Dmitrieva, O. 2012. Geminate typology and the perception of consonant duration. Stanford University PhD Dissertation.

Esposito, A. et al. 1999. Acoustical and perceptual study of gemination in Italian stops. *Journal of the Acoustical Society of America* 106:4, 2051–2062. https://doi.org/10.1121/1.428056

Fintoft, K. 1961. The duration of some Norwegian speech sounds. *Phonetica* 7, 19–39. https://doi.org/10.1159/000258096

Ghai, K. 1980. Contributions to Dogri phonetics and phonology. *Annual Report of the Institute of Phonetics 14*. University of Copenhagen. 31–94.

Ghalib, G. 1984. *An experimental study of consonant Gemination in Iraqi Colloquial Arabic*. Unpublished Ph.D. Thesis, University of Leeds.

Gussenhoven, C. 2000. On the origin and development of the Central Franconian tone contrast. In A. Lahiri (Ed.), *Analogy, Levelling, Markedness: Principles of Change in Phonology and Morphology*. Berlin: Mouton de Gruyter. 215–260. https://doi.org/10.1515/9783110808933.215

Ham, W. 2001. *Phonetic and phonological aspects of geminate timing*. New York: Routledge.

Hamzah, H. 2013. The acoustics and perception of the word-initial singleton/geminate contrast in Kelantan Malay. The University of Melbourne PhD Dissertation.

Hansen, B. 2004. Production of Persian geminate stops: Effects of varying speaking rate. In Augustine Agwuele, Willis Warren and Sang-Hoon Park (eds.), *Proceedings of the 2003 Texas Linguistics Society Conference*, 86–95. Somerville: Cascadilla Press.

Hassan, Z. 2002. Gemination in Swedish and Arabic with a particular reference to the preceding vowel: an instrumental and comparative approach. *In Proceedings of Fonetik TMH-QPSR* 44. 81–85. Swedish Loredana Cerrato Centre for Speech Technology.

Hirose, A., and Michael A. 2007. An acoustic study of devoicing of the geminate obstruents in Japanese. In Trouvain Jürgen and William J. Barry (eds.), *Proceedings of ICPhS XVI*, Saarbrücken, Germany, 909–912.

Jessen, M. 1998. *Phonetics and phonology of tense and lax obstruents in German*. Amsterdam: Benjamins.

Khattab, G., and Al-Tamimi, J. 2008. Durational cues for gemination in Lebanese Arabic. *Language and Linguistics* 22. 39–55.

Khattab G., and Al-Tamimi, J. 2009. Phonetic cues to gemination in Lebanese Arabic. *In the 17th Manchester Phonology Meeting*. Manchester University.

Khattab, G., and Al-Tamimi, J. 2014. Geminate timing in Lebanese Arabic: the relationship between phonetic timing and phonological structure. *Laboratory Phonology* 5(2):231–269. https://doi.org/10.1515/lp-2014-0009

Kraehenmann, A. and Lahiri, A. 2008. Duration differences in the articulation and acoustics of Swiss German word-initial geminate and singleton stops. *Journal of the Acoustical Society of America* 123/6, 4446–4455. https://doi.org/10.1121/1.2916699

Ladd, R., and Scobbie, J. 2003. External sandhi as gestural overlap? Counter-evidence from Sardinian. In John Local, Richard Ogden, and Rosalind Temple (eds.), *Papers in Laboratory Phonology* VI, 164–182. Cambridge: Cambridge University Press.

Ladefoged, P., and Maddieson, I. 1996. *The sounds of the world's languages*. Oxford: Blackwell.

Lahiri, A., and Hankamer, J. 1988. The timing of geminate consonants. *Journal of Phonetics* 16. 327–338.

Letterman, R. 1994. A phonetic study of Sinhala syllable rhymes. *Working Papers of the Cornell Phonetics Laboratory* 9. 155–181.

Local, J., and Simpson, A. 1999. Phonetic implementation of geminates in Malayalam nouns. In John Ohala, Yoko Hasegawa, Manjari Ohala, Daniel Granville, and Ashlee C. Bailey (eds.), *Proceedings of the 14th International Congress of Phonetic Sciences* Vol. 1, 595–598. San Francisco, CA.

Maddieson, I. 1997. Phonetic universals. In William J. Hardcastle and John Laver (eds.), *The Handbook of Phonetic Sciences*, 619–639. Oxford: Blackwell.

Nakai, S., et al. 2009. Utterance-final lengthening and quantity in Northern Finnish. *Journal of Phonetics* 37(1). 29–45. https://doi.org/10.1016/j.wocn.2008.08.002

Ohala, M. 2007. Experimental methods in the study of Hindi geminate consonants. In *Experimental Approaches to Phonology*, Maria Josep Sol´e, Patrice Beddor, and Manjari Ohala (eds.), Oxford: Oxford University Press. 351–368.

Pajak, B. 2013. Non-intervocalic geminates: typology, acoustics, perceptibility. In L. Carroll, B. Keffala, and D. Michel (eds.), *San Diego Linguistics Papers* 4: 2–27. San Diego, CA: UC San Diego.

Palva, H. 1994. Bedouin and Sedentary elements in the dialect of Es-Salt. Diachronic notes on the sociolinguistic development. *Actes des Premieres journees internationals de dialectologie arabe de Paris*. D. Caubet et M. Vanhove (eds.), 459–469.

Palva, H. 2008. 'Northwest Arabian Arabic'. In: K. Versteegh et al. (eds.) *Encyclopedia of Arabic Language and Linguistics* 3: Leiden: Brill. 400–408.

Payne, E. 2005. Phonetic variation in Italian consonant gemination. *Journal of the International Phonetic Association* 35(2), 153–189. https://doi.org/10.1017/S0025100305002240

Ridouane, R. 2003. Geminates vs. singleton stops in Berber: An acoustic, fibroscopic and photoglottographic study. *Proceedings of the 15th International Conference on Phonetic Sciences*. Barcelona 1743–1746.

Ridouane, R. 2007. Gemination in Tashlhiyt Berber: an acoustic and articulatory study. *Journal of the International Phonetic Association* 37 (2), 119–142. https://doi.org/10.1017/S0025100307002903

Sakarna, A. 1999. Phonological aspects of 9abady Arabic: A Bedouin Jordanian dialect. PhD dissertation, University of Wisconsin, Madison.

Suleiman, S. 1985. *Jordanian Arabic between Diglossia and Bilingualism: Linguistic Analysis*. John Benjamins Publishing Company: Amsterdam/Philadelphia. https://doi.org/10.1075/pb.vi.8

Turk, A., Nakai, S., and Sugahara, M. 2006. Acoustic segment durations in prosodic research. In Stefan Sudhoff, Denisa Lenertova, Roland Meyer, Sandra Pappert, Petra Augurzky, Ina Mleinek, Nicole Richter, and Johannes Schlieber (eds.), *Language context and cognition: methods in empirical prosody research*, 1–28. Berlin and New York: Walter de Gruyter. https://doi.org/10.1515/9783110914641.1

Watson, J., 2007. Syllabification patterns in Arabic dialects: long segments and mora sharing. *Phonology* 24 (2), 335–356. https://doi.org/10.1017/S0952675707001224

Zeroual, C. 2008. Aerodynamic study of Moroccan Arabic guttural consonants. *Proceedings of the XVth ICPhS Barcelona*, pp. 1859–1862.

Appendix A. Short vowels-medial (cvCCvc) & (cvCvc)

English	Arabic	IPA	English	Arabic	IPA
bent	طبّق	tˤab:ag	dish	طبق	tˤabag
made one write	كتّب	kat:ab	wrote	كتب	katab
exchanged	بدّل	bad:al	in exchange	بدل	badal
made some one shut up	سكّت	sak:at	shut up (past)	سكت	sakat
made someone carry	حمّل	ħam:al	carried	حمل	ħamal
made a lot	صنّع	sˤan:aʕ	made	صنع	sˤanaʕ
taught	علّم	ʕal:am	flag	علم	ʕalam
smuggled something	هرّب	har:ab	escaped	هرب	harab
extinguished something	طفّى	tˤaf:a	turned off	طفى	tˤafa
made someone fail	رسّب	ras:ab	failed	رسب	rasab
passed someone	قزّا	gaz:a	passed	قزا	gaza
pushed something	حشّر	ħaʃ:ar	packed	حشر	ħaʃar
expelled someone	هجّر	had͡ʒ:ar	abandoned	هجر	had͡ʒar
loosened	رخّى	rax:a	loosened	رخى	raxa
hired someone	شغّل	ʃaɣ:al	made oneself busy	شغل	ʃaɣal
made someone move	رحّل	raħ:al	moved	رحل	raħal
made someone stay up	سهّر	sah:ar	staying up	سهر	sahar
leveled out	سوّى	saw:a	together	سوى	sawa
splashed	نثّر	maθ:ar	threw	نثر	maθar

(*continued*)

English	Arabic	IPA	English	Arabic	IPA
cautioned someone	حذّر	ħað:ar	caution	حذر	ħaðar
preached	نظّر	naðˤ:ar	sight	نظر	naðˤar
gave up	بطّل	batˤ:al	hero	بطل	batˤal
foresaw	بصّر	basˤ:ar	sight	بصر	basˤar
pulled something down	مزّط	maz:atˤ	ran away	مزط	mazatˤ
made someone tired	هتشبّ	hat͡ʃ:ab	tiresome	هتشب	hat͡ʃab
moved a lot	نقّل	nag:al	moved	نقل	nagal
made someone angry	زعّل	zaʕ:al	anger	زعل	zaʕal

Long vowels-medial (cvCCv:c) & (cvCv:c)

English	Arabic	IPA	English	Arabic	IPA
lace	ربّاط	rab:a:tˤ	proper name	رباح	raba:ħ
bathroom	حمّام	ħam:a:m	pigeon	حمام	ħama:m
ventilated something	هوّاه	haw:a:h	his love	هواه	hawa:h
whistler	صفّار	sˤaf:a:r	yellowness	صفار	sˤafa:r
put patches on it	رثّاه	raθ:a:h	wrote elegy	رثاه	raθa:h
attractive	جذّاب	d͡ʒað:a:b	torture	عذاب	ʕaða:b
finished it	قضّاه	gaðˤ:a:h	spent it	قضاه	ʕaðˤa:h
screamer	فغّار	faɣ:a:r	screaming	فغار	faɣa:r
fed someone lunch	غدّاه	ɣad:a:h	his lunch	غداه	ɣada:h
covered someone	غطّاه	ɣatˤ:a:h	his cover	غطاه	ɣatˤa:h
built it hardly	بنّاه	ban:a:h	built it	بناه	bana:h
outside something	برّاه	bar:a:h	sharpened something	براه	bara:h
met him in the evening	مسّاه	mas:a:h	his evening	مساه	masa:h
offered his condolences	عزّاه	ʕaz:a:h	his funeral home	عزاه	ʕaza:h
commanded someone	وصّاه	wasˤ:a:h	commandment	وصاه	wasˤa:h
raised the price	غلّاه	ɣal:a:h	boiled something	غلاه	ɣala:h
walked someone	مشّاه	maʃ:a:h	walked it	مشاه	maʃa:h
lean one on something	رتشّاه	rat͡ʃ:a:h	put it against something	رتشاه	rat͡ʃa:h
spelled it	هجّاه	had͡ʒ:a:h	said defamatory poem	هجاه	had͡ʒa:h
sleeper	بيّات	baj:a:t	sleeping	بيات	baja:t
selected something	نقّاه	nag:a:h	selection	نقاه	naga:h
paid charity	زكّاه	zak:a:h	charity	زكاه	zaka:h

English	Arabic	IPA	English	Arabic	IPA
loosened something hardly	رخّاه	rax:a:ah	loosened something	رخاه	raxa:ah
zip	سحّاب	saħ:a:b	clouds	سحاب	saħa:b
made someone breed it	رعّاه	raʕ:a:h	breed animal	رعاه	raʕa:h
made him busy	لهّاه	lah:a:	cautioned someone	نهاه	naha:
clerk	ختّام	xat:a:m	proper name	ختام	xata:m

Short vowels-final (cvCC) & (cvC)

English	Arabic	IPA	English	Arabic	IPA
he loved	حبّ	ħab:	seed	حب	ħab
he poisoned	سمّ	sam:	poison	سم	sam
he rubbed	حفّ	ħaf:	rubbing	حف	ħaf
broadcasted	بثّ	baθ:	broadcasting	بث	baθ
he bit	عظّ	ʕaðˤ:	biting	عظ	ʕaðˤ
made decision	بتّ	bat:	making decision	بت	bat
he deviated	شذّ	ʃað:	deviation	شذ	ʃað
he demolished	هدّ	had:	demolishing	هد	had
he popped something	بطّ	batˤ:	ducks	بط	batˤ
tossed a coin	فنّ	fan:	art	فن	fan
teased	حرّ	ħar:	heat	حر	ħar
spread something	بسّ	bas:	enough	بس	bas
danced	هزّ	haz	dancing	هز	haz
he cut	قصّ	gasˤ:	cutting	قص	gasˤ
he sprayed	رشّ	raʃ:	spraying	رش	raʃ
he shook	رجّ	radʒ͡:	shaking	رج	radʒ͡
he shut something off	صكّ	sˤak:	shutting off	صك	sˤak
he cracked something	شقّ	ʃag:	crack	شق	ʃag
he shot something	طخّ	tˤax:	firing	طخ	tˤax
he poked someone	دغّ	daɣ:	poking	دغ	daɣ
he shoved someone	دعّ	daʕ:	shoving	دع	daʕ
he solved something	حلّ	ħal:	answer	حل	ħal
he rinsed	لحّ	laħ:	rinse	لح	laħ
alive	حيّ	ħaj:	neighborhood	حي	ħaj

Long vowels-final (cv:CC) & (cv:C)

English	Arabic	IPA	English	Arabic	IPA
pouring	صابّ	sˤa:bː	hit	صاب	sˤa:b
collecting	لامّ	la:mː	blamed	لام	la:m
lighting	خافّ	xa:fː	feared	خاف	xa:f
broadcasting	باثّ	ba:θː	destroyed	عاث	ʕa:θ
biting	عاظّ	ʕa:ðˤː	preached	عاظ	ʕa:ðˤ
deviating	شاذّ	ʃa:ðː	sneaked	لاذ	la:ð
decisive	باتّ	ba:tː	slept	بات	ba:t
ignoring	صادّ	sˤa:dː	hunted	دصا	sˤa:d
popping	باطّ	ba:tˤː	armpit	باط	ba:tˤ
thinking	ظانّ	ðˤa:nː	sheep	ظان	ðˤa:n
towing	جارّ	d͡ʒa:rː	neighbor	جار	d͡ʒa:r
spreading	باسّ	ba:sː	kissed	باس	ba:s
jumping	فازّ	fa:zː	won	فاز	fa:z
fed up	غاصّ	ɣa:sˤː	dived	غاص	ɣa:sˤ
wetting	بالّ	ba:lː	temper	بال	ba:l
deflating	فاشّ	fa:ʃː	grew big	فاش	fa:ʃ
popping	بازّ	ba:zː	broken	باز	ba:z
immigrating	هاجّ	ha:d͡ʒː	got crazy	هاج	ha:d͡ʒ
coming	جايّ	d͡ʒa:jː	here	جاي	d͡ʒa:j
rubbing	حاكّ	ħa:kː	conspired	حاك	ħa:k
spreading something	راقّ	ra:gː	feeling better	راق	ra:g
spraying	باخّ	ba:xː	became bad	باخ	ba:x
rinsing	احّب	ba:hː	revealed a secret	باح	ba:h
pushing	داعّ	da:ʕː	spread quickly	فاع	fa:ʕ

PART II

Syntax

On complex adjectival phrases in Standard Arabic

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In this paper, we present three puzzling observations concerning a class of adjectival constructions in Standard Arabic: (i) pleonastic definiteness, where an instance of definite morphology is semantically transparent, (ii) required resumption, where the absence of a resumptive pronoun leads to deviance, and (iii) case and agreement misalignment, where the domain for structural case assignment does not coincide with that for agreement marking. We then propose a resolution for these puzzles. Our proposal takes seriously the idea that semantics is purely interpretive, i.e. that the truth condition of the sentence is to be computed compositionally from its syntactic structure. The proposal includes two generalizations about case and agreement which turn out to concur to a large degree with widely accepted views on syntactic relations concerning these phenomena. The generalizations are (i) that arguments of 2-place predicates receive Accusative case and arguments of one-place predicates receive Nominative case, and (ii) that sentential nodes are barriers for agreement. Another conclusion of our proposal is that indices on pronouns can undergo movement which results in predicate abstraction and which exhibit properties of Ā-movement.

Keywords: adjectives, case, agreement, definiteness, resumption

1. Presenting three puzzles

The empirical focus of this paper is on sentences such as (1), which have not, to the best of our knowledge, been studied systematically within modern linguistics theories.[1]

1. Note that we use the following symbols for the corresponding Arabic sounds:
ʔ: glottal stop, ð: voiced dental fricative,ˤ: emphatic version of /t, d, s, ð/, ʒ: voiced postalveolar fricative, x: voiceless velar fricative, y: palatal glide, and ʃ: voiceless postalveolar.

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(1) raʔay-tu atˤ-tˤaalib-a tˤ-tˤawiilat-a qaamat-u-hu
see.PRF-1S the-student.M-ACC the-tall.F-ACC figure.F-NOM-his
"I saw the tall student."

Note that the literal translation of (1) is 'I saw the student whose figure is tall.' In Arabic, 'having a tall figure' is synonymous with 'being tall.' Note, also, that (1) is not the only syntactic strategy to convey the proposition 'I saw the tall student' where the property 'tall' is expressed as 'having a tall figure.' The sentences in (2) are two other constructions which also do this.

(2) a. raʔay-tu atˤ-tˤaalib-a ða al-qaamat-i tˤ-tˤawiilat-i
cee.PRF-1S the-student.M-ACC with the-figure.F-GEN the-tall.F-GEN
"I saw the student with the long figure."
b. raʔay-tu atˤ-tˤaalib-a allaðii qaamat-u-hu tˤawiil-at-un
see.PRF-1S the-student.M-ACC that figure.F-NOM-his long-F-NOM
"I saw the student whose figure is tall."

This paper focuses on sentences of the same type as (1). The next three subsections present the puzzles to be resolved.

1.1 Pleonastic definiteness

We observe that there are two instances of definiteness in (1): *atˤ-tˤaalib-a* 'the student' and *tˤ-tˤawiilat-a* 'the tall (person).'

(3) raʔay-tu atˤ-tˤaalib-a tˤ-tˤawiilat-a qaamat-u-hu
student[+*def*] tall[+*def*]
"I saw the student who is a tall person" /
* "I saw the student who is the tall person."

However, the interpretation of the sentence involves only one instance of definiteness: the sentence presupposes that there is exactly one tall student but does not presuppose that there is exactly one student and exactly one tall person (cf. Heim, 1982, 1991; Heim & Kratzer, 1998).

1.2 Required resumption

The sentence in (1) contains a resumptive pronoun, *hu*, whose presence is required: removing it from the sentence gives rise to ungrammaticality, as evidenced by (4).

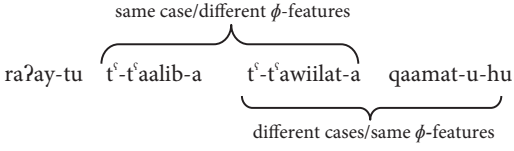
(4) * raʔay-tu atˤ-tˤaalib-a
see.PRF-1S the-student.M-ACC

tˤ-tˤawiilat-a qaamat-un
the-tall.F-ACC figure.F-NOM

1.3 Case and agreement misalignment

The sentence in (1) shows a misalignment in case and agreement: *tˤ-tˤawiil-a* 'tall' has the same case as the preceding but not the following XP, while it has the same ϕ-features as the following but not the preceding XP.

(5)

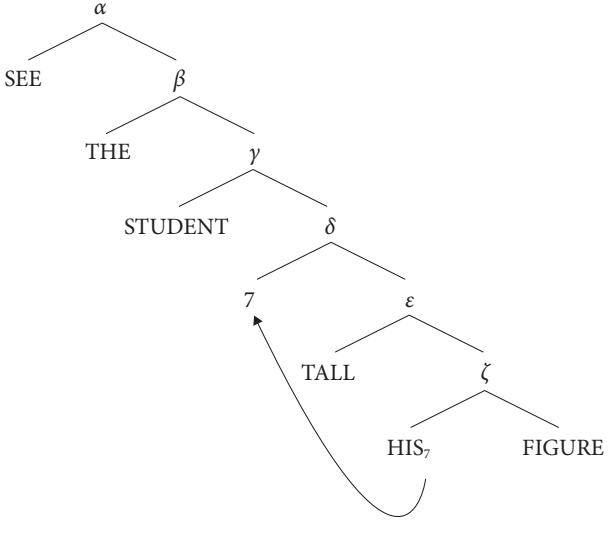


2. Resolving the puzzles

2.1 Accounting for pleonastic definiteness

We propose the following Logical Form for (1), abstracting from how it relates to the Phonetic Form. We use English words in small caps to represent their Standard Arabic counterparts.

(6)



The arrow indicates wh-movement of the index on the resumptive pronoun. The output of this movement, δ, is interpreted by Heim and Kratzer's (1998) rule of Predicate Abstraction.

(7) Predicate Abstraction
If X dominates Y and an index i, then
$[\![X]\!]^a = [\lambda x \in D_e \,.\, [\![\beta]\!]^{ax/i}]$, for any assignment a.

We derive the following meaning for δ in (6).

(8) $[\![\delta]\!]^a = [\lambda x \in D_e \,.\, x$'s figure is tall] = the set of tall people

The next higher node, γ, is interpreted by Heim and Kratzer's (1998) rule of Predicate Modification.

(9) Predicate Modification
If X has Y and Z as its daughters, then for any assignment a, if $[\![Y]\!]^a$ and $[\![Z]\!]^a$ are both in $D_{<e,t>}$, then $[\![X]\!]^a = [\lambda x \in D_e \,.\, [\![Y]\!]^a(x) = [\![Z]\!]^a(x) = 1]$

We derive the following meaning for γ in (6).

(10) $[\![\gamma]\!]^a = [\lambda x \in D_e \,.\, x$ is a student $\wedge$ x's figure is tall] = the set of tall students

We then assume Heim and Kratzer's (1998) definition of THE, which is (11).

(11) $[\![\text{THE}]\!]^a = [\lambda P \in D_{<e,t>} : |P| = 1 \,.$ the unique x such that $P(x) = 1]$

The sister of SEE is then interpreted by the Heim and Kratzer's (1998) rule of Functional Application,

(12) Functional Application
If Y and Z are daughters of X and $[\![Y]\!]^a$ is a function whose domain contains $[\![Z]\!]^a$, then $[\![X]\!]^a = [\![Y]\!]^a\,([\![Z]\!]^a)$.

We derive the following meaning for β in (6).

(13) $[\![\beta]\!]^a$ = the unique x such that x is a tall student = the student

Thus, the structure in (6) accounts for the fact that there is only one interpreted instance of definiteness. Specifically, (6) ends up presupposing that there is exactly one tall student: it does not presuppose there is exactly one student, nor does it presuppose there is exactly one tall person.[2]

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2. Our analysis can be extended to cases of attributive adjectives, where pleonastic definiteness is also observed:

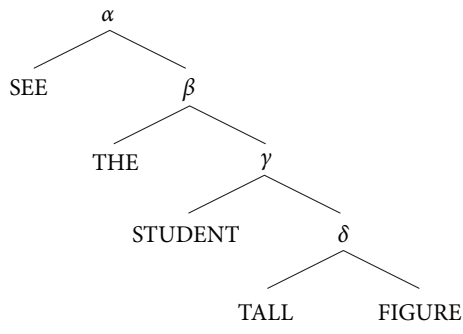
(i) cʔatˢ-tˢaalib-u tˢ-tˢawiil-u yarqusˢu
the-student.NOM the-tall.NOM 3.SM.dance.IMF
"The tall student is dancing."

We thank an anonymous reviewer for pointing this out.

2.2 Accounting for required resumption

The structure of (4) is presumably (14).

(14)



The nodes δ and γ will be interpreted by Predicate Modification, resulting in (15).

(15) $[\![\gamma]\!]^a = [\lambda x \in D_e \,.\, x \text{ is a student} \wedge x \text{ is a tall person} \wedge x \text{ is a figure}] = \varnothing$

This means that $[\![\beta]\!]^a$ will not be in the domain of $[\![\text{THE}]\!]^a$, since $|\varnothing| = 1$. Thus, β will be uninterpretable. We submit that the cause of the deviance of (4).[3]

Our account of required resumption also predicts that embedding the constituent ζ of (6) in a conjunctive phrase will result in ungrammaticality, since movement of the index will violate the Coordinate Structure Constraint (Ross, 1967). This prediction is correct, as evidenced by the deviance of (16).[4]

3. We are aware that explaining ungrammaticality in terms of presupposition failure in this way raises questions about expressions such as *the square circle or the king of France*. These are all cases of the definite article combining with an empty predicate. Why are they well-formed? More generally, when does semantic deviance lead to ungrammaticality and when does it not? This is an issue which has been at the center of lively debate for quite a long time and is still far from settled (cf. Barwise & Cooper, 1981; von Fintel, 1993; Krifka, 1995; Gajewski, 2003; Chierchia, 2006; Fox & Hackl, 2006; Abrusán, 2007). We hope that the questions raised by our account of required resumption observed in (4), while they will not be answered by us in this talk, will be a research problem towards a better understanding of the interface between logic and grammar.

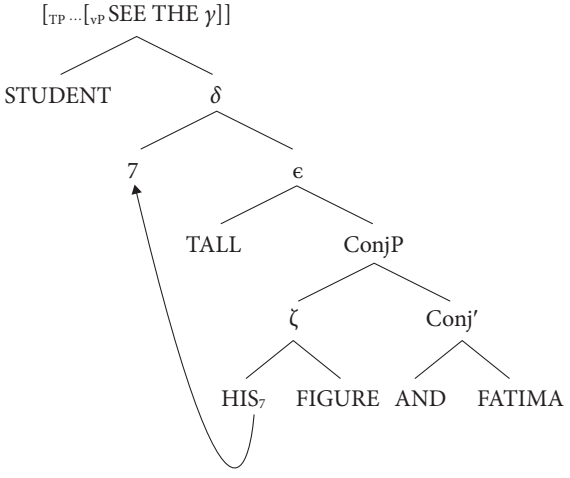
4. An objection was raised against our example by an anonymous reviewer: (16) might be semantically deviant, as TALL is intended to apply "metaphorically" to FIGURE and "literally" to FATIMA. However, this objection can be met by constructing another example with the same syntactic profile in which the adjective is certainly applicable to both nouns in the same sense.

(i) *raʔay-tu atˤ-tˤaalib-a l-qawiyyat-a ʔumm-u-hu wa fatimat-u
see.PRF-1S the-student.M-ACC the-strong.F-ACC mother.F NOM-his and fatima.F-NOM
("I saw the student *x* such that *x*'s mother is strong and Fatima is strong")

(16) *raʔay-tu atˢ-tˤaalib-a tˢ-tˤawiilat-a qaamat-u-hu wa
see.PRF-1S the-student.M-ACC the-tall.F-ACC figure.F-NOM-his and
fatimat-u
fatima.F-NOM
("I saw the student *x* such that *x* is tall and Fatima is tall")

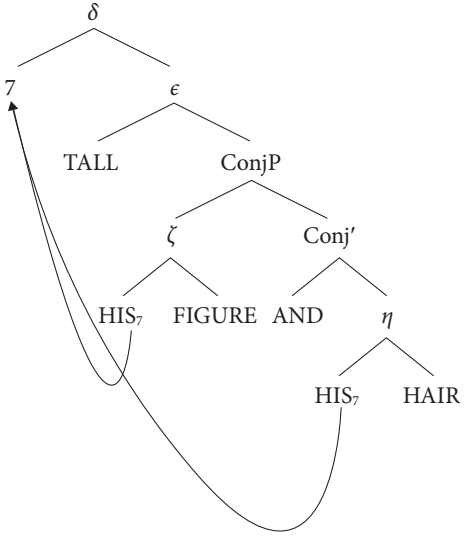
Presumably, (16) has the structure in (17).

(17)



We also predict that replacing FATIMA in (17) with HIS_7 HAIR would rescue the sentence, due to the possibility of ATB-movement, as represented in (18).

(18)



This prediction is correct: (19) is perfectly acceptable.

(19) raʔay-tu atˤ-tˤaalib-a tˤ-tˤawiilat-a qaamat-u-hu wa
see.PRF-1S the-student.M-ACC the-tall.F-ACC figure.F-NOM-his and
ʃaʕar-u-hu
hair-NOM-his
"I saw the student whose figure and hair are long"

2.3 Accounting for case and agreement misalignment

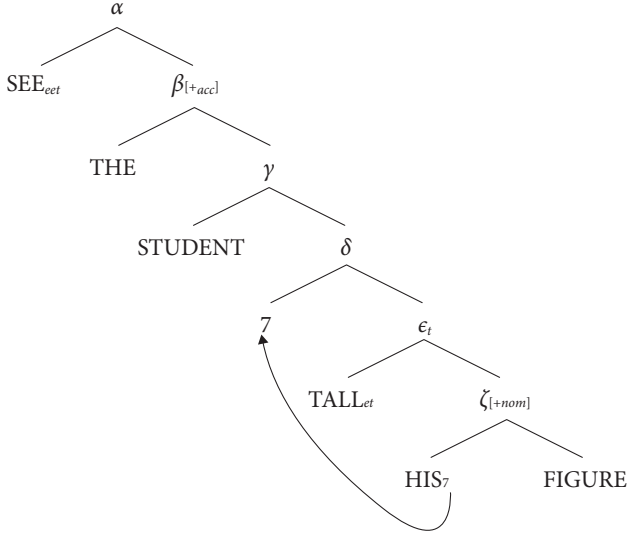
We start with two descriptive generalizations. These will be derived from more general assumptions in Section 3.

(20) Case Generalization (CG)
(i) Arguments of predicates of type < *e*, < *e*, *t* > > receive ACC
(ii) Arguments of predicates of type < *e*, *t* > receives NOM

(21) Agreement Generalization (AG)
Nodes of type *t* are barriers for agreements

Here is (6) with the addition of types and cases for the relevant constituents.

(22)



From CG it follows that *β* receives ACC and *ζ* receives NOM, which means, given familiar locality constraints, that all nodes dominated by *β* bear ACC except those dominated by ζ, which bear NOM. This is exactly what is observed. From AG it follows that there can be no agreement between something which is a sub-constituent of *ϵ* and something which is not, or more specifically, between TALL and STUDENT. This is also what is observed. Importantly, neither *δ* nor STUDENT

receives NOM, even though both are sisters of an < *e*, *t* > node. This is, of course, because neither δ nor STUDENT is an argument of the other: they compose by way of Predicate Modification.

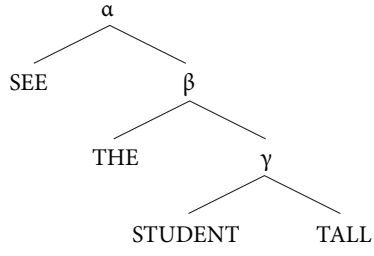
Note that the domain for ϕ-feature agreement does not correlate with the domain for (structural) case assignment (cf. Bobaljik, 2006).

Given AG, we make the following prediction: if instead of δ we just have the predicate TALL, agreement between the head noun STUDENT and TALL would occur. This prediction is correct, as evidenced by the acceptability of (23).

(23) raʔay-tu at^{ç}-t^{ç}aalib-a t^{ç}-t^{ç}awiil-a
see.PRF-1S the-student.M-ACC the-tall.M-ACC
"I saw the tall student."

Presumably, the structure of (23) is (24).

(24)



We now turn to the derivation of the two descriptive generalizations CG and AG.

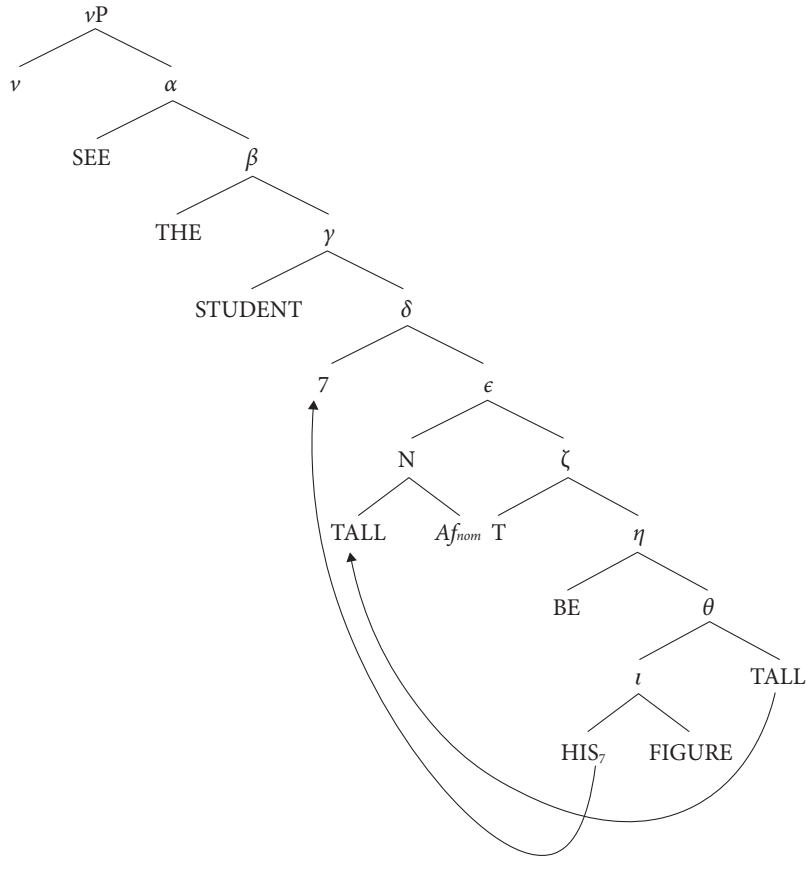
3. Deriving CG and AG

We propose that (22) is to be analyzed in more detail as in (25), where Af_{nom} is the null "nominalizing" affix (cf. Aldholmi, 2015).

For present purposes, we assume that BE, T and Af_{nom} are semantically empty. Furthermore, we assume that movement of TALL does not leave a trace/copy, which means TALL is interpreted only at the derived position.[5]

5. The reason for this might be that only movement to a c-commanding position can create traces/copies, as these must be bound. Movement of TALL in (25) is not to a c-commanding position.

(25)



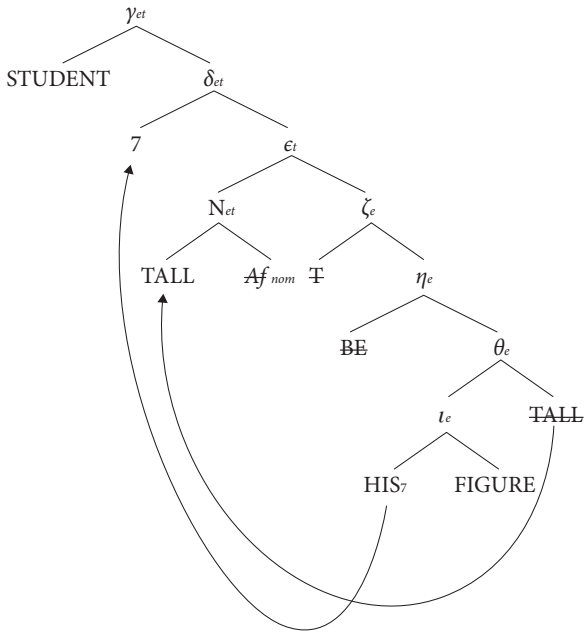
We are thus left with two options: (i) it is the higher copy of TALL which gets interpreted, or (ii) it is the lower copy of TALL which gets interpreted.[6] These two options are represented in (26) and (27), respectively, with strikethrough indicating non-interpretation.[7]

6. The option of interpreting both copies as a chain is ruled out, since the higher copy does not c-command the lower one (cf. Heim & Kratzer, 1998; Fox, 2003).

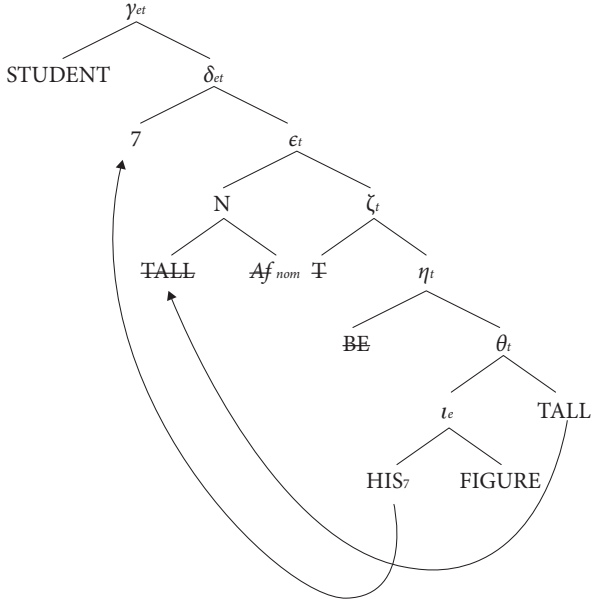
7. Note that the assumption that T is semantically empty is meant to hold for the cases we consider in this paper only. There is evidence that T in such structure as (26) can be realized, and semantically interpreted. Consider (i).

(i) raʔay-tu at^{ʕ}-t^{ʕ}aalib-a l-qawiyyat-a kaanat ʔumm-u-hu
see.PRF-1S the-student.M-ACC the-strong.F-ACC be.PAST mother.F-NOM-his
("I saw the student *x* such that *x*'s mother was strong")

(26)



(27)



The facts considered until now do not decide between (26) and (27). Nevertheless, we submit that (26) is the correct analysis. The empirical justification for our claim is presented in the next section. CG and AG would then be derived from the rather standard assumptions in (28a) and (28b), respectively.

(28) a. *v* assigns ACC and T assigns NOM
(cf. Pesetsky & Torrego, 2011, and references therein)
b. Nodes of type *t* are phases, which are islands for agreement
(cf. Chomsky, 2001, et seq.)

Agreement between TALL and HIS_7 FIGURE is thus established within θ, not ϵ.

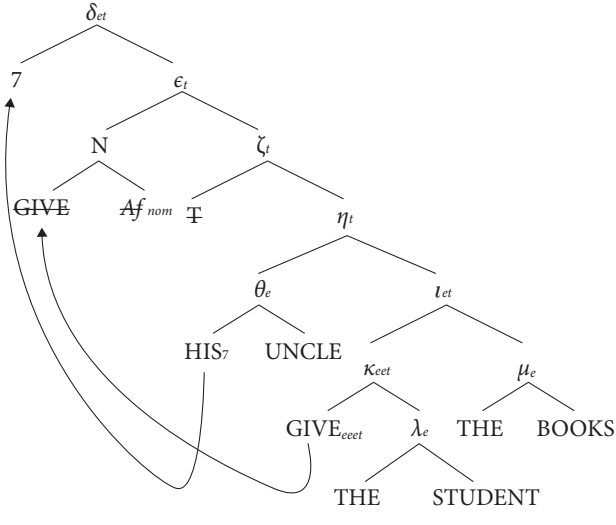
4. Extending the analysis to transitive predicates

Our analysis can be extended to account for judgements on more complex adjectival phrases such as those which contain ditransitive predicates, for Example (29).

(29) raʔay-tu at^{ʕ}-t^{ʕ}ullaab-a
see.PRF-1S the-student.M.PL-ACC
l-maanih-a xaal-u-hum
the-giver.M.SG- ACC uncle.M.SG-NOM-their
t^{ʕ}-t^{ʕ}aalibat-a l-kutub-a
the-student.F.SG-ACC the-book.M.PL-ACC
"I saw the students whose uncle gave the female student the books."

The modifier of STUDENT is (30). Obviously, it must be the lower copy of GIVE that gets interpreted, because interpretation of the upper copy would founder on type mismatch.

(30)



We take this to be evidence for (27) and against (26) and leave the derivation of this fact for future research.

The agreement between the nominalized verbs or adjectives and the head noun holds obligatorily of gender, but not always of number. As pointed out by one reviewer, the nominalized adjective is obligatorily singular if the following noun is singular or dual and is also singular even when the following noun is plural.

(31) raʔay-tu r-raʒul-a
see.PRF-1S the-man-ACC
al-kariim-a ʔabnaaʔ-u-hu
the-generous-ACC sons-NOM-his
'I saw the man whose sons are generous'

We take these to be similar to the standard known cases of agreement asymmetries in Arabic. When the predicate precedes the subject, partial agreement is obligatory. When the subject precedes the predicate, full agreement is obligatory. All things being equal, we adopt the analysis proposed in Soltan (2007) which claims that SVO and VSO sentences have two different underlying structures.

(32) a. SVO structure
$[_{TP}\ DP_{subj}\ T\ [_{vP}\ pro\ [_{VP}\ V\ DP_{obj}\ ]]]$
b. VSO structure
$[_{TP}\ T\ [_{vP}\ DP_{subj}\ [_{VP}\ V\ DP_{obj}\ ]]]$

In the SVO structure T must be Phi-complete (required by the identification of pro). In the VSO structure, T is Phi-incomplete. We take the lower TP in (30) to have the VSO structure with a Phi-incomplete T which explains the partial agreement facts.

References

Abrusán, M. 2007. Contradiction and grammar: The case of weak islands (Doctoral dissertation, Massachusetts Institute of Technology).

Aldholmi, Y. 2015. *Unusual behaviors of nouns and adjectives in Arabic. A Squib*, UW-Milwaukee.

Barwise, J., & Cooper, R. 1981. Generalized quantifiers and natural language. In *Philosophy, Language, and Artificial Intelligence* (pp. 241–301). Springer, Dordrecht. https://doi.org/10.1007/978-94-009-2727-8_10

Bobaljik, J. 2008. Where's phi? Agreement as a post-syntactic operation. In D. Habour, D. Adger, and S. B′ejar: *Phi- theory: Phi features across interfaces and modules* (pp. 295–328). Oxford University Press.

Chierchia, G. 2006. Broaden your views: Implicatures of domain widening and the "logicality" of language. *Linguistic inquiry* 37(4), (pp. 535–590). https://doi.org/10.1162/ling.2006.37.4.535

Chomsky, N. 2001. Derivation by Phase (MITOPL 18). In *K. Hale: A Life is Language*, (pp. 1–52).

Fox, D. 2003. On logical form. *Minimalist syntax*, (pp. 82–123). https://doi.org/10.1002/9780470758342.ch2

Fox, D., & Hackl, M. 2006. The universal density of measurement. *Linguistics and Philosophy* 29(5), (pp. 537–586). https://doi.org/10.1007/s10988-006-9004-4

Gajewski, J. 2002. L-analyticity and natural language. *Manuscript, MIT*.

Heim, I. 1982. The semantics of definite and indefinite noun phrases. (Doctoral dissertationUniversity of Massachusetts, Cambridge).

Heim, I. 1991. Artikel und Definitheit. In *Arnim v. Stechow & D. Wunderlich: Semantik: ein internationales Handbuch der Zeitgenössischen forschung*, (pp. 487–535) De Gruyter.

Kratzer, A., & Heim, I. 1998. *Semantics in generative grammar*. Oxford: Blackwell.

Krifka, M. 1995. The semantics and pragmatics of polarity items. *Linguistic analysis* 25(3–4), (pp. 209–257).

Pesetsky, D. & Esther T. 2011. Case. In *C. Boeckx: The Oxford Handbook of Linguistics Minimalism, Chapter 7*. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199549368.013.0003

Ross, J. R. 1967. Constraints on variables in syntax. (Doctoral dissertation, Massachusetts Institute of Technology, Cambridge).

Soltan, U. 2007. On formal feature licensing in minimalism: Aspects of Standard Arabic morphosyntax, (Doctoral dissertation, University of Maryland, College Park).

Von Fintel, K. 1993. Exceptive constructions. *Natural Language Semantics* 1(2), (pp. 123–148). https://doi.org/10.1007/BF00372560

The syntax of negative coordination in Jordanian Arabic

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Coordination constructions can either conjoin or disjoin phrases or clauses. Languages vary in the strategies employed to establish these logical relationships, creating distributional contrasts and co-occurrence restrictions on the coordination particles. This paper describes negative coordination and puts forward an analysis for this unexplored topic in Arabic. The paper argues that *laa-wala* coordination is a disjunction construction distinct from the construction involving two negative phrases/clauses coordinated by *wa-*. The analysis projects a Disjunction Phrase (DisjP) headed by *wala* and two DPs/CPs, CP1 for the first disjunct occupying the Spec,DisjP and CP2 for the second disjunct as a complement of DisjP. The analysis shows that *wala* is a disjunction operator with an uninterpretable negation feature (i.e., an NCI) licensed by a negative operator. With a postverbal DisjP, the negative operator is *maa*; elsewhere it is a covert negative operator that dominates DisjP. With coordinated DPs, the analysis shows that singular agreement on the verb involves clausal coordination and VP ellipsis in one disjunct.

Keywords: coordination, Arabic, negation, disjunction, ellipsis

1. Introduction and empirical generalizations

Coordination constructions are an important component of syntactic structure used to string together phrases or clauses with a compositional meaning of conjunction or disjunction. Previous studies on the syntax of Arabic have shown only a limited focus on this topic, with some research on conjunction constructions focusing specifically on the phenomenon known as First Conjunct Agreement. There is hardly any research on disjunction constructions in Arabic. This paper describes this construction and contrasts it with conjunction constructions in

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Jordanian Arabic (JA).[1] The paper advances an analysis for this construction that differs from previous analyses of conjunction constructions in Arabic and of disjunction constructions in English.

Coordination constructions for conjoining phrases or clauses in JA involve the particle *wa-* 'and.'[2]

(1) a. *Zeed wa ʕumar šaafuu-na*
Zeed and Omar saw.3MP-us
'Zeed and Omar saw us.'
b. *šufna Zeed wa šufna ʕumar*
saw.1P Zeed and saw.1P Omar
'We saw Zeed and we saw Omar.'

Negative coordination, on the other hand, involves the use of two particles *laa-wala* 'neither-nor' in a more sophisticated manner. The syntax of this construction raises questions about the status of coordination particles (e.g. *neither … nor …* in English; *laa … wala …* in JA) and the nature of the functional head that combines the two parts of a coordination construction. The coordination particles are homophonous with negative markers and negative sensitive items. The coordination particle *laa* 'neither' is homophonous with the negative marker used in negative imperatives:

(2) *laa tsaafir*
NEG travel.2MS.IMP
'Don't travel.'

The coordination particle *wala* 'neither' in (3b) is homophonous with the Negative Concord Item (NCI) *wala* as in *wala waaħad* 'no one' in (3a):[3]

(3) a. *maa šuft wala waaħad*
NEG saw.1S NCI one
'I didn't see anyone.'

---

1. The following abbreviations are used in this chapter: JA = Jordanian Arabic; Conj = Conjunction; Disj = Disjunction; NCI = Negative Concord Item; NPI = Negative Polarity Item; PERF = perfective verb; IMPERF = imperfectve verb; ASP = aspect; IND = indicative mood; SUBJ = subjunctive; IMP = imperative; NOM = nominative case; NEG = negative marker; 1, 2, 3 for first, second and third person agreement; M = masculine; F = feminine; P = plural; S = singular.

2. The conjunction *wa* in Jordanian Arabic is phonetically [w].

3. The disjunction particle *walla* 'or' is pronounced as *willa* by other speakers of Hourani. I personally use both *walla* and a non-geminate variant *wala*. All of these variants, however, are orthogonal to the analysis in this paper because I treat the disjunction *walla* 'or' as the affirmative counterpart of the negative coordination particle *wala* 'nor'. I thank Enam Al-Wer for her comments on the variants of the disjunctive particles, and other valuable comments in this paper.

b. *laa Zeed wala ʕumar šaaf-na*
neither Zeed nor Omar saw.3MS-us
'Neither Zeed nor Omar saw us.'

The main goal of the paper is to analyze negative coordination with *laa-wala* 'neither-nor.' These negative coordination markers can coordinate two phrases or two clauses. The coordination particle *laa* precedes the first element of a coordination construction; see, for example, the higher phrase in (4) and the higher clause in (5). The coordination particle *wala* precedes the second element of coordination; for example, the lower phrase in (4) and the lower clause in (5).

(4) *laa Zeed wala ʕumar šaafuu-na*
neither Zeed nor Omar saw.3MP-us
'Neither Zeed nor Omar saw us.'

(5) *laa šufna Zeed wala šufna ʕumar*
neither saw.1P Zeed nor saw.1P Omar
'We neither saw Zeed, nor did we see Omar.'

The negative coordination marker *wala* also displays the characteristics of Negative Concord Items (NCIs).

(6) a. **(maa) šuft wala waaħad*
NEG saw.1S NCI one
'I didn't see anyone.'
b. **(maa) šuft laa Zeed wala ʕumar*
NEG saw.1S neither Zeed nor Omar
'I neither saw Zeed nor Omar.'

(7) a. *wala waaħad šaaf-na*
NCI one saw.3MS-us
'No one saw us.'
b. *laa Zeed wala ʕumar šaaf-na*
neither Zeed nor Omar saw.3MS-us
'Neither Zeed nor Omar saw us.'

In interrogative contexts, *walla* and its variant *willa* have the affirmative coordination interpretation 'or' and behave more like a disjunction operator.

(8) Affirmative disjunction
šuft Zeed walla/willa (šuft) ʕumar?
saw.2MS Zeed or saw.2MS Omar
'Did you see Zeed or (did you see) Omar?'

The presupposition in this example is that the addressee saw either *Zeed* or *Omar* but not both or neither of them.

The syntax of negative coordination has received little attention in the literature on Arabic syntax, with the discussion focusing primarily on the particle *wala* in the context of negative polarity or as an NCI. The analysis in this paper treats *wala* as the head of a Disjunction Phrase that takes the first disjunct as a specifier and the second one as a complement.[4] The coordination particle *laa* occupies the Spec,XP position of the first disjunct. Consider the following representations that I propose for disjoined DPs and disjoined CPs:

(9) a. [DisjP [CP laa [C…]] [Disj *wala* [CP [C…
b. [DisjP [DP laa [D…]] [Disj *wala* [DP [D…

This analysis captures the meaning of the disjunction construction by allowing *wala* to head the Disjunction Phrase and capturing its dependency relation with negation, as an NCI, via syntactic licensing under the scope of a negative operator. This negative operator is the negative marker *maa* when the disjoined DP is postverbal and is a null negative operator dominating the Disjunction Phrase elsewhere.

(10) a. [NegP Neg *maa* [TP [VP [DisjP [*laa* CP] Disj *wala* [CP …]…
b. [NegP Neg *Op*¬ [DisjP [*laa* DP] Disj *wala* [DP …] TP…
c. [NegP Neg *Op*¬ [DisjP [*laa* CP] Disj *wala* [CP …]…

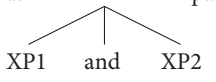
The subsequent sections develop this syntactic analysis for negative coordination with *laa-wala*. It contrasts it with coordination using the conjunction *wa-* and discusses the consequences of this analysis for a variety of syntactic phenomena, such as ellipsis, first conjunct agreement, and the coordinate structure constraint.

2. Theoretical issues

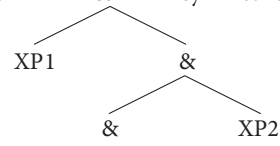
A number of theoretical issues arise in the context of analyzing the syntax of negative coordination. A general issue is whether coordination structures are tripartite (Jackendoff, 1977; Chomsky, 1981) or asymmetric (De Groot, 1959; Munn, 1993; Kayne, 1994). I assume the latter, in keeping with minimalist assumptions regarding binary branching as seen in (11) (XP = DP, CP, etc.).

4. Admittedly, this analysis is tentative and the details of how the verb agrees with the disjoined DP remains unanswered in this paper. The issue here falls under the debate over whether the DP coordination is headed by a special &P functional projection or a lexical projection such as DP. The latter option is a promising one since it is possible to claim that the coordinated DP is a plural noun, thus explaining the plural agreement on the verb. Nevertheless, this requires more research and independent motivation. I leave this for future research.

(11) a. Tripartite

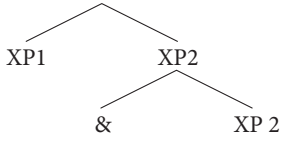


b. Asymmetric



A second issue is whether the coordination particle (conjunction 'and'; disjunction 'or') is the head of the coordination construction or a phrasal category at the left edge of the second XP (Zwart, 2005).[5]

(12)

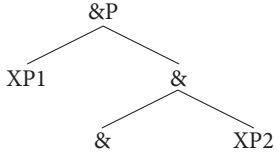


For English coordination constructions, Den Dikken (2006) argues that the two elements of the disjunction construction (*neither … nor …*) are phrasal categories in two clauses combined by an abstract functional head labeled 'J' (for 'junction'). This is an illustration:

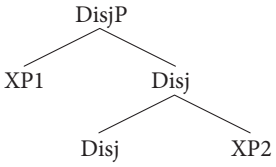
(13) $[_{JP}$ $[_{CP}$ neither [C did $[_{TP}$ john eat]]] [J $[_{CP}$ nor [C did $[_{TP}$ he swim …

At least on the surface, Arabic seems to be different when compared to English; unlike in English, the Arabic coordination construction uses the conjunction particle *wa-* and the negative marker *la* together to make up *wala*. The assumption, then, that *wala* is the negative counterpart of *wa-* is the null hypothesis. In other words, the question at hand is whether coordination in Arabic involves two negative clauses/phrases coordinated by the conjunction particle *wa-la* 'and-not' or two negative clauses/phrases coordinated by a disjunction particle *wala* 'nor'.

(14) Conjunction



5. A third issue, not directly involved with this paper, has to do with whether the two coordinated XPs are ordered in the syntactic structure. Goodall (1987) proposes that the two coordinated XPs are parallel; that is, neither XP dominates or precedes the other in syntax. The two XPs are in parallel syntactic planes. Kramer (2010) adopts this view for coordination in Amharic DPs and derives word order via morphological rules subject to various linearization sub-operations (adjacency, concatenation, and chaining) within a Distributed Morphology framework.

(15) 

3. Empirical contrasts between *wa-* and *wala*

If coordination by *la …wala* involves two negative XPs conjoined by *wa-*, we can expect such constructions to behave like two clauses which have been negated by bipartite negation and then conjoined by *wa-*:

(16) *ma-šuft- iš Zeed wa ma-šuft- iš ʕumar*
NEG-saw.1S-NEG Zeed Conj NEG-saw.1S-NEG Omar
'I didn't see Zeed and I didn't see Omar'

(17) *laa šuft Zeed wala šuft ʕumar*
neither saw.1S Zeed nor saw.1S Omar
'I neither saw Zeed, nor did I see Omar'

Empirical facts, however, show that the two constructions exhibit key contrasts. First, when we use the conjunction *wa-*, the two coordinated XPs must have identical negation (bipartite negation), while the first XP can be negated by either - when we use *wala*:

(18) a. *ma-šuft- iš Zeed wa ma-šuft- iš ʕumar*
NEG-saw.1S-NEG Zeed Conj NEG-saw.1S-NEG Omar
'I didn't see Zeed and I didn't see Omar'
b. * *laa šuft Zeed wa ma-šuft- iš ʕumar*
neither saw.1S Zeed Conj NEG-saw.1S-NEG Omar
c. * *maa šuft Zeed wa ma-šuft- iš ʕumar*
NEG saw.1S Zeed Conj NEG-saw.1S-NEG Omar

(19) a. *laa šuft Zeed wala šuft ʕumar*
neither saw.1S Zeed nor saw.1S Omar
'I neither saw Zeed, nor did I see Omar'
b. *maa šuft Zeed wala šuft ʕumar*
NEG saw.1S Zeed nor saw.1S Omar
'I didn't see Zeed, nor did I see Omar'
c. *ma-šuft- iš Zeed wala šuft ʕumar*
NEG-saw.1S-NEG Zeed nor saw.1S Omar
'I didn't see Zeed, nor did I see Omar'

Another key contrast between coordination by *wa-* and coordination by *wala* is that only the latter exhibits contrastive focus, where *wala* c-commands the constituent serving as contrastive focus:

(20) a. *laa* *šufna* *Zeed* *wala* *šufna* *ʕumar*
neither saw.1P Zeed nor saw.1P Omar
'We neither saw Zeed, nor did we see Omar.'
b. *laa* *Zeed* *wala* *ʕumar* *šaaf-na*
neither Zeed nor Omar saw.3MS-us
'Neither Zeed nor Omar saw us.'

(21) a. *ma-šuft- iš* *Zeed wa* *ma-šuft-iš* *ʕumar*
NEG-saw.1S-NEG Zeed Conj NEG-saw.1S-NEG Omar
'I didn't see Zeed and I didn't see Omar'
b. *miš* *Zeed wa* *miš* *ʕumar šaaf-na*
NEG Zeed Conj NEG Omar saw.3MS-us
'It is not Zeed and not Omar that saw us.'

These empirical contrasts do not support the hypothesis that *wala* is the negative counterpart of *wa-*. In fact, there is empirical evidence that *wala* is a disjunction operator associated with the [+ NEG] feature in indicative sentences, and thus it is the negative counterpart of *walla/willa* which do not carry [+ NEG] and occur in interrogative sentences (i.e., in affirmative disjunction):

(22) Affirmative disjunction
šuft *Zeed* *walla/willa* *(šuft)* *ʕumar?*
saw.2MS Zeed or saw.2MS Omar
'Did you see Zeed or (did you see) Omar?'

4. Analysis of negative coordination by *wala*

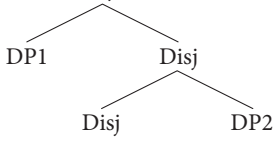
It is clear that coordination by *wala* is distinct from coordination by *wa-*. The particle *wala* behaves roughly like 'nor' in English as opposed to 'and not.' The distinction between conjunction and disjunction largely has to do with the fact that in disjunction structures the two members of the coordination structure can be in an exclusive relation, while they can only be in an inclusive relationship in conjunction structures.

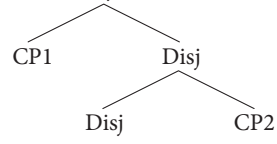
The following is further evidence for the distinction between *wa-* as a conjunction particle and *wala* as a disjunction particle. The coordination phrase *laa Zeed wala ʕumar* is the subject of the sentence. The fact that the verbs can be singular is evidence that the coordinate structure here has a disjunctive interpretation where

the two members of the coordinate construction are in an exclusive relationship, i.e., each disjunct is an a separate clause I later argue:

(23) a. *laa Zeed wala ʕumar šaaf-na*
neither Zeed nor Omar saw.3MS-us
'Neither Zeed nor Omar saw us.'
b. *laa Zeed wala ʕumar šaaf-uu-na*
neither Zeed nor Omar saw-3MP-us
'Neither Zeed nor Omar saw us.'
c. *Zeed wa -ʕumar šaaf-*(uu)-na*
Zeed and-Omar saw-*(3MP)-us
'Zeed and Omar saw us.'

The following derivations represent the coordination constructions that I argue for in the rest of this paper, with coordinated DPs in (24a) and coordinated CPs in (24b):

(24) a.


b.


The locus of XP1 as the specifier of DisjP finds credence in the fact that the scope of its negation does not cover the disjunction head. This is clear from cases in which the disjunction operator has a positive interpretation (i.e., it is interpreted as 'or') despite the fact that the first disjunct is a negative clause, as in (25). This is expected under the structure in (24b) since negation of the first clause is buried inside the CP1:

(25) *ma-šuf-tuu-š Zeed wala (ma-šuf-tuu-š) ʕumar?*
NEG-saw-2MP-NEG Zeed or NEG-saw-2MP-NEG Omar
'You didn't see Zeed or (you didn't see) Omar?'

Status and locus of laa

As for the status of *laa* and *wala* in JA, I argue that *laa* is a phrasal category (not a head) in Spec,DP with DP coordination, or Spec,CP with CP coordination, of the first disjunct, while *wala* is the head of the disjunction projection. The two disjuncts are dominated by a disjunction projection (DisjP). The first disjunct occupies the Spec/DisjP position, while the second one is the complement of DisjP:

(26) $[_{\text{DisjP}}$ $[_{\text{CP}}$ *laa* [C …]] [Disj *wala* $[_{\text{CP}}$ …

The status of *laa* as a phrasal category is clear from the following contrasts with *maa.* The particles *laa* and *maa* exhibit contrasts in their distribution within coordinated CPs and DPs:

(27) a. *laa Zeed šaaf-na wala ʕumar šaafna*
neither Zeed saw.3MS-us nor Omar saw.3MS.us
'Neither Zeed saw us nor Omar saw us.'
b. * *maa Zeed šaaf-na wala ʕumar šaafna*
NEG Zeed saw.3MS-us nor Omar saw.3MS.us

The fact that *maa*, unlike *laa*, cannot precede the preverbal subject suggests that *maa* heads a NegP projection while *laa* is a syntactic adverb, XP, in the CP layer. These facts suggest that *laa* is not a negative marker in a NegP projection dominating the subject.

If *laa* were a negative marker, we would expect *maa* to appear in disjoined DPs. Since this is not possible (cf. the ungrammaticality of **maa Zeed wala ʕumar* below), it is reasonable to treat *laa* as a marker of negative coordination on par with *neither* in English.

(28) a. *laa Zeed wala ʕumar šaafna*
neither Zeed nor Omar saw.3MS.us
'Neither Zeed nor Omar saw us.'
b. * *maa Zeed wala ʕumar šaafna*[6]
NEG Zeed nor Omar saw.3MS.us

The status of *laa* as a coordination adverb (disjunction adverb), then, is consistent with the fact that *laa* cannot be used for negating perfective and imperfective verbs:

(29) a. *maa/*laa saafar*
NEG/*NEG travel.3MS.PERF
'He did not travel.'
b. *maa/*laa bi-saafir*
NEG/*NEG ASP-travel.3MS.IMPERF
'He did not travel.'

---

6. *maa* also cannot occur post-verbally, suggesting that it is the head of a negative projection (NegP) in coordination constructions:

(i) *laa šaaf-na (*maa) Zeed wala ʕumar*
NEG saw.3MS-us NEG Zeed nor Omar
'Neither Zeed nor Omar saw us.'

(ii) *maa šaafna (*maa) Zeed wala ʕumar*
NEG saw.3MS-us NEG Zeed nor Omar
'Neither Zeed nor Omar saw us.'

In fact, *laa* is largely restricted to negative imperatives in JA:

(30) *laa tsaafir*
NEG travel.2MS.SUBJ
'Don't travel.'

So far, these empirical facts suggest that *laa* in the coordination construction *laa-wala* is semantically vacuous in negative force. Interestingly, there is evidence that *laa* is indeed a disjunction particle without semantic negation. Consider the following example where a disjoined DP in postverbal position requires a negative marker, suggesting that *laa* is semantically vacuous:

(31) **(maa) šuft laa Zeed wala ʕumar*
NEG saw.1S neither Zeed nor Omar
'I saw neither Zeed nor Omar'

Status and locus of wala *as an NCI and disjunction operator*

As for the status of *wala*, it is necessary to consider first that it is a disjunction operator and an NCI. The particle *wala* that requires negation in the postverbal position, but not in the preverbal position (cf. Alqassas 2015, 2016, 2018):

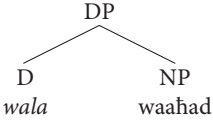
(32) a. **(maa) šuft wala waaħad*
NEG saw.1S NCI one
'I didn't see anyone.'
b. **(maa) šuft laa Zeed wala ʕumar*
NEG saw.1S neither Zeed nor Omar
'I neither saw Zeed nor Omar.'

(33) a. *wala waaħad šaaf-na*
NCI one saw.3MS-us
'No one saw us.'
b. *laa Zeed wala ʕumar šuft*
neither Zeed nor Omar saw.1S
'I saw neither Zeed nor Omar.'

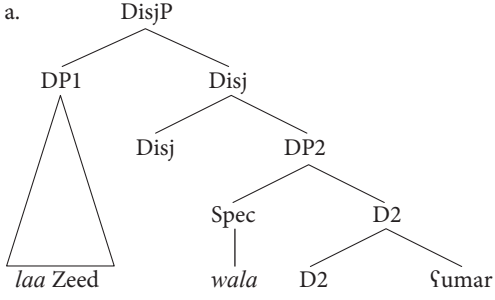
Crucially, the NCI *wala* in (32a) and (33a) is in complementary distribution with the definite determiner (cf. the representation in (35)). By contrast, the disjunction particle *wala* in (32b) and (34b) cannot be the head of the DP because it can co-occur with the definite noun/determiner. Thus, *wala* in (32b) and (34b) is either a phrasal category in Spec,DP or the head of the DisjP; see the structural representations in (36a) and (36b).

(34) a. *maa šuft wala (*al)-walad*
NEG saw.1S NCI det-boy
'I didn't see any boy.'
b. *maa šuft laa al-walad wala al-bint*
NEG saw.1S neither det-boy nor det-girl
'I saw neither the boy nor the girl.'

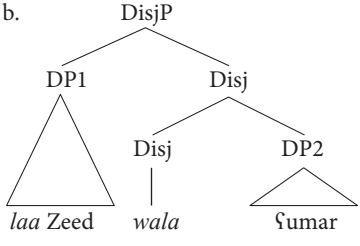
(35)



(36) a.



b.



The issue is whether *wala* is located in the head of the DisjP (i.e., it is the lexicalization of the disjunction operator) or whether it is located in the second disjunct. I argue that the particle *wala* is the head of the disjunction projection (JP) which is the lexicalization of the disjunction head in JA, unlike in English (den Dikken 2006).

(37) $[_{\text{DisjP}}$ $[_{\text{CP}}$ *laa* [C …]] [Disj *wala* $[_{\text{CP}}$ [C …

First, let us consider *wala* in coordinated DPs. The fact that *wala* in disjunction phrases displays NCI behavior (cf. (32) and (33) above) suggests that the whole disjunction phrase interacts with a negative projection (i.e., it is licensed by a negative marker). I assume that the NCI *wala* establishes dependency with negation via a negative agreement process, whereby *wala* carries a [uNEG] feature that gets

valued by a negative marker carrying a [iNEG] feature (Ouali and Soltan, 2014; Alqassas, 2015, 2016).

I propose that DisjP undergoes phrasal movement from its postverbal position in (32b) into the preverbal position in (33b), specifically in Spec,NegP as in (38).

(38) $[_{\text{NegP}}\ [_{\text{DisjP}}$ laa Zeed wala$_{[\text{uNEG}]}$ ʕumar$]_i$ Neg op$_{\neg[\text{iNEG}]}$ [TP šaaf-na [DisjP …$]_i$]]

Ouali and Soltan (2014) propose that the preverbal *wala* in Egyptian is inherently negative and does not need a negative marker to license it. While this issue seems orthogonal to the analysis here, there is evidence that in JA even the preverbal *wala* fails to contribute a negative interpretation when preceded by a negative constituent (Alqassas, 2015, p. 125):

(39) *maʕumurhuuš*$_{[\text{iNEG}]}$ *wala-ħada* $_{[\text{uNEG}]}$ *zaar* *el-batra*
never NCI-person visited.3MS the-Petra
'Never has anyone visited Petra.'

This analysis suggests that the disjunction *wala* in coordinated CPs is licensed by a negative operator. Crucially, *wala* in such contexts can license an NPI in the post-verbal position suggesting that it c-commands it (cf. Benmamoun, 1997, 2006; Alqassas, 2015, 2016; Aoun et al., 2010):

(40) *laa* *štareet* *ʔiši,* *wala biʕit* *ʔiši*
neither bought.1S NPI-thing, nor sold.1S NPI-thing
'I neither bought anything nor did I sell anything,'

If we follow the analysis above to analyze disjoined DPs in preverbal position, it is reasonable to suggest that there is a negative operator dominating DisjP and licensing the disjunctive particle *wala* under c-command:

(41) [NegP Neg *Op*¬ [DisjP [*laa* CP] Disj *wala* [CP …] …

This analysis is supported by the fact that, as an NCI, *wala* in preverbal position can be licensed by a covert negative operator (cf. Alqassas, 2015, 2016). Here, too, the disjunction marker *wala* is licensed by a covert negative operator by virtue of the fact that the entire disjunction phrase is under c-command by the negative operator.

Recall that there is evidence that the locus of disjunction *walla/willa* is under the head of DisjP. Evidence comes from the fact that this particle can function as a disjunction operator 'or' without negative interpretation in interrogative contexts. Consider the following example:

(42) *šuft Zeed walla/willa (šuft) ʕumar?*[7]
saw.2MS Zeed or saw.2MS Omar
'Did you see Zeed or (did you see) Omar?'

Further evidence comes from the fact that preverbal subjects and focused constituents cannot precede *walla/willa* but they can follow it.

(43) *laa Zeed šaaf-na <*ʕumar> wala <ʕumar> šaaf-na*
neither Zeed saw.3MS-us Omar nor Omar saw.3MS-us
'Neither Zeed saw us nor Omar saw us.'

(44) *laa Zeed šufna <*ʕumar> wala <ʕumar> šufna*
neither Zeed saw.1P Omar nor Omar saw.1P
'We neither saw Zeed nor did we see Omar.'

Ellipsis

Let us now consider ellipsis facts relating to the second disjunct and constraints on the interaction between JA's bipartite negation and disjunction. It is possible to elide the VP of the second disjunct:

(45) *laa šaaf-na Zeed wala ~~šaaf-na~~ ʕumar*
neither saw.3MS-us Zeed nor saw.3MS-us Omar
'Neither Zeed nor Omar saw us.'

Crucially, it is the disjunction particle *wala* that licenses VP ellipsis. This becomes clear when we compare *wala* with the conjunction *wa-*. The conjunction *wa-* fails to license VP ellipsis:

(46) **Zeed ma-šaaf-naa-š wa-ʕumar ~~ma-šaafnaa-š~~*
Zeed NEG-saw.3MS-us-NEG and-Omar NEG-saw.3MS-us-NEG
'Zeed did not see us, and Omar did ~~not see us~~.'

It is well known that VP ellipsis can be licensed by a negative marker (Potsdam, 1996; Lobeck, 1995). So, can *wala* license VP ellipsis because it is negative or because it is a disjunction operator? There is evidence that even *walla/willa* as

7. Coordination by *wala* here behaves like an NPI because it can be licensed without negation in affirmative interrogative contexts. It is interesting to note that this behavior is not consistent with its behavior as a non-strict NCI in the declarative contexts above.

particles of affirmative disjunction can license VP ellipsis. Ellipsis of the VP of the second disjunct is possible in such contexts: [8]

(47) *šuf-tu Zeed walla/ willa ~~šuf-tu~~ ʕumar?*
saw-2MP Zeed or saw-2MP Omar
'Did you see Zeed or (did you see) Omar?'

(48) *šuf-tu Zeed mbaariħ walla/ willa ~~šuf-tu~~ ʕumar?*
saw-2MP Zeed yesterday or saw-2MP Omar
'Did you see Zeed yesterday or (did you see) Omar?'

The fact that the two members of the disjunction construction involve the use of an adverb separating the two direct objects suggests that the two objects are not a conjoined noun phrase of one verb, but rather two objects of two verbs, the overt verb and the elided verb.

Negative coordination and first conjunct agreement

One of the interesting aspects that negative coordination exhibits is how it interacts with verbal agreement. In general, coordination constructions in Standard Arabic exhibit what is known as first conjunct agreement. First conjunct agreement is the phenomenon whereby only one of the two conjoined DPs enters into a phi-agreement with the verb (Munn, 1999; Aoun, Benmamoun, and Sportiche, 1999; Soltan, 2007; Larson, 2013):

(49) a. *ya-drus-u Zayd-un wa-Layla*
3MS-study.IMPERF-IND Zayd-NOM and-Layla
'Zayd and Layla are studying.'
b. * *ta-drus-u Zayd-un wa-Layla*
3FS-study.IMPERF.-IND Zayd-NOM and-Layla
'Zayd and Layla are studying.'

---

8. Other interesting contrasts:

(i) a. ?**maa šaafna Zeed wala ~~šaaf-na~~ ʕumar*
NEG saw.3MS-us Zeed nor saw.3MS-us Omar
'Zeed did not see us, nor did Omar ~~see us~~.'
b. **ma-šaafnaa-š Zeed wala ~~šaaf-na~~ ʕumar*
NEG-saw.3MS-us-NEG Zeed nor saw.3MS-us Omar
'Zeed did not see us, nor did Omar ~~see us~~.'

It is not clear why the sentences in (i-a) and (i-b) are acceptable without VP ellipsis (cf. (19) above) but unacceptable with it?

c. *ta-drus-u* *Layla wa-Zayd-un*
3FS-study.IMPERF-IND. Layla and-Zayd-NOM
'Layla and Zayd are studying.'

d. * *ya-drus-u* *Layla wa-Zayd-un*
3MS-study.IMPERF-IND Layla and-Zayd-NOM
'Layla and Zayd are studying.'

The phi-agreement paradigm in (49) clearly shows that the agreement morphology on the verb is determined by the first conjunct. The masculine DP *Zayd* triggers the third person masculine singular prefix on the verb, and the feminine DP *Layla* triggers the feminine counterpart.

Notice that the agreement involved here is gender agreement. It is not possible to probe number agreement in such a context because Standard Arabic has only partial agreement in verb-subject word orders. Partial agreement means that the verb does not carry plural agreement even when the subject is plural.

(50) a. *ya-drus-u* *al-walad-u*
3MS-study.IMPERF-IND the-boy
'The boy is studying.'

b. *ya-drus-u* *al-ʔawlaad-u*
3MS-study.IMPERF-IND the-boys-NOM
'The boys are studying.'

Interestingly, however, negative coordination gives us a testing ground for number agreement because DPs coordinated by *laa …wala* can trigger either a singular or plural number morphology on the verb (cf. coordination by *wa-* in Example (51c), where singular agreement is not possible):

(51) a. *laa Zeed wala ʕumar šaaf-na*
neither Zeed nor Omar saw.3MS-us
'Neither Zeed nor Omar saw us.'

b. *laa Zeed wala ʕumar šaaf-uu-na*
neither Zeed nor Omar saw-3MP-us
'Neither Zeed nor Omar saw us.'

c. *Zeed wa-ʕumar (*šaaf-na)/ šaaf-uu-na*
Zeed and-Omar saw.3MS-us saw-3MP-us
'Zeed and Omar saw us.'

Considering the fact that first conjunct agreement involves a singular agreement on the verb with a plural subject in VS word order, the singular agreement on the verb in Example (51a) is quite interesting because the word order is SV. Is this construction, then, similar to first conjunct agreement? To answer that, we need to look at a subject with disjoined nouns mixed in gender. Interestingly, it is

not possible to have singular agreement when the negatively coordinated NPs are mixed in gender:

(52) a. *laa Zeed wala layla (*šaaf-na)/ šaaf-uu-na*
neither Zeed nor Layla saw.3MS-us/ saw-3MP-us
'Neither Zeed nor Layla saw us.'
b. *laa Zeed wala layla (*šaafat-na)/ šaaf-uu-na*
neither Zeed nor Layla saw.3FS-us/ saw-3p-us
'Neither Zeed nor Layla saw us.'

This suggests that the singular agreement on the verb is not an instance of first conjunct agreement. Let us instead entertain the possibility that what is involved here is ellipsis. Recall that in the previous section we saw that VP coordination using *laa …wala* involves VP ellipsis. If the coordinated DPs in (51a) involve VP ellipsis, we should be able to reconstruct the elided VP. This is indeed possible:

(53) *laa Zeed ~~šaaf-na~~ wala ʕumar šaaf-na*
neither Zeed saw.3MS-us nor Omar saw.3MS-us
'Neither Zeed nor Omar saw us.'

Why is it not possible to elide the VP when the coordinated DPs are mixed in gender?

(54) a. *laa Layla šaaf-at-na wala Zeed šaaf-na*
neither Layla saw-3FS-us nor Zeed saw.3MS-us
'Neither Layla nor Zeed saw us.'
b. * *laa Layla ~~šaaf-at-na~~ wala Zeed šaaf-na*
neither Layla saw-3FS-us nor Zeed saw.3MS-us

First, however, let us look at Example (51b). It is clear that the DPs coordinated by *laa …wala* display the same behavior as the ones coordinated by *wa-* in Example (51c); that is, they both trigger plural agreement on the verb. Consequently, it is reasonable to assume that both constructions involve the whole coordinated DP entering into an agreement relation with one verb with no ellipsis involved.

(55) a. *[DP laa Zeed wala ʕumar [TP šaaf-uu-na*
neither Zeed nor Omar saw-3MP-us
'Neither Zeed nor Omar saw us.'
b. *[DP Zeed wa-ʕumar [TP šaaf-*(uu)-na*
Zeed and-Omar saw-*(3MP)-us
'Zeed and Omar saw us.'

This suggests that the two DPs coordinated by *laa …wala* are conjoined rather than disjoined DPs. However, as we saw in Section 3, there is evidence that

coordination by *laa …wala* is different from coordination by *wa-*. I would like to add more evidence supporting the claim that *wala* is a disjunction rather than a conjunction particle. Arabic has collective verbs like *ltaga* 'meet' that require two conjoined NPs or a plural NP as external arguments (cf. Aoun, Benmamoun and Sportiche, 1999; Benmamoun, 2003):

(56) a. *ltaga li-wlaad/ (*al-walad)*
met the-boys (*the-boy)
'The boys met.'
b. *ltaga Zeed w-ʕumar*
met Zeed and-Omar
'Zeed and Omar met.'

If the two DPs coordinated by *laa …wala* form a conjoined construction, we can predict the grammaticality of this construction as an external argument for a collective verb like *ltaga* 'meet'. This prediction, however, is not born out:[9]

(57) a. *ma-ltagaa-š Zeed w-ʕumar*
NEG-met-NEG Zeed and-Omar
'Zeed and Omar did not meet.'
b. * *ma-ltagaa-š laa Zeed wala ʕumar*
NEG-met-NEG neither Zeed nor Omar

Once again, we find evidence that NPs coordinated by *wala* involve a disjunction rather than a conjunction relationship.

Why is it, then, not possible to elide one VP from a coordination structure if the second VP carries different gender agreement morphology?

(58) a. *laa Layla šaaf-at-na wala Zeed šaaf-na*
neither Layla saw-3FS-us nor Zeed saw.3MS-us
'Neither Layla nor Zeed saw us.'
b. * *laa Layla ~~šaaf-at-na~~ wala Zeed šaaf-na*
neither Layla saw-3FS-us nor Zeed saw.3MS-us

This ungrammaticality can be explained if the reconstructed VP must match the identity of the second VP. In other words, the ungrammaticality can be reduced to the following reconstructed VP where the reconstructed VP does not agree with its subject in gender:

(59) * *laa Layla ~~šaaf-na~~ wala Zeed šaaf-na*
neither Layla saw.3MS-us nor Zeed saw.3MS-us

9. I am thankful for Abbas Benmamoun for pointing this out to me.

Therefore, there must be a constraint that VP ellipsis is only possible if the two verbs are identical, allowing us to recover (reconstruct) the elided VP through the second VP. When the masculine feature of the verb *šaaf-na* 'saw.3MS-us' enters into an agreement process with the feminine subject, the external disjunct Layla, the syntactic structure crashes. Support for this analysis can be seen in cases where both of the disjoined nouns are feminine. Crucially, the verb can be singular, thus giving further support to the ellipsis analysis:[10]

(60) *laa Layla ~~šaafat-na~~ wala Lubna šaafat-na*
neither Layla saw.3FS-us nor Lubna saw.3FS-us
'Neither Layla nor Lubna saw us.'

5. Conclusion

This paper established a distinction between coordination by *wa-*, a conjunction structure, and coordination by *wala*, a disjunction structure. I have shown that negative coordination involves a disjunction projection (DisjP) that takes the first member of the coordination structure as its specifier and the second member as its complement. The negative marker *laa* is in Spec,XP (Spec,DP, Spec,CP) of the first disjunct. The disjunction particle *wala*, on the other hand, is the head of DisjP.

The particle *wala* is the lexicalization of a disjunction operator. This disjunction particle is polarity sensitive. It behaves like a non-strict NCI interpreted as 'nor' in indicative sentences requiring a negative marker when postverbal but not when preverbal. I argued that this particle is specified for an uninterpretable negation feature [uNEG] that is valued via agreement with a negative projection.

This analysis shows that the negative contrast between the disjunction particles *walla/willa* 'or' and *wala* 'nor' lies in the feature structure of *coordination* rather than in the presence of [+ NEG] (or lack thereof) under the disjunction head (contra den Dikken's (2006) analysis of English 'or' and 'nor'). Instead, the negative disjunction *wala* 'nor' is specified for [uNEG], whereas the affirmative disjunction *walla/willa* is not. The dependency between the disjunction phrase and negation is reduced to a syntactic licensing requirement. The disjunction particle *wala* carries a [uNEG] feature licensed by a negative marker or negative operator specified for a [iNEG] feature.

10. I thank Abbas Benmamoun for pointing the relevance of this contrast to the analysis.

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References

Alqassas, A. 2015. Negation, tense and NPIs in Jordanian Arabic. *Lingua* 156, 101–128. https://doi.org/10.1016/j.lingua.2014.12.010

Alqassas, A. 2016. Temporal NPIs and NCIs as adverb phrases: The case of Jordanian Arabic. In: Y. A. Haddad & E. Potsdam (Eds.), *Perspectives on Arabic Linguistics* XXVIII (pp. 129–152). Amsterdam/Philadelphia: John Benjamins Publishing Company.

Alqassas, A. 2018 Negative sensitive items. In: E. Benmamoun and R. Bassiouney (Eds.), *The Routledge Handbook of Arabic Linguistics*. Routledge.

Aoun, J., Benmamoun, E., & Sportiche, D. 1999. Further remarks on first conjunct agreement. *Linguistic Inquiry* 30(4), 669–681. https://doi.org/10.1162/002438999554255

Aoun, J., Benmamoun, E., & Choueiri, L. 2010. *The syntax of Arabic*. Cambridge: Cambridge University Press.

Benmamoun, E. 1997. Licensing of negative polarity items in Moroccan Arabic. *Natural Language and Linguistic Theory* 15, 263–287. https://doi.org/10.1023/A:1005727101758

Benmamoun, E. 2003. Reciprocals as Plurals. *Research in Afroasiatic Grammar II* . In: J. Lecarme (Ed.), John Benjamins. https://doi.org/10.1075/cilt.241.05ben

Benmamoun, E. 2006. Licensing configurations: the puzzle of head negative polarity items, *Linguistic Inquiry* 37(1), 141–147. https://doi.org/10.1162/ling.2006.37.1.141

Chomsky, N. 1981. *Lectures on Government and Binding*. Dordrecht: Foris.

De Groot, A. W. 1959. *Structurele syntaxis*. Den Haag: Servire.

den Dikken, M. 2006. Either-float and the syntax of co-or-dination. *Natural Language and Linguistic Theory* 24, 689–749. https://doi.org/10.1007/s11049-005-2503-0

Goodall, G. 1987. *Parallel structures in syntax*. Cambridge: Cambridge University Press.

Han, C.-H & Romero, M. 2004. The syntax of whether/Q …or questions: Ellipsis combined with movement. *Natural Language and Linguistic Theory* 22, 527–564. https://doi.org/10.1023/B:NALA.0000027674.87552.71

Hankamer, J. 1979. Deletion in coordinate structures. Outstanding Dissertations in Linguistics. Garland Publishing, New York, NY.

Hendriks, P. 2001. Initial coordination and the law of coordination of likes. In H. Broekhuis and T. van der Wouden (Eds.), *Linguistics in the Netherlands* 2001 (pp. 127–138). Amsterdam/Philadelphia: John Benjamins Publishing Company.

Hendriks, P. 2003. Either' as a focus particle. Manuscript, University of Groningen.

Hendriks, P. 2004. Either, both and neither in coordinate structures. *Manuscript, University of Groningen*. https://doi.org/10.1075/cilt.255.08hen

Hoyt, F. 2010. Negative concord in Levantine Arabic. Ph.D. Dissertation, University of Texas at Austin.

Jackendoff, R. 1977. *X-Bar Syntax: A study of phrase structure*. Cambridge, MA: MIT Press.
Kayne, R. S. 1994. *The antisymmetry of syntax*. Cambridge, MA: MIT Press.
Kramer, R. 2010. The Amharic definite marker and the syntax-morphology interface. *Syntax* 13, 196–240. https://doi.org/10.1111/j.1467-9612.2010.00139.x
Larson, B. 2013. Arabic Conjunct-Sensitive Agreement and Primitive Operations. *Linguistic Inquiry* 44(4), 611–631. The MIT Press. https://doi.org/10.1162/LING_a_00140
Larson, R. 1985. On the syntax of disjunction Scope. *Natural Language and Linguistic Theory* 3, 217–264. https://doi.org/10.1007/BF00133841
Lobeck, A. 1995. *Ellipsis: Functional heads, licensing and identification*. New York: Oxford University Press.
Munn, A. 1993. Topics in the syntax and semantics of coordinate structures. Ph.D. Dissertation, University of Maryland.
Munn, A. 1999. First conjunct agreement: Against a clausal analysis. *Linguistic Inquiry* 30(4), 643–668. https://doi.org/10.1162/002438999554246
Ouali, H. & Soltan, U. 2014. On negative concord in Egyptian and Moroccan Arabic. In S. Farwaneh and H. Ouali (Eds.) *Perspectives of Arabic Linguistics* XXV(pp. 159–180). Amsterdam/Philadelphia: John Benjamins Publishing Company.
Potsdam, E. 1996. Syntactic Issues in the English Imperative. Ph.D. Dissertation, University of Santa Cruz.
Ross, J.-R. 1967. Constraints on variables in syntax. Ph.D. Dissertation, MIT.
Schwarz, B. 1999. On the syntax of either …or. *Natural Language and Linguistic Theory* 17, 339–370. https://doi.org/10.1023/A:1006046306942
Soltan, U. 2007. On agree and postcyclic merge in syntactic derivations: First conjunct agreement in Standard Arabic. In Benmamoun, E., (Ed.), *Perspectives on Arabic Linguistics* XIX (pp. 191–213). Amsterdam/Philadelphia: John Benjamins Publishing Company. https://doi.org/10.1075/cilt.289.15sol
Zwart, J.-W. 2005. Some notes on coordination in head-final languages. In J. Doetjes & J. van de Weijer (eds.), *Linguistics in the Netherlands 2005* (pp. 231–242). Amsterdam/Philadelphia: John Benjamins Publishing Company.

Huwwa

A focus operator in Iraqi Arabic

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This paper is an account of the function and interpretation of the pronominal *huwwa* found in a variety of clausal constructions in Iraqi Arabic. This element has received various analyses in studies on clause structure in a number of Arabic varieties. It has been considered an appositive pronominal, a copulative pronoun, a copula with pronominal features, and a Q operator. The distribution of this element in Iraqi Arabic is observed, not only in verbless equational sentences with focused elements, but also in one type of wh-questions and in yes/no questions. In all of these contexts, it is associated with a focus reading. This motivates analyzing it as an overt realization of a focus operator, with φ features valued in agreement with the focused element. As such, it should be located in the head position of the Focus Phrase, one of the functional projections constituting the discourse-functional layer of clausal architecture.

Keywords: Iraqi Arabic, *huwwa*, focus operator, equational sentences, bi-clausal wh-questions, functional projections

1. Introduction

Iraqi Arabic (IA), like Standard Arabic and other varieties of spoken Arabic, features a pronominal element in the form of an independent (strong) subject pronoun, *huwwa*, 'he', and its feminine and plural variants, *hijja* 'she,' *humma* 'they(m),' and less frequently *hinna* 'they(f).' This element, usually referred to as (PRON) in the literature, is found in a variety of constructions, including verbless equational clauses of the cleft type, one type of wh-questions that are structurally analogous to equational sentences, and yes/no questions.

A number of analyses have been proposed to account for the function, categorial status, and distribution of this element in other varieties of Arabic. This paper will discuss the characteristics of this element and the constructions in which it

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appears in IA. After reviewing existing accounts from the literature, it puts forth a more adequate analysis, making use of insights into the discourse layer of the clause structure (the left periphery) and the complex shell of the projections in that layer. I argue that in these sentences, PRON is an overtly spelled-out focus operator located in the Focus Phrase.

The paper is divided as follows: Section 2 provides an overview of the constructions in which this element appears (i.e., bi-clausal wh-question types and verbless equational clauses) and sketches the syntactic structure they project. Section 3 reviews a number of proposals put forth by Eid (1983,1991), Ouhalla (2013), and Choueiri (2016) to account for this element in one of the two constructions, namely, verbless equational sentences. Section 4 presents an alternative account that treats this element as a focus operator that is located in the head of a Focus Phrase (FocP) in the left periphery. Section 5 offers additional support from a third construction (yes/no questions) in which this element appears. Section 6 provides a conclusion.

2. Iraqi Arabic constructions with *huwwa*

Wh-Questions

The first type of constructions in which *huwwa* may occur is wh-questions. The formation of these questions follows two strategies. The first is the mono-clausal construction strategy, in which a wh-phrase moves from a clause-internal position where it originate to a clause-initial position, possibly a specifier position in the left periphery of the sentence. Wh-questions may also be formed using the bi-clausal strategy. In these questions, which are limited to the questioning of arguments, the wh-phrase is assumed to be base-generated within the predicate of a subject-predicate sentence whose subject is a headless relative clause. These two strategies are exemplified in (1) and (2) respectively.

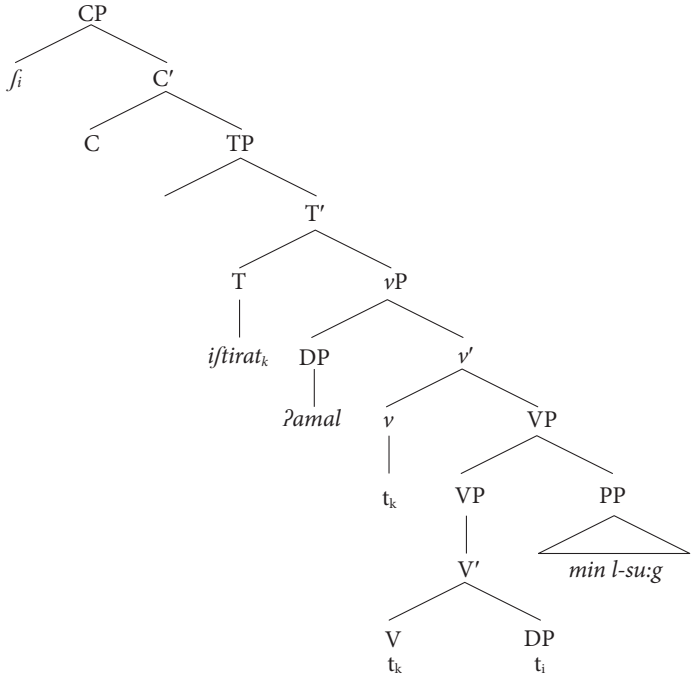
(1) *ʃ- iftirat ʔamal min l-su:g*[1]
what-bought.3.F.SG Amal from DEF-market
'What did Amal buy from the market?'

(2) *minu illi ʃa:f-a zeid l-ba:rħa*
who REL saw.3.M.SG-him Zaid DEF-yesterday
'Who is it that Zaid saw yesterday?'

1. The following abbreviations are used in the glosses of Iraqi Arabic data in the paper: 1, 2, 3 for first, second, and third person, respectively; SG = singular; PL = plural; M = masculine; F = feminine; COMP = complementizer; DEF = definite article; REL= relativizer Q = question-particle.

In (1), the wh-phrase *ʃ* 'what' is assumed to have merged as a complement of the verb *iftirat* 'bought' and to have subsequently moved to a clause-initial position, conventionally Spec,CP. In this movement, the wh-phrase leaves a gap or unspelled copy in its original position. Leaving out unnecessary details, this sentence is assumed to have the structure shown in (3).

(3)



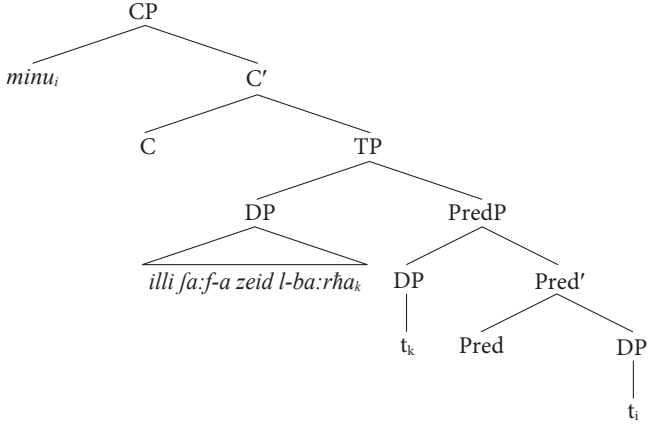
On the other hand, the sentence in (2) is that of a cleft structure composed of two constituents, a subject/topic DP *illi ʃa:f-a zeid l-ba:rħa* 'who Zayd saw yesterday' and a headless relative clause that begins with the relativizer *illi*[2] and continues with a predicate containing the wh-phrase *minu* 'who'. The structural composition of this kind of sentence is thus what gives the bi-clausal strategy its name (cf. Potsdam, 2006).

2. The DP status of these headless relative clauses stems from their clear nominal properties as seen in their occupation of argument positions in all types of clauses. See Ouhalla (2004) for a detailed discussion. Their subjecthood in these clauses is based on their informational roles in the clause. The headless relative furnishes the 'topical' familiar, or old information, which the wh-phrase never furnishes, but rather seeks. This role can also be seen in the focused equational sentences that are dealt with presently, See Shlonsky (2002) for an alternative analysis, where the headless relatives are relegated to predicate position and the wh-phrase is assigned a subject position.

Following the structural analysis sketched in Aoun et al. (2010) for verbless sentences, I assume that these sentences project a clause structure in which the complement of T is a predicate phrase (PredP). In other words, it is a small clause (SC), whose head is null, complement is the predicate DP, AP, or PP, and specifier is the subject DP that may raise to the higher position of Spec,TP to satisfy the optional EPP feature (See also Ouhalla, 2013 and Choueiri, 2016).[3] In bi-clausal wh-questions like (2), the predicate DP is being questioned and merges as a wh-phrase. Where the complement of their predicate is a DP, these bi-clausal wh-questions may be called 'equational' in the same sense that their verbless declarative namesakes are, (see footnote 6 below).

Like sentence (1), sentence (2) exhibits movement of the wh-phrase *minu* from its original position in the predicate phrase to a clause-initial position in Spec,CP. This is the conventional landing site of wh-movement, again leaving a gap, or a silent copy.[4] Within this sketch, the structure of sentence (2) may initially be represented as (4).

(4)



These bi-clausal wh-questions may also show up in a different form, as is seen in (5).

(5) *minu huwwa illi ʃa:f-a zeid l-ba:rħa*
who he REL saw.3.M.SG-him Zaid DEF-yesterday
'Who is it that Zaid saw yesterday?'

3. Optionality in the occurrence of the EPP feature on the head T is responsible for the admissible occurrence of the subject to the left or right of the verbal *ɣa:n* 'be' when past reference is indicated. The subject of these clauses has alternatively been hypothesized to originate in Spec,TP. In this case, of course, there is no movement of the subject DP.

4. IA is a language whose wh-questions exhibit wh-movement to a clause-initial position. In situ wh-questions yield an echo interpretation, and are used only to confirm information.

Here, we find the fronted wh-element followed by PRON, the third person singular masculine 'nominative' pronoun *huwwa* 'he' that has feminine gender and plural number variants as in (6) and (7).[5]

(6) *minu hijja illi ntˁe:tha l-kta:b*
who she REL gave.2.M.SG.her DEF-book
'Who is it that you gave the book to?'

(7) *minu humma illi riħit wja:-hum*
who they REL went.2.M.SG with-them
'Who are they that you went with?'

Verbless equational clauses

The pronominal element PRON may appear in another clausal construction. These are a type of verbless equational clauses consisting of a subject and a predicate. The predicate is a definite DP with a referential rather than a predicational function.[6] These clauses may exhibit fronting of their predicate DP accompanied by strong stress on the fronted DP for contrastive focus purposes.[7] Such clauses may be assigned a similar structure to that of bi-causal wh-questions. However, instead of a fronted wh-element, we here find a fronted 'focused' DP as exemplified in sentences like (8).

(8) *mħammad illi ʃtira l-sajja:ra*
Mohammad REL bought.3.M.SG DEF-car
'It was Mohammad who bought the car.'

---

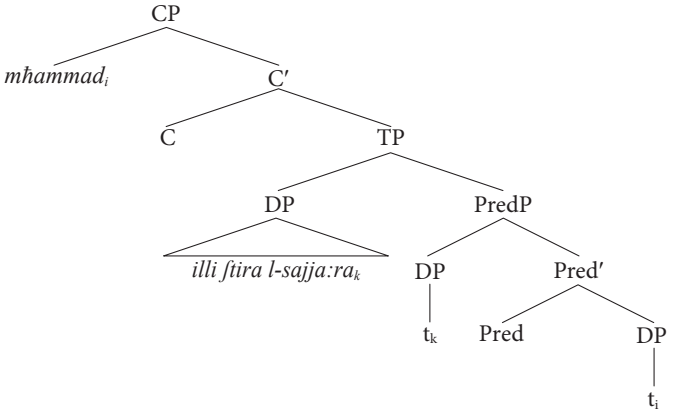
5. And less frequently, the third person feminine plural *hinna*.

6. The term 'equational' is used to refer to only one type of verbless clauses, which also include locative and existential clauses. Equational clauses may differ depending on the type of predicate they have: they could be predicational when the predicate is an AP, a PP, or an indefinite DP, or referential 'identity clauses', when the predicate is a definite DP (See Eid, 1991 and Choueiri 2016 for a detailed discussion of these types). In this latter type, we see the 'true' equative status of these sentences ascertained by the reversibility of the two components of the sentence, where the predicate can assume the position of the subject and the subject may occupy the predicate position. The referential sentences are of two types: identificational and specificational clauses.

7. Fronting is only one way to signal focus. Focused elements may remain in situ but will be phonologically marked for their strong stress. The fronting of focused elements seems to be restricted to contrastive focus and not to identificational focus (Kiss, 1998). It is worth noticing here that sentence (6) may not be the result of fronting, and that the first DP is the subject of the clause. The difference between the two versions is in the stress mark on the first element, using a stressed and fronted DP to give the clause a focused reading. Without special stress, and with a pause possibly following it, the first DP is a subject, or topic, constituting the given information, in which case no DP has undergone any focus-related fronting.

These sentences are similarly analyzed as TP's with a 'small clause', a PredP, as its complement. This PredP has a null head and a DP complement. As such, the structure of a sentence like (8) above may be represented as (9).

(9)



In this sentence, the focused DP *mhammad* has been fronted from its original position as complement of Pred to the beginning of the clause, presumably to a, yet unidentified, higher position within the CP domain. The subject DP *illi ʃtira l-sajja:ra* has also raised to Spec,TP to satisfy the EPP (assuming, as was mentioned above, that the subject in such clauses originates in Spec,PredP).

These verbless equational clauses are similar to bi-clausal wh-questions in that it is possible for them to include a pronominal element, PRON. Sentence (8) above can appear with PRON occupying a medial position between the first DP and the second DP, which is either a headless relative clause or another 'definite' DP. Sentence (10) is an example. This medial position is the same position it occupies in the bi-clausal wh-questions mentioned above.

(10) *mħammad huwwa illi ʃtira l-sajja:ra*
Mohammad he REL bought.3.M.SG DEF-car
'It was Mohammad who bought the car.'

Two things may be noted about the agreement pattern of PRON in these verbless equational clauses. First, PRON presumably shows agreement in number and gender with the DP to its left. This is seen in the contrast between the singular *huwwa* 'he' in (10), and the plural *humma* 'they' in (12) which agree with the singular subject *mħammad* and the plural *l-tˁulla:b*, respectively. PRON also agrees with the DP in gender as evidenced by the use of the different forms *huwwa* 'he' and *hijja* 'she' in (10) and (11), respectively.

(11) *muna: hijja illi tˁubxat l-simʧa*
Muna she REL cooked.3.F.SG DEF.fish
'It was Muna who cooked the fish.'

(12) *l-tˁulla:b humma l-masʔu:li:n*
DEF-students they DEF-responsible
'It is the students who are responsible.'

Strangely enough, PRON does not show agreement in person with this first DP. When it is a first or second person pronoun, this DP does not select a first or a second person PRON. In these cases, PRON is a third person subject pronoun in its various number and gender forms, as is seen in (13) through (15). In (13), the first DP is the second person singular masculine pronoun *ʔinta*; in (14), it is the second person singular feminine pronoun *ʔinti*; and in (15), it is the first person singular pronoun *ʔa:ni*.

(13) *ʔinta huwwa illi raħ yisiʔl-u:*
you.2.M.SG he REL will ask.3.PL-him
'It is you who they are going to ask.'

(14) *ʔinti hijja il-maʂru:fa*
you.2.F.S she DEF-known
'It is you who is known.'

(15) *ʔa:ni huwwa il-ħiʧa wjaa-hum*
I he REL-talked.3.M.SG with-them
'It is me who talked to them.'[8]

The asymmetric agreement pattern of PRON and its medial surface position in these two clause types raise questions about its categorial and functional status, as well as the position it occupies in clause structure. These questions will be addressed in the following two sections. I start by reviewing existing proposals before I put forth what I believe is a more adequate analysis of this phenomenon.

8. A reviewer raised doubt about the grammaticality of sentences (9)–(11), in which the first and second person pronominal DPs are followed by the same PRON *huwwa*, citing their unacceptability in Jordanian Arabic. Despite the infrequency of such sentences, there is no doubt about their well-formedness in IA. Such sentences are also attested in EA (cf. Eid, 1983, 1991), and in Standard Arabic (Mohammad 2000). This appears to be an instance of cross-dialectal variation.

3. The syntactic status of PRON *huwwa*

The occurrence of PRON in verbal sentences, similar but not limited to those in (10–15), has been a topic of interest in the research on the syntax of Arabic and other Semitic languages. Different proposals have been put forward to account for its syntactic function and category, as well as the position it occupies in these sentences.

Within the generative literature, Eid (1983) was one of the first accounts to deal exclusively with the occurrence of this element in verbless sentences in Egyptian Arabic (EA). According to Eid, PRON occurs in only one type of such sentences, namely, referential equational sentences. It is not allowed in predicational sentences (with AP, PP, or indefinite DP predicates) or in locative or existential sentences. The PRON element *huwwa* is analyzed as a copula pronoun functioning as a syntactic link, or a predication marker, on par with the English copular verb 'be' in similar sentences in English. In these sentences, *huwwa* is assumed to be in complementary distribution with the past tense copular verb *ka:n* 'was.'

For Eid, the complementary distribution of PRON with *ka:n*, the agreement pattern that it exhibits with the subject DP in number and gender and its role as a linking device between the two elements of an equational construction are sufficient pieces of evidence to justify assigning it a copular function while maintaining its pronominal category. Additional support comes from the similarity that its negation shows to the verbal negation pattern in EA. She thus concludes that this element is a suppletive form of the copula, presumably generated in the same position as *ka:n*.

The suggested structural similarity of auxiliary *ka:n* and PRON *huwwa* with respect to negation is offered in support of their identity of origin and hence their distributional complementarity (see Choueiri, 2016 for a critical review in which she shows that this similarity cannot be maintained). Choueiri also shows that the supposed similarity between 'pronominal negatives' and PRON, and the presumption that the former is the negation of the latter, cannot be maintained.

Another account by Eid (1991), attributes to this element the more definite function of being an "identity predicate" that signals the identity of reference between the subject and the predicate. *huwwa* is assumed to be generated as the head of the NP that represents the predicate of the equational clause and contains a 'sister' NP to this head, as shown in the representation in (16).

(16) $[_{IP}\ [\ _{NP}\ \ldots]\ [_{I}\ \ldots].\ [_{NP}\ [_{N}\ \text{PRON}]..[_{NP}\ \ldots]]]$

This structure is similar to the one given to equational clauses with the auxiliary *ka:n* except that the predicate in this case is a VP, headed by *ka:n* instead of an NP headed by PRON. However, although this analysis avoids the problem of assigning

a verbal categorial status to PRON[9] and provides a plausible explanation for the predicational function of this element since it is generated as the head of a predicate, it nevertheless encounters the following problems.

First, this analysis posits a structure that is not attested anywhere else in EA, namely, that of a pronoun functioning as the head sub-constituent of an NP or a predicate element inside an NP. Second, PRON is also assumed to assign the nominative case to its complement NP, a function that is not shared by any other pronoun or NP in EA. Third, it would be difficult to explain why the two elements of the discontinuous negative particle /*ma–ʃ*/ would end up surrounding this subcomponent of the NP instead of the whole NP, as would be expected. To arrive at this surface order, PRON is supposed to move outside the NP in which it originates to the higher node of the Neg head situated outside the predicate NP. This is a process akin to the movement of the verb in negative sentences. See Edwards (2006) and Choueiri (2016) for a more detailed discussion.

When this analysis is applied to the IA data presented in Section 2, the following issues arise. First, the presumed verbal feature that PRON has in EA, namely, being negated like a verb in EA, does not seem to hold for its counterpart in IA. Here, its negation differs from that of verbs. Verbless equational sentences like (8) and (11) are negated with the negative particle *mu:* used for constituent negation, as (17) and (18) illustrate, and not *ma,* the particle used for sentential negation in verbal sentences.

(17) *mħammad mu: huwwa illi ʃtira l-sajja:ra*
Mohammad NEG he REL bought.3.M.SG DEF-car
'It was not Mohammad who bought the car.'

(18) *muna: mu: hijja illi tˁubxat l-simʧa*
Muna NEG she REL cooked.3.F.SG DEF-fish
'It was not Muna who cooked the fish.'

The suggestion of a complementary distribution between PRON and the auxiliary verb *kaan/ʧaan,* cannot be maintained either. Focused equational clauses with fronted DPs in IA seem to allow the co-occurrence of both elements in the same sentence, as witnessed in (19) below. Consequently, this element cannot be considered a suppletive copula form, as is proposed for its counterpart in EA. Furthermore, the availability of both *huwwa* and *ʧaan* suggests that the two elements must be assigned different syntactic statuses.

9. The seemingly predicative function of PRON has tempted researchers to assign it a verbal categorial status. For example, it was considered a quasi-verb by Brustad (2000).

(19) *zeid huwwa ʧa:n illi bina l-be:t*
Zaid he was.3.M.SG REL built.3.M.SG DEF-house
'It was Zaid who built the house.'

Another analysis that has been proposed for this element in Egyptian and other varieties of spoken Arabic with similar structures takes it to be a strong (independent) pronoun that carries focus in the sentence (Ouhalla, 1999). Here it is similar to all strong (independent) pronouns, which are used for various pragmatic functions, including disambiguation, subject switch, and contrastive focus. As a target of focus, PRON is assumed to be generated in the Agreement (Agr) part of Infl as a carrier of a [+ Focus] feature. In line with an analysis for similar constructions in Modern Hebrew by Doron (1986), this analysis suggests that in equational sentences with PRON, Agr includes this feature. Such a feature is responsible for the selection of PRON as a focus marker and a carrier of agreement features with the subject DP, rather than a verbal element that usually undertakes this task. PRON is, therefore, the realization of the agreement features in Agr. Within this proposal, verbless equational clauses with PRON are given the syntactic representation in (20).

(20) $[_{CP}$ …..$[_{InflP}$ $[_{AgrP}$ ….$[_{Agr}$ …PRON …$[_{PredP}$ …..]]]]]

While linking PRON to focus is an adequate characterization of its function in these sentences, the proposal that it is a spell-out of agreement features with the subject DP raises questions about the limited nature of agreement that this element exhibits, since agreement here does not extend to the feature of person. This sets PRON apart from the usual agreement relation in all three phi-features typically found between a verb and its subject. If it were a spell-out of agreement in INFL, why should it exhibit a different agreement pattern from the usual one?

Another question that is raised in the context of the position of this element is related to the status of Agr in the clause structure. Agr, as a functional category and an independent functional projection, has been put to question and argued against within the Minimalist Program framework (cf Chomsky, 1995). More adequately, agreement should be understood as a relation between elements in which specific features are valued on an element in accordance with those found on a c-commanded second element or a goal, (see Chomsky, 2000, 2001). Hence, agreement features are no longer features of a functional category located in INFL, which is now the locus of tense inflection.

A later modification to this analysis is found in Ouhalla (2013) in which PRON is treated as an Aux element, like the copular *ka:n* 'be' that is inserted directly under T, as is represented in (21) below (Ouhalla, 2013: p. 321). Agreement between this element and the subject DP is accounted for via a probe-goal relation,

and its apparent lack of person feature is suggested to be the result of "weakened agreement, due to some phonological influence."

(21) [$_{CP}$ ...[$_{TP}$ .. [$_{T}$ [$_{Aux}$ PRON/be]] [$_{AspP/FP}$ ..]]]

The linking characteristic of PRON in verbless sentences is also recognized in Choueiri's (2016) account of its role in such sentences. Based on arguments on linking by den Dikken (2006) and Philip (2012), in which a separate functional projection FP is isolated for linkers, Choueiri posits such a projection for verbless equational sentences in Arabic. To her, the projection originates below TP and above PredP, with PRON as its head. It is the projection to whose specifier the predicate raises from PredP. PRON will thus link this raised predicate to the subject of PredP. The agreement features that PRON displays are 'valued' in the now customary c-command-based Agree relation with the closest goal/target.

4. *huwwa* as a focus operator

The above analyses primarily deal with the linking role of the element PRON in verbless equational sentences. However, the focusing function of this element is not wholly recognized by them. Choueiri (2016) and Ouhalla (1999, 2013) are an exception. They recognize the focusing nature of this element and account for it in terms of a [+ Focus] feature that PRON carries as a 'strong' independent pronoun. Ouhalla (1999) assumes that PRON is generated under the Agr component of Infl, while Ouhalla (2013) and Choueiri (2016) maintain that it is generated as the head of a particular functional projection for linkers

The focused reading of these sentences is unmistakable, and the presence of PRON is a clear manifestation of that focus. Furthermore, this reading is shared with the similarly constructed bi-clausal wh-questions, a commonality that deserves to be accounted for preferably via a unified analysis. The similarity between these wh-questions and verbless equational sentences is based on the identical role that the fronted DPs in the first type of sentences and the fronted wh-elements in the second play. Both behave as focused elements binding variables in the locus of their base generation. If both of them are available in the same structure, only one of them may be fronted (Ouhalla, 1994, 1999).

The proposals put forth regarding the structure of the left periphery, which hosts discourse-related projections, may help provide a straightforward analysis of wh-questions and verbless equational sentences in IA and may help determine the syntactic status of PRON. The original hypothesis about this cartography of projections at the higher functional layer was developed by Rizzi (1997) in which

a fixed hierarchy of interpretively transparent projections are proposed in the clausal left periphery, as in (22).

(22) $[_{\text{ForceP}} .. [_{\text{Force}} ..[_{\text{TopP}} .. [_{\text{Top}} ..[_{\text{FocP}} ..[_{\text{Foc}} .. [_{\text{FinP}} ..[_{\text{Fin}} ..[_{\text{TP}} ..]]]]]]]]]]$

Further research on this layer investigates issues concerning the positional rigidity of these projections, their order, category label, and possible recursion. Other approaches have assumed the existence of a system of such syntactic projections, but argue that they are interpretively opaque; see Rizzi (2013) for an overview.[10] However, these arguments do not question the validity of the basic notion of the discourse-functional projections that interface syntax with pragmatics.

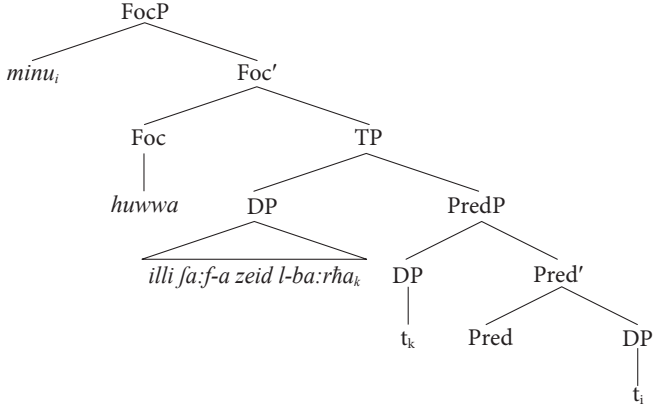
Of concern to us in this cartography is a particular projection which functions as the landing site of these focused elements, conventionally labeled as the Focus Phrase (FocP). This projection is assumed to be the locus of the focus operator that binds focused elements, including wh-phrases. The head of this projection, Foc^0, with its [+ Focus] feature, represents the focus operator. The head also contains an 'edge feature' [+ EF] that is responsible for triggering the movement of the focused element (be it a DP or a wh-phrase) to its specifier position. As focus-related elements, wh-elements are assumed to occupy this position when they move from their original position inside the clause to a clause-initial position, in the case of ex-situ questions (see Ouhalla, 1994). This also applies to the other elements that occupy this Spec,FocP position, i.e. the focused DPs that originate as complements of PredP in focused equational sentences.

In IA, this focus operator seems to be overtly spelled out only occasionally. In such cases, it shows up in the form of an independent subject pronoun that is marked for gender and number, such as *huwwa, hiyya,* or *humma*. Thus, in its overt form, the focus head has φ features licensed via agreement with the nearest goal. The closest goal available for this agreement is the subject DP, which occupies Spec,TP. In bi-clausal wh-questions, the headless relative surfaces to the right of *huwwa*. In focused equational clauses, this element is a DP. Wh-elements and focused DPs move from their predicate-internal positions to the specifier of the Focus phrase due to the presence of the 'edge' [+ EF] feature in the head of this phrase.

10. The functional layer on the left periphery of the clause exhibits parametric variation with regards to the flexibility of the order of the projections, their number, recursion and types. IA is one language that does not seem to have a fixed order of the different projections at this layer, which casts doubt on the validity of assigning specific categorial labels to them, see Bakir (2011) for a discussion of the possible indeterminacy of the hierarchy of these projections.

Within this framework, the bi-clausal wh-question with the PRON *huwwa*, like (5), repeated here as (23a), will have a syntactic structure representation as in (23b)

(23) a. *minu huwwa illi ʃa:f-a zeid l-ba:rħa*
who he REL saw.3.M.SG-him Zaid DEF-yesterday
'Who is it that Zaid saw yesterday?'



Similarly, sentences (6) and (7), repeated here as (24a) and (25a), will have the structures in (24b) and (25b) respectively.

(24) a. *minu hijja illi ntˁe:tha l-kta:b*
who she REL gave.2.M.SG.her DEF-book
'Who is it that you gave the book to?'
b. [$_{FocP}$ *minu*$_i$ [$_{Foc}$ *hijja*] [$_{TP}$ [$_{DP}$ *illi ntˁe:tha l-kta:b*]$_k$ [$_{PreP}$ [...t$_k$] [$_{Pre'...}$[t$_i$..]]]]]

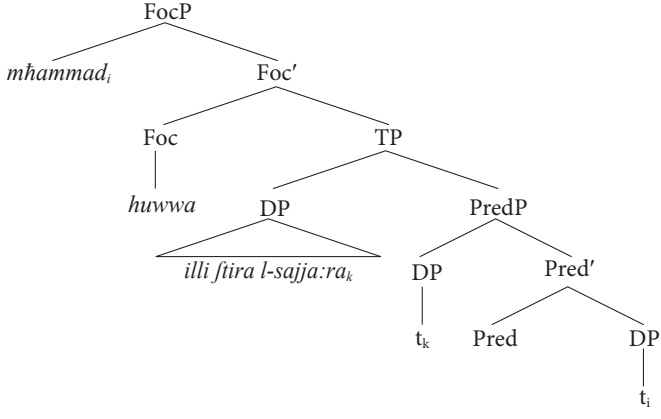
(25) a. *minu humma illi riħit wja:-hum*
who they REL went.2.M.SG with-them
'Who are they that you went with?'
b. [$_{FocP}$ *minu*$_i$ [$_{Foc}$ humma] [$_{TP}$ [$_{DP}$ *illi riħit wja:-hum*]$_k$ [$_{PreP}$ [...t$_k$] [$_{Pre'...}$ [t$_i$..]]]]]

In these sentences, the complement wh-phrase in PredP raises to Spec,FocP to satisfy the edge feature [EF] that the head of this projection has. Another movement involves the subject of PredP from its original position in Spec.PredP to Spec,TP to satisfy the EPP. It is also necessary to assume that the focus operator in the head of FocP has φ features, which are valued via agreement with the closest appropriate goal. In our case this is: *illi ʃa:f-a zeid l-ba:rħa* 'that Zaid saw yesterday' in (23a), *illi ntˁe:tha l-kta:b* 'that you gave the book to' in (24a), and *illi riħit wja:-hum* 'that you went with' in (25a). The operator is accordingly spelled out as an independent

pronoun that displays appropriate number and gender agreement. The outcome in (23) through (25) is *huwwa, hijja,* and *humma* respectively.

In a similar fashion, focused equational clauses like (10), repeated here as (26a), will have the syntactic structure in (26b).

(26) a. *mħammad huwaa illi ʃtira l-sajja:ra*
Mohammad he REL bought.3.M.SG DEF-car
'It was Mohammad who bought the car.'



Similarly, sentences (11) and (12) above, repeated here as (27a) and (28a) will have the structures in (27b) and (28b).

(27) a. *muna: hijja illi tˁubxat l-simʧa*
Muna she REL cooked.3.F.SG DEF.fish
'It was Muna who cooked the fish.'
b. [$_{FocP}$ *muna:*$_i$ [$_{Foc}$*hijja*] [$_{TP}$[$_{DP}$ *illi tˁubxat l-simʧa*]$_k$ [$_{PreP}$ [..t$_k$] [$_{Pre'...}$[t$_i$..]]]]]

(28) a. *l-tˁulla:b humma l-masʔu:li:n*
DEF-students they DEF-responsible
'It is the students who are responsible.'
b. [$_{FocP}$ *l-tˁulla:b*$_i$ [$_{Foc}$ *humma*] [$_{TP}$ [$_{DP}$ *l-masʔu:li:n*]$_k$ [$_{PreP}$ [...t$_k$] [$_{Pre'...}$[t$_i$..]]]]]

In these sentences, the focused DP constituting the complement of the predicate phrase raises to the specifier of FocP to satisfy the edge feature [EF] on the head of this projection. Again, the Focus operator is overtly spelled out with φ features that get valued via agreement with a c-commanded relevant goal. The closest goals in the sentences above are the subject DPs *illi ʃtira l-sajja:ra* 'who bought the car,' *illi tˁubxat l-simʧa* 'who cooked the fish.' and *l-masʔu:li:n* 'responsible' respectively.

Of significance in this analysis is the goal of the agreement that the overt focus operator PRON seeks for the valuation of its features. The above structures show that the closest c-commanded goal is neither the wh-phrase in (23), (24) and (25),

nor the focused DPs in (26), (27) and (28), all of which show up as the left-most elements in their clauses, but originate as the complements of the PredP. The closest candidates for this agreement process are the subject DPs which appear to the right of PRON, and reside in Spec,TP of the clause, all of which are nominals and are characterized as third person. This explains why PRON carries a third person feature and is consequently realized as an independent pronoun in these and other sentences of similar structure. Agreement is not limited to gender and number as widely claimed in the literature, but also extends to the third person φ feature. Consequently, the agreement pattern that this pronominal element displays is, after all, the regular pattern that all pronouns in IA display; this includes the three features of person, number, and gender. This, therefore, solves the puzzle of the incomplete agreement of PRON.

This also explains the disagreement between the pronoun at the left-most position and the PRON element in sentences (13), (14), and (15) above. If the agreement of PRON in these sentences is not with the focused DPs *ʔinta, ʔinti,* and *ʔa:ni,* but with the original subjects *illi raħ yisiʔl-u:* 'who they are going to ask,' *il-maʂru:fa* 'known,' and *il-ħiʧa wja:-hum* 'who talked to them' respectively, then PRON actually exhibits full agreement in all the three phi features, since the original subjects are all third person DPs.

5. Yes/no questions

The focus operator PRON shows up in a third clausal construction in IA: yes/no questions. Like other spoken dialects of Arabic, Iraqi Arabic forms its yes/no questions by changing the falling intonation associated with statements into a rising one. No syntactic changes are noticeable in the formation of these questions. There is a tendency to retain a VSO order in these questions, but a SVO word order is not excluded. Thus, for the statement in (29), we have the questions in (30a) and (30b).

(29) *mħammad sa:far l-baɣda:d* ↘
Mohammad travelled.3.M.SG to-Baghdad
'Mohammad travelled to Baghdad.'

(30) a. *sa:far mħammad l-baɣda:d* ↗
travelled.3.M.SG Mohammad to-Baghdad
'Mohammad travelled to Baghdad.'

b. *mħammad sa:far l-baɣda:d* ↗
Mohammad travelled.3.M.SG to-Baghdad?
'Mohammad travelled to Baghdad.'

As was the case in the bi-clausal wh-questions and focused equational sentences discussed above, yes/no questions in IA may also show up with PRON. Like the other two types of clauses, they also have a focused reading when PRON is involved. However, they differ from the former two constructions in one significant feature; PRON does not occupy a medial position here. Rather, it is located at a clause-initial position, as in sentences (31) through (34).

(31) huwwa *sa:far* *mħammad* *l-bayda:d*
he travelled.3ms Mohammad to-Baghdad
'Did Mohammad travel to Baghdad?'

(32) *huwwa n-na:s* *ʔajjidaw* *l-ʔinqila:b*
he DEF-people supported.3M.PL DEF-coup
'Did the people support the coup?'

(33) *huwwa muna: ʃa:fat* *l-be:t*
he Muna saw.3.F.SG DEF-house
'Did Muna see the house?'

(34) *huwwa ʔinta* *riħit* *l-hna:k*
he you.M.SG went.2.M.SG to-there
'Did you go there?'

In addition, the form of PRON in these questions is mostly the third person masculine singular *huwwa*. However, occasional variation in agreement with the subject's gender, and number is allowed. The question that we face here concerns the difference in position that PRON occupies in yes/no questions as compared to the former two types of constructions, as well as how to accommodate this difference within the proposed analysis.

IA yes/no questions like the ones in (31) through (34) are similar to PRON-initial yes/no questions in Egyptian Arabic (EA). The clause-initial *huwwa* that is found in different types of questions in EA, including yes/no questions, is considered a question particle. Eid (1992) argues that it is the same pronominal copula that we find in verbless sentences. She adds that in these questions, unlike in verbless sentences, the pronominal copula moves from its position in the predicate phrase to C, and thus appears as the left-most element in the clause. Another analysis is offered in Soltan (2011), in which *huwwa* is considered an interrogative morpheme, a phonetically spelled-out question (Q) operator that marks the clause as a question.

Alternatively, we could take PRON in these sentences to be the same overtly spelled out focus operator that we find in bi-clausal wh-questions and focused equational sentences. As a focus operator, this element occupies the head of the focus phrase FocP and conventionally provides these sentences with their focused

interpretation. Within this picture, sentences (31), (32), (33), and (34) have the structures in (35), (36), (37), and (38).

(35) [$_{FocP}$ [$_{Foc}$ huwwa] [$_{TP}$ sa:far mħammad l-baɣda:d]]

(36) [$_{FocP}$ [$_{Foc}$ huwwa] [$_{TP}$ n-na:s ʔajjidaw l-ʔinqila:b]]

(37) [$_{FocP}$ [$_{Foc}$ huwwa] [$_{TP}$ muna: ʃa:fat l-be:t]]

(38) [$_{FocP}$ [$_{Foc}$ huwwa] [$_{TP}$ ʔinta riħit l-hna:k]]

As was mentioned above, the appearance of PRON in a clause-initial position constitutes the main formal difference between these clauses, on the one hand, and bi-clausal wh-questions and focused equational clauses, on the other hand. In the latter type of clauses, PRON follows the wh-phrase and the fronted DP. This seems to be related to the difference that these constructions exhibit with respect to the nature of the element under focus. In bi-clausal wh-questions and focused equational clauses, PRON serves as the fronted wh-phrase and the fronted DP that constitute the focused element. This is not the case in yes/no questions. In these questions, focusing seems to involve the entire proposition rather than a specific element within it. That is to say, in yes/no questions the entire question is being focused. Attraction to the specifier position, which causes wh-elements and fronted DPs to surface in a pre-PRON, clause-initial position, does not seem to hold in this case. Hence, there does not seem to be any fronting in yes/no questions.[11]

The second point in which these constructions differ from the previous two is the form of PRON. The form of this element in yes/no questions is almost always that of the third person singular masculine independent pronoun. No agreement process seems to occur in this context. Rather, PRON assumes its default form *huwwa* in all these sentences regardless of the person, gender, or number of the subject DP, the closest relevant goal for feature valuation. For those instances in which we do find such agreement taking place between PRON and the following DP, the variation in the form of PRON is limited to gender and number (i.e., *hijja* and *humma*). In yes/no questions with first and second person subjects (*ʔa:ni* 'I,' *ʔiħna* 'we,' *ʔinta* 'you (M.SG),' *ʔinti* 'you (F.SG),' and *ʔintu* 'you (PL)'), PRON assumes its default form. This is also the case in questions with third person subject pronouns. In all these cases, PRON is invariably found in its default form as *huwwa*. The fact that this invariability of PRON is linked to the occurrence of pronominal subjects, to which it is adjacent in these sentences, raises the possibility of a phonological constraint against the 'repetition' of phonologically identical units,

11. One can invoke notions like 'heaviness' as a possible reason to block the raising of the whole TP to a position in the functional layer, hence the appearance of the PRON *huwwa* at the beginning of such questions. However, pursuing this is outside the scope of the present work.

something akin to the Obligatory Contour Principle. However, more research is certainly needed to explain such a constraint.

6. Conclusion

In this paper, I have provided an analysis of a number of constructions in IA that share the common feature of having a pronominal element PRON occupying a clause-initial position or mediating between the main two components of a clause. The clause constructions in which this element assumes a medial position are of two types. The first is wh-questions of the cleft-type which consist of a subject DP in the form of a headless relative clause and a predicate consisting of a wh-phrase. The second construction is that of verbless equational sentences in which the subject is a definite DP and the predicate is another definite DP. This pronominal element may also be found in a clause-initial position in yes/no questions.

A number of proposed accounts were argued to be untenable, such as those that consider PRON as an identifying predicate, a quasi-verb, or just an agreement marker generated in INFL. Alternatively, this element could more appropriately be considered a focus operator occupying the head position in a FocP (one of the functional projections in the left periphery of the clause architecture), with the focused DP or wh-phrase occupying the specifier position of that phrase. Similarly, in yes/no questions, this element plays the same role as a focus operator and is assumed to occupy the same position as the head position of FocP. Yes/No questions, however, do not exhibit a specifically focused element that might move to the specifier of FocP. The absence of such an element is therefore responsible for the clause-initial surface position in which PRON appears.

References

Aoun, J., Benmamoun. E., & Choueiri, L. 2010. *The syntax of Arabic*. Cambridge: Cambridge University Press.

Bakir, M. 2011. Against the split-CP hypothesis: Evidence from Iraqi Arabic. In E. Broselow & H. Ouali (Eds.), *Perspectives on Arabic linguistics* XXII-XIII (pp. 187–201). Amsterdam & Philadelphia: Benjamins. https://doi.org/10.1075/cilt.317.09bak

Brustad, K. 2000. *The syntax of spoken Arabic*. Washington, DC: Georgetown University Press.

Chomsky, N. 1995. *The Minimalist Program*. Cambridge, Mass: MIT Press.

Chomsky, N. 2000. Minimalist inquiries: The framework. In R. Martin, D. Michaels, & J. Uriagereka (Eds.), *Step by step: Essays on Minimalist syntax in honor of Howard Lasnik* (pp. 89–155). Cambridge, MA: MIT Press.

Chomsky, N. 2001. Derivation by phase. In M. Kenstowicz (Ed.), *Ken Hale: A life in language* (pp. 1–52). Cambridge, MA: MIT Press.

Choueiri, L. 2016. The pronominal copula in Arabic. *Brill's Journal of Afroasiatic Languages and Linguistics* 8, 101–135.

Den Dikken, M. 2006. *Relators and linkers: The syntax of predication, predicate inversion, and copulas*. Cambridge, MA: MIT Press.

Doron, E. 1986. The pronominal copula as an agreement clitic. In H. Borer (Ed.), *The syntax of pronominal clitics. Syntax and Semantics 19*, (pp. 313–332). New York: Academic Press.

Edwards, M. 2006. Pronouns, agreement and focus in Egyptian Arabic. *SOAS Working Papers in Linguistics* 14, 51–62.

Eid, M. 1983. The copula function of pronouns. *Lingua* 59, 197–207. https://doi.org/10.1016/0024-3841(83)90063-3

Eid, M. 1991. Verbless sentences in Arabic and Hebrew. In M. Eid & B. Comrie (Eds.), *Perspectives on Arabic linguistics III: Papers from the Third Annual Symposium on Arabic Linguistics*, (pp. 31–61). Amsterdam & Philadelphia: Benjamins. https://doi.org/10.1075/cilt.80.05eid

Eid, M. 1992. Pronouns, questions, and agreement. In E. Broselow, M. Eid & J. McCarthy (Eds.), *Perspectives on Arabic linguistics IV: Papers from the Annual Symposium on Arabic Linguistics*, (pp. 107–141). Amsterdam & Philadelphia: Benjamins. https://doi.org/10.1075/cilt.85.08eid

Kiss, K. É. 1998. Identificational focus versus information focus. *Language* 74, 245–273. https://doi.org/10.1353/lan.1998.0211

Mohammad, M. 2000. *Word order, agreement and pronominalization in Standard and Palestinian Arabic*. Amsterdam & Philadelphia: John Benjamin. https://doi.org/10.1075/cilt.181

Ouhalla, J. 1994. Focus in Standard Arabic. *Linguistics in Potsdam* 1, 65–92.

Ouhalla, J. 1999. Focus and Arabic clefts. In G. Rebuschi & L. Tuller (Eds.) *The grammar of focus. Linguistik Aktuell* 24 (pp. 335–360). Amsterdam & Philadelphia: Benjamins. https://doi.org/10.1075/la.24.12ouh

Ouhalla, J. 2004. Semitic relatives. *Linguistic Inquiry* 35, 288–300. https://doi.org/10.1162/002438904323019084

Ouhalla, J. 2013. Agreement unified: Arabic. In L. Cheng & N. Cover (Eds.), *Diagnosing syntax* (pp. 314–333). Oxford: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199602490.003.0015

Phillip, J. 2012. Subordinating and coordinating linkers. Ph.D. diss. University College, London.

Potsdam, E.. 2006. The cleft structure of Malagasy wh-questions. In H-M. Gartner, P. Law, & J. Sabel. (Eds.) *Clause Structure and adjuncts in Austronesian languages* (pp. 195–232). Berlin: Mouton de Grutyer.

Rizzi, L. 1997. The fine structure of the left periphery. In L. Haegman (Ed.), *Elements of grammar: Handbook of generative syntax* (pp. 281–337). Dordrecht: Kluwer. https://doi.org/10.1007/978-94-011-5420-8_7

Rizzi, L. 2013. The functional structure of the sentence, and cartography. In M. den Dikken (Ed.), *The Cambridge handbook of generative syntax* (pp. 425–457). New York: Cambridge University Press. https://doi.org/10.1017/CBO9780511804571.016

Shlonsky, U. 2002. Constituent questions in Palestinian Arabic. In J. Ouhalla & U. Shlonsky (Eds.), *Themes in Arabic and Hebrew syntax* (pp. 137–160). Dordrecht: Kluwer. https://doi.org/10.1007/978-94-010-0351-3_5

Soltan, U. 2011. On strategies of question formation and the grammatical status of the Q-particle *huwwa* in Egyptian Arabic wh-questions. In L. Friedman (Ed.), *University of Pennsylvania Working Papers in Linguistics* 17, 215–224.

Syntactic parallels between verbal and nominal φ-morphology in Classical Arabic

Martin Walkow

Much recent work investigates the role of syntax in regulating the distribution of φ-morphology (person, number and gender) in the nominal and clausal domains. Two main ideas are that the syntactic structure that introduces φ-categories in the two domains shows some degree of parallelism and that syntactic processes of agreement and cliticization affect the realization of φ-morphology. Here, the most fine-grained analysis of Classical Arabic φ-morphology to date reveals two strong parallels between the φ-morphology of nouns and verbs: (i) the same morphs are used on both, and (ii) these morphs appear in the same order. The parallels break down in third person: There are third person morphs on pronouns, but not on verbs. While (i) and (ii) are explained by syntactic parallelism, the status of third person is illuminated by the alternation between suffixal and prefixal person-morphology in perfective vs imperfective aspect. First and second person morphs can appear as prefixes or suffixes because they are clitics that are undergoing movement. A comparison of person morphs in pronouns indicates that third person morphs are not clitics, explaining their absence on verbs. These little analyzed data in Classical Arabic reveal a diversity of morphosyntactic processes in what might informally be called *agreement*.

Keywords: classical Arabic, morphosyntax, agreement, syntax-morphology interface

1. Parallels between the clausal and the nominal domain

This paper investigates the intersection of two long standing lines of research into the φ-categories person, number and gender: (i) A long line of research going back at least to Abney (1987) exploring parallel functional structure in the clausal and the nominal domains, often by investigating parallels in verbal and nominal

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morphology (e.g., Ritter, 1995) and a more recent line of research investigating the roles of cliticization and agreement in deriving the distribution φ-morphemes in the clausal domain (e.g., Nevins, 2011; Preminger, 2009, 2011; Kramer, 2014). The discussion here is organized by three morphological parallels between the nominal and the verbal/clausal domains. Section 2 establishes a parallel in form:

(1) IDENTICAL φ-MORPHOLOGY: The same φ-morphs are used in the verbal and nominal domain and the same factors condition allomorphy in both domains

The section presents the most detailed analysis of CA φ-morphology to date, and shows that the same morphs are used to express φ-morphemes on nouns and verbs. Based on (1), Section 3 establishes that φ-morphs on nouns and verbs always appear in the same order:

(2) IDENTICAL MORPHEME ORDER: φ-morphs in the verbal and the nominal domains appear in the following order: PERSON>PLURAL>GENDER

This will be derived from an identical hierarchical arrangement of φ-feature bearing heads in in the extended projection of the noun and along the clausal spine (similar to Ritter, 1995; Harbour, 2008). Parallels like (1) and (2) have been observed in other languages but need to be established before addressing an apparent breakdown in parallelism between the nominal and verbal domains (§ 4):

(3) THIRD PERSON EXCEPTIONALITY: There are clear third person morphs in pronouns, but not on verbs.

This is where questions of the syntactic status of the phenomena descriptively called *agreement* will arise. Based on the DP internal properties of person morphs, I will argue that first and second person morphemes ('1/2-morphemes') are clitics and that their appearance on verbs arises via clitic movement. Third person morphs in pronouns on the other hand are not clitic like, and hence there are no third person markers on verbs. Hence the apparent exceptionality in (3) is in fact another parallelism.

2. Parallel 1: Identical φ-morphs and allomorphy

This section establishes parallel (1): The same φ-morphs are used in the verbal and nominal domains and the same factors condition their allomorphy. To demonstrate this, the φ-affixes are decomposed further than has often been done in the past (see McCarthy, 1979, though for an important precursor). The argument is built around φ-morphology in four domains: perfective verbs, imperfective verbs,

free pronouns and common nouns. φ-Features are also expressed in other contexts, which broadly follow the observations made for these four categories. The morphs for gender, number and person will be discussed in this order, followed by the discussion of allomorphy.

2.1 Gender morphs

CA has two genders, feminine and masculine, to be discussed in this order. First person does not distinguish genders so it is omitted in Table 1.

Table 1. Gender morphs (bold) on verbs, pronouns and common nouns.

		Perfective		Imperfective		Pronoun		Common N.	
		SG	PL	SG	PL	SG	PL	SG	PL
Fem.	2:	*…-t-**i***	*…-u-**n:a***	*t-…-**i:***	*t-…-**na***	*ʔant-**i***	*ʔantu-**n:a***		
	3:	*…-**at***	*…-**na***	*t-…*	*j-…-na*	*h-**i**-ja*	*h-u-**n:a***	*…-**at***	*…-**a:t***
Masc.	2:	*…-t-**a***	*…-tu-**m***	*t-…*	*t-…-u:*	*ʔant-**a***	*ʔantu-**m***		
	3:	*…-a*	*…-u:*	*j-…*	*j-…-u:*	*h-u-wa*	*hu-**m***	*…*	*…-u:*

Table 1 shows three morphs for feminine: /-na/, /(a)t/ and /-i/. /-na/ appears in all feminine plurals except common nouns. It is not a PL.F-portmanteau though. The 2PL.F-perfective, 2PL.F-pronoun and 3F.PL-pronoun contain /-na/ as well as the plural morph realized as lengthening of /n/ (see § 2.2), showing that /-na/ does not itself realize plural. /(a)t/ appears in 3SG.F-forms of the verb (suffixed in the perfective and prefixed in the imperfective) and in common nouns. /-i/ appears only as a suffix, and is found in all pronouns as well as second person verbal forms. Section 2.4 shows that the choice between the /(a)t/ and /-i/ is conditioned by the presence of a person morph. Finally, /(a)t/ can be realized as /-at/ (common nouns, 3.SG.F-perfective) and as /t-/ (3.SG.F-imperfective). The form /t/ also appears in demonstratives and relative pronouns (Wright, 1874a: 264, 270). No insight is offered here into what conditions this allomorphy, and I only point out that both allomorphs appear in nominal and verbal contexts.

The discussion of masculine focuses on /-m/. /-m/ appears in 2/3 non-singular pronouns and the second person perfective verb. /-m/ is not a portmanteau of masculine and plural, but an allomorph of masculine in the context of non-singular. This can be seen by comparing the singular and plural forms in Table 1 to the dual forms in Table 2. Where the plural contains /-m/, the dual does as well (3.D: *hum-a:*, 2.D: *-tum-a:*). No other dual forms contain a plural morph. If /-m/ were a masculine-plural portmanteau, forms with /-m/ would be the only duals that

Table 2. Distribution of dual forms across genders

		Perfective	Imperfective	Pronoun	C. noun
2	M:	…-***tum***-*a:*	*t-*…*-a:*	*ʔan-**tum**-a:*	
	F:				
3	M:	…*-a:*	*j-*…*-a:*	***hum**-a:*	…*-a:*
	F:	…-at-a:	t-…-a:		…-at-a:

morphologically contain a plural. Section 2.4 further addresses the distribution of /-m/.

To summarize, all gender morphs discussed here appear both in the nominal and in the verbal domain.

2.2 (Sound) Plural Morph: μ

The discussion here is limited to what is traditionally called the *sound* plural, shown in Table 3. In addition, there are so called *broken* plurals for nouns and adjectives (e.g., Wright, 1874a: 199), which will not be discussed here, because they are absent in the verbal domain. The sound plural morph is a mora (μ) that is realized as gemination on consonants and lengthening on vowels (for other moraic morphemes in Arabic see McCarthy & Prince, 1990). The μ appears in both nominal and verbal forms, but, more interestingly, is often absent. The mora's absence is due to phonotactic restrictions, which are independently known to affect the realization of μ (see Wright, 1874a: 61 on shortening of *-u:*).

μ never appears in PL.M forms in -/m/. *hum* and *-tum* could realize μ by lengthening either the vowel or the final consonant. The first option would create a superheavy syllable (e.g., *[hu:m]). Such syllables are generally repaired by shortening, e.g., the long vowel of *ta-**qu:**l-u* 'you.M say' shortening to ***qul*** 'say.M.SG!' in the imperative due to the absence of the final vowel (Wright, 1874a: 26). Lengthening of the final consonant would create a final geminate e.g., *[hum:]. Geminate word

Table 3. Sound plural forms, plural morph is boxed

		Perfective	Imperfective	Pronoun	C. noun
1		… *-na-*[:]	*na-…*	*naħnu*	
2	M	… *-tum*	*t-… -u-*[:]	*ʔantum*	
	F	… *-tun-*[:]*-a*	*t-… -na*	*ʔantun-*[:]*-a*	
3	M	… *-u-*[:]	*j-… -u-*[:]	*hum*	… *-u-*[:]
	F	… *-na*	*t-… -na*	*hun-*[:]*-a*	… *-a-*[:]*-t*

final codas are generally banned (Wright, 1874a: 26) and when they arise are repaired by degemination (e.g., pausal forms Wright, 1874b: 373).

An apparent challenge to this analysis comes from the fact that *hum/-tum* can appear with an additional vowel as *humu(:)/-tumu(:)* when the following word begins with a consonant (e.g., Wright, 1874a: 22). This would allow μ to be realized by lengthening either the vowel or the consonant. The resolution to this challenge comes from considering the phonological processes involved. The presence of the additional /u/ is controlled by phonological requirements above the word level, i.e., syllable contact between words. The shortening/degemination on the other hand is a word level phenomenon that cannot be preempted by phonological phenomena at higher prosodic levels. The shortening of imperatives mentioned above illustrates this lack of interaction between word-level and above-word-level phenomena. In imperatives, the initial V or VC-combination of a following word can be syllabified with the imperative verb. This is illustrated in (4) (where '.' = syllable boundary, '#' = word boundary).

(4) [*qu.1 #un.ðˀu.r -u:*]
say.IMP look.at.IMP-PL
'Say "look (y'all)"' (Wright, 1874a: 22)

The initial [un] of the verb */unðˀuru:/* 'look!' appears as the rhyme of the final syllable of the verb [*qul*] 'say!' giving the syllable structure [qu.lun]. [*qul*] underwent shortening from */qu:l/* due to the ban on superheavy syllables, despite the fact that the surface form after syllabification with the following word would allow a long vowel like [*qu:.lun*]. This shows that violations of word level phonotactics cannot be voided by above-word-level phonological phenomena in CA.

The moraic moprh μ is also absent with /-na/ in some feminine and first person plurals. For the feminine plural /-na/, lengthening is absent when /-na/ immediately follows the root. This is expected on phonotactic grounds. When combined with a root ending in a non-glide, /-μ-na/ creates a consonant cluster where one consonant is a geminate. Geminate onsets are generally banned (Wright, 1874a: 26 § 26), ruling out a realization as [VCn:a]. Geminate codas are only possible intervocalically (Wright, 1874a: 26,15 § 13REM), ruling out a realization as [VC:na]. When /-μ-na/ combines with a root ending in a glide, a different issue arises. Due to the interaction of the vowel pattern and the glide, verb forms in /-μ-na/ can end in /u:/, /i:/, /a͡u/ and /a͡i/, but never in /a:/ (see Wright, 1874a: 309ff). The resulting sequence is /V:n:a/. Wright (1874a: 15§ 13REM) reports that sequences of the form V1:C:V2 are possible when V1 is /a:/, rare when when it is /u:/ or /i:/, and absent when V1 is a diphthong (with the exception of diminutives). This means that the contexts where V:n:V would arise by addition of /-μ-na/ are independently contexts where gemmination of the medial /n/ is expected to be marked or impossible

due the quality of V1. Questions remain about the absence of lengthening in the 1PL /na-/. The proposal about plural in § 4.2.1 leaves open why a 1PL imperfective indicative like na-ktub-u 'we write' is not realized as **na-ktub:-u* or **na-ktub-u:*. This matter has to remain open for now.

In summary, the sound plural is marked by μ in both the nominal and the verbal domain. Phonotactics prevent μ's realization in many contexts.

2.3 Person morphs

The expression of person offers a more mixed picture, which will be the major interest of this paper in § 4. There are clear cases where the same morphs are used in all relevant contexts, but third person shows a split: Pronouns show person morphology, but verbs do not.

I begin with the clear cases. Second person, Table 4, is expressed by /t/ in all contexts. Similarly, first person plural is always expressed by /n/ (also McCarthy, 1979: 296). /n/ is not a 1-PL portmanteau, but an allomorph of 1 in the context of plural. This can be seen in the 1PL perfective -na-:, where the plural morph μ is present in addition to /n/. The /a/ vowel of the suffixed forms may not be part of the person morph as it is absent in the prefixed forms (e.g., Wright, 1874a: 55/56). The picture for 1PL is complicated by the pronoun *naḥnu*, the morphological constituency of which is somewhat unclear. Two parses seem plausible: *n-aḥn-u* and *naḥ-n-u*, where in both cases the /n/ is the same as that in other 1PL contexts, and the /-u/ may be the same as in the 1SG perfective *-t-u*. Both interpretations would additionally assume that the pronoun contains non-φ-related material (*-aḥn-* or *naḥ-*), analogous to the *ʔan-* of the other 1/2-pronouns. Support for the decomposition *naḥ-n-u* comes from the fact that several modern Arabic dialects have a 1PL pronoun *ʔiḥna* or *ḥna*, where the first /na-/ is absent (Eid et al., 2007). These dialects still have *n-* as in 1PL forms of the verb. This data is inconsistent with a *n-aḥn-u* analysis as it suggests that the first /n/ is not treated as a morph.

Table 4. Person morphs

		Perfective		Imperfective		Pronoun	
		Singular	**Plural**	**Singular**	**Plural**	**Singular**	**Plural**
1		*…-**t**-**u***	*…-**n**-a:*	*ʔ-…*	***n**-…*	*ʔan-a*	*naḥ-n-u*
2	M:	*…-**t**-a*	*…-**t**-um*	***t**-…*	***t**-…-u:*	*ʔant-**t**-a*	*ʔan-**t**-um*
	F:	*…-**t**-i*	*…-**t**-un:a*	***t**-…-i:*	***t**-…-na*	*ʔan-**t**-i*	*ʔan-**t**-un:a*
3	M:	*…-a*	*…-u:*	*j-…*	*j-…-u:*	***h**-uwa*	***h**-um*
	F:	*…-at*	*…-na*	*t-…*	*j-…-na*	***h**-ija*	***h**-un:a*

First person singular shows no parallelism of forms. All four contexts have different morphs. This is consistent with the argument for structural parallelism promoted in this paper. Structural parallelism creates the conditions that allow the same morphs to appear in different contexts, as happens in second person, but it does not preclude existence of context specific forms, as happens in first person.

Third person shows a novel pattern. The pronouns have a clear third person morph: /h-/. It appears in all and only third person pronouns and it conditions allomorphy like second person /t/ (§ 2.4). The verbal forms are different. The perfective plural has the same suffixes as the second person imperfective, offering no evidence of a person morph. Likewise, 3SG-perfective has /-at/ and /-a/ on feminine and masculine respectively. While the feminine /-at/ is analogous to feminine morphs elsewhere, the status of /-a/ in 3SG.M-perfective is unclear. Wright (1874a:55/56) argues that /-a/ is part of the perfective verb template $C_1aC_2VC_3$**a** (where C_1–C_3 are the three root consonants). He supports this treatment with the observation that the first /a/ disappears when there is a prefix to the verb, and that the last /-a/ does so in the presence of a suffix. McCarthy (1979:296ff) observes that perfective singulars, except for 3.F, all end in a short vowel. The short vowel is realized as /-a/ in second and third person masculine. This precludes a treatment of /-a/ as a third person morph. Furthermore, he proposes that the /a/ in feminine singular /-**a**t/ is the same /a/. This precludes a treatment of /a/ as a masculine morph. The two analyses share that 3SG.M-perfective /-a/ is present due to phonological requirements on the shape of verb forms, not in order to realize φ-categories. I follow this interpretation here. The conclusion then is that there are no third person morphs on perfective verbs. Turning now to the imperfective, we find the pattern in (5):

(5) IMPERFECTIVE PREFIXATION PATTERN

a.	A person morph precedes the root	(1/2)
b.	Feminine /t/ precedes the root	(3F.SG/DUAL)
c.	/j-/ precedes the root	(3M and 3PL)

First and second person clearly show a person morph preceding the verb root, but third person shows a mixture of the feminine /t/ in non-plural forms, and /j-/ elsewhere. A first attempt might be to treat /j/ as a third person morph. This works for masculine, but raises questions for feminine. Why would the feminine morph block the realization of third person in non-singular, but not the plural? More generally put, the distribution of /j/ across third person is that of a default form. The cases where it is absent form a natural class (feminine non-plurals), while the ones where it is present do not (all masculine forms and all plurals). The mixed behavior of third person can be better understood from the perspective of the perfective forms. Across third person perfective forms, there is nothing that could

be identified as a person morph. So in the absence of a person morph, something else fills the position before the verb – the feminine morph /t/ does in the non-plural feminine forms. We also saw that there are no masculine morphs in the perfective singular, so a gender prefix analogous to the feminine /t/ is unavailable in the imperfective singulars. In addition, gender morphs appear to generally be prevented from being prefixes in the plural.

This sets up the major puzzle addressed in this paper: Why are there clear third person morphs in pronouns, but not on verbs, when there is a clear parallelism in the expression of person between in first and second person?

2.4 Allomorphy

We now turn to the allomorphy of feminine singular /(a)t/ vs /-i/ and the conditioning of masculine plural /-m/. In both cases, the same generalizations govern the distribution of these morphs in the nominal and verbal domains.

The choice between feminine singular /(a)t/ and /-i/ is conditioned by person: /(a)t/ never appears in a form that contains a person morph anywhere. This can be seen by comparing third person pronouns to common nouns and third person verbs. Third person pronouns contain a person morph /h-/, and feminine is expressed by /-i/. Common nouns do not contain a person morph, and as suggested in § 2.3 and elaborated in § 4.2, third person verbs do not either. In both contexts, /(a)t/ appears. Comparing second and third person verbs illustrates the same point. Importantly, the presence of person conditions the choice between /(a)t/ and /-i/ in the nominal and the verbal domain alike.

Person also conditions the choice of masculine plural /-m/, but with different locality conditions: /-m/ appears when the complex of φ-morphs that contains the gender morph also contains a person morph. /-m/ is present in pronouns and second person perfective verbs, but absent in imperfective forms where the person morph precedes the verb, common nouns and 3PL-perfective, which I will argue contains no person morph (§ 4.2). Importantly, /-m/'s affinity to person is present in the nominal and the verbal domain.

2.5 Summary: Same morphs and allomorphy

Across person, number and gender, the same morphs are used in the verbal and nominal domains and the same conditions control gender allomorphy in both domains. There are two categories that are expressed inconsistently. One is the plural, where I argued that the frequent absence of the plural morph μ is explained by phonotactic restrictions. The second is third person, where person is expressed on pronouns, but less obviously on verbs. This asymmetry will be explored further in § 4.

The appearance of the same morphs in the nominal and verbal domains is important for diagnosing Parallels 2 and 3, but it is of no greater interest here. It follows if the mappings from syntactic φ-features to morphs are underspecified for the syntactic category of their base – that is, whether the morph attaches to a verb or a noun.

3. Parallel 2: Morpheme Order

The second parallelism, (2), concerns the order in which the morphs identified in § 2 appear: φ-morphs in the verbal and the nominal domains appear in the order PERSON>PLURAL>GENDER.

The order PLURAL>GENDER can be observed in several feminine plural contexts. For example, the sound feminine plural is *-a:-t*(*-u/-i*), where *-u/-i* are case morphs that typically follow the feminine morph. The plural μ appears as lengthening of the segment preceding the gender morph /t/, not on /t/ itself or a following segment. Such a reverse order, **-at:*(*-u/-i*) or **-at*(*-u:/-i:*), would be phonologically possible, but is not attested. Feminine plural forms in *-n:a* make the same point. Both of these show that the plural morph μ associates with the leftmost element of a following feminine morph, suggesting that it underlyingly precedes it.

The position of person before all other morphs is readily visible. Wherever person morphs can be identified (3: /h-/, 2: /t/, 1PL: /n/), they precede all other φ-morphs. This is clearest in feminine plural forms like ***h****-un:a* 'they.F,' where all three morphs are present. The same can be shown for definite common nouns. The definite marker /l/- precedes both gender and number morphs. Ritter (1995) shows that person and definite markers originate in the same syntactic projection, D. If so, definite nouns show the same order of morphemes as verbs and pronouns: A D-morpheme preceding the plural morph, preceding the gender morph.

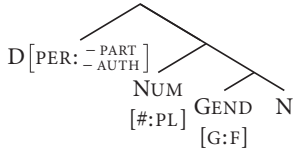
The proposal for deriving the order of morphs is simple: The parallel order of φ-morphs, (2), reflects the identical hierarchical relations between φ-feature bearing heads in the nominal and the clausal domains. This has been proposed in various places (e.g., Ritter, 1995 and Harbour 2008).

3.1 Deriving morpheme order in the nominal domain

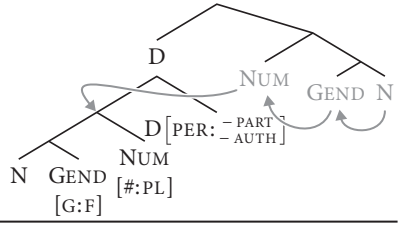
The order PER/DEF-PL-GEN follows from the hierarchical relations of the syntactic heads that introduce them (Table 5a) as developed by Ritter (1995) and many proposals since. For person and number, I use the feature system similar to the one advocated by Nevins (2011). Person categories are cross classified by ±AUTH(OR)

Table 5. φ-Heads in pronouns and head-movement

a. Underlying structure for 3F.PL pronoun *h-u-n⟨:⟩a*



b. Table 5a after head-movement.



and ±PART(ICIPANT) such that 1 = [$^{+\text{PART}}_{+\text{AUTH}}$] and 2 = [$^{+\text{PART}}_{+\text{AUTH}}$]. Third person will be underspecified for ±AUTH(OR) so that 3 = [−PART] for reasons that will become clear in § 4.2.1. Number is represented by a privative feature PL, such that [#:PL] is plural and [#:] is singular. Gender (G) is represented by M and F for masculine and feminine respectively. The N in pronouns is silent but contributes a semantic index (e.g., Kratzer, 2009).

A complication arises once head movement is considered, as shown in Table 5b, where gray solid arrows indicate head movement and moved heads are grayed out. Adjoining head-movement (Travis, 1984) of the noun through the intervening φ-heads would derive the wrong order of morphs. Several types of proposals exist that avoid this issue (Rice, 2000; Harbour, 2008; Fassi Fehri, 1998; Kremers, 2003; Shlonsky, 2004; Zukoff, 2016). For ease and clarity of exposition, I adopt Zukoff's (2016) proposal here. The central observation of Zukoff (2016) is that head-movement does not change the c-command relations between heads. As long as the morphology maps c-command relations to precedence (Kayne, 1994), the heads in the complex D-head of Table 5b are linearized in the same way as they are in the structure in Table 5a.

3.2 Deriving morpheme order in the clausal domain

For the verbal (i.e., clausal) domain the parallelism means that agreement heads introducing unvalued φ-features (i.e., probes) along the clausal spine follow the same hierarchical arrangement as those introducing valued ones in the nominal domain:

(6) D[PER:__]…NUM[#:__]…GEND[G:__]… *v*P

As in the nominal domain, I have to assume that the hierarchical relations present in this structure are mapped to linear precedence at PF. I assume that the same processes discussed there apply here. The hierarchy in (6) is less clearly semantically motivated (see Harbour, 2008: 195, though). If correct, it may reflect a truly syntactic fact.

4. Parallel 3: Third person exceptionality

The first two parallels have previously been observed for other languages. The third parallel is novel in its particulars, but fits a common pattern: Third person is different from first and second person. The discussion begins by elaborating on the observations in § 2.3. I will show for pronouns that 1/2-morphs are bound, while those in third person are free in a sense to be clarified. This mirrors the verbal domain in the following way: There are 1/2-morphs that are consistent across perfective and imperfective and appear as prefixes or suffixes. Exactly the same morphs that are bound in the nominal domain also appear in the verbal domain as both prefixes and suffixes. There are no third person morphs in the verbal domain that share these properties, just as there are no bound third person morphs in pronouns. I will propose that 1/2-morphemes are clitics in both the nominal and the verbal domains, but that there are no third person morphs in the verbal domain. The /j/ with certain imperfective third person morphs is a dummy morph inserted to fulfill the need of the imperfective for a prefix. From this perspective, third person exceptionality is still a parallel between the nominal and the verbal domain in that the absence of verbal third person marking is rooted in the properties of the pronominal third person morph.

When it comes to verbal φ-morphology, the more general goal of this section is to understand why patterns of prefixal and suffixal agreement arise in CA and why they take the form that they do, as in (5). As far back as Noyer (1992), alternations between prefixal and suffixal agreement have been analyzed in purely morphological terms within the framework of Distributed Morphology (Halle & Marantz, 1993). One of the central goals of Distributed Morphology is to understand the syntactic underpinnings of morphological phenomena, and it is the role of syntax that distinguishes the current proposal from proposals like Noyer (1992). If syntax can explain the alternation between suffixal φ-morphology in the perfective and circumfixal φ-morphology in the imperfective, then this explanation should be preferred, unless it requires unreasonable assumptions about syntax. Below is an attempt at making such a proposal. Specifically, I will propose that the perfective/imperfective distinction rests in whether the aspect head that codes it triggers verb movement (perfective) or has an EPP (imperfective). Together with the proposal that person markers are clitics, this explains the prefixal φ-morphemes in the imperfective as clitics that have undergone movement to aspect, and the /j/ of certain third persons as an expletive that appears when no φ-clitic can move to aspect. The discussion begins with the person morphemes in pronouns, § 4.1, and the proceeds to the verbal domain in § 4.2. Section 4.3 summarizes the proposal.

4.1 Nominal domain

This section introduces a novel empirical generalization about pronominal D-heads in CA that will underly the observed asymmetry between the verbal and the nominal domains: The person markers for first and second person are bound morphemes, the one for third person is free.

The first step is to show that free pronouns contain material that does not express any φ-categories. The comparison of free pronouns and the clitic pronouns in Table 6 shows that 1/2 and 3SG free pronouns contain material in addition to the φ-morphemes seen in the bound pronouns. Most 1/2-pronouns contain *ʔan-*. *ʔan-* is absent in bound pronouns, suggesting that it is only necessary to allow a free-standing realization of the pronouns. If a decomposition for 1PL as *naħ-n-u* is correct (§ 2.3), 1PL would resemble other 1/2-pronouns in having initial non-φ-material followed by φ-material.

Contrary to 1/2-pronouns, free and bound 3PL pronouns are identical and hence do not contain any non-φ-material. 3SG-pronouns do contain non-φ-material, as can be seen from comparing 3SG.M *huwa* and *-hu*. This material is consistent across masculine and feminine: a glide-/a/ sequence, where the glide is homorganic to the preceding vowel. I propose that the glide-/a/ sequences in 3SG-pronouns, unlike *ʔan-*, are present for purely prosodic reasons, specifically, to meet the minimal word requirement of two moras (McCarthy & Prince, 1990: 17,20). Three pieces of evidence support this. First, glide-/a/ sequences are absent in the 3PL-pronouns, which are bimoraic from their φ-morphs alone. This contrasts with the *ʔan-*, which is also present in the plural and dual where the φ-material alone is bimoraic. Second, glide-/a/ sequences are absent in bound pronouns, which are prosodically part of another word and thus not themselves subject to minimal word requirements. This suggests that they are only required for free realization of the φ-material. Third, McCarthy & Prince (1990:20) discuss other cases in CA were material is added to meet the minimal word requirement. The added material always appears at the end of the word, just as it does in 3SG-pronouns and

Table 6. Free pronouns and bound pronouns (non-φ-material is bold)

		Free pronouns		Bound pronouns	
		Singular	**Plural**	**Singular**	**Plural**
1		***ʔan****-a*	*naħ-n-u*	*= (n)i:*	*= na:*
2	M:	***ʔan****-ta*	***ʔan****-tum*	*= ka*	*= kum*
	F:	***ʔan****-ti*	***ʔan****-tun:a*	*= ki*	*= kun:a*
3	M:	*hu-**wa***	*hum*	*= hu*	*= hum*
	F:	*hi-**ja***	*hun:a*	*= ha:*	*= hun:a*

contrary to the situation with *ʔan-*. In conclusion, though both 1/2-pronouns and 3SG-pronouns require 'support' of some kind to appear as a freestanding pronoun, the nature of that support is different. In 3SG-pronouns the need for support is regulated by prosody, in 1/2-pronouns it is not. I propose that the requirement for support with 1/2-morphs is morphosyntactic rather than phonological, and that *ʔan-* is a dummy morph inserted to give a base for 1/2-morphs to attach to. This is the sense in which 3-morphs are *free*, while 1/2-ones are not.

Few morphemes in CA qualify as *free* in the sense of being able to appear on their own as a word. Nouns always appear with case morphology and verbs always appear with tense, aspect or mood morphology. So verbs and nouns are not *free morphemes* in the typical sense of the term. The qualified version of the term that I will be using here is that nouns and verbs can stand alone once they have combined with inflectional categories appropriate to their syntactic contexts, in a way that, say, gender/plural morphs or the bound pronouns in Table 6 cannot. The next step then is to show that the third person morpheme realized as /h-/ is free in this sense. The 3SG.M-pronoun *huwa* offers the strongest case that /h-/ is indeed free. We saw above that the *-wa* in *huwa* is present to satisfy minimal word requirements, leaving /h-/ and /u/ as possible candidates for exponents of the morph that allow *huwa* to stand alone. The /u/ of *huwa* is shared by the second and third person plural pronouns *ʔantum/ʔantun:a* and *hum/hun:a*, masculine and feminine respectively. As argued above, only the presence of the supporting morph *ʔan-* allows 2-pronouns to stand alone. This means that the /u/ in *ʔantum/ʔantun:a* is not a morph that is free in the current sense, because otherwise *ʔan-* would not be necessary. By extension, /u/ cannot be the morph that allows *huwa* to stand alone. The only candidate for the morph that allows *huwa* to be free is the D-morpheme realized as /h-/.

To summarize, the 3-morpheme realized as /h-/ is free, but 1/2-morphemes are not.

4.2 The verbal/clausal domain

We now return to the discussion of the verbal/clausal φ-morphology from § 2.3 to make two novel proposals about the verbal agreement morphology on verbs in CA. The discussion begins (§ 4.2.1) with a proposal for morphemes that are relatively consistent in their expression: first and second person, feminine gender and plural. The central proposals will be that (i) 1/2-morphemes and feminine /t/ are clitics that undergo movement, (ii) plural and other gender morphs are agreement markers and (iii) the perfective/imperfective distinction rests in the movement triggered by ASP(ECT): head movement vs phrasal movement. Against this background, the exceptional behavior of third person will fall out from the

following two proposals (§ 4.2.2): (i) there are no third person morphs on verbs in CA and (ii) the /j/-prefix of the imperfective is a dummy morph, similar to English expletive *it*.

4.2.1 *Some φ-morphemes are clitics, some are agreement markers*

So far, φ-morphs have been discussed in the somewhat pre-theoretical terms of being *bound* or *free*. From a morphosyntactic perspective, there are two types of bound φ-elements: agreement affixes and clitics. Following Kramer (2014), I take *agreement affix* to mean the morphological realization of valued φ-features on a functional head, whereas clitics are morphologically defective D elements that have moved to a functional head (Nevins 2011: 952ff, Kramer 2014). The argument here proceeds in four steps: (i) argue that 1/2-morphemes have clitic-like positional properties, whereas number and some gender morphemes behave has expected for agreement affixes, (ii) propose a syntactic implementation of the relevant notion of *clitic* based on the Big DP analysis in Nevins (2011), (iii) implement the difference between perfective and imperfective in terms of the movement properties of the ASP-head, deriving prefixal agreement in the imperfective from clitic movement and (iv) extend this proposal to the feminine marker /t/.

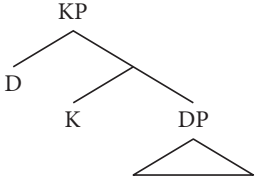
The discussion of pronouns in the previous section indicates a further parallel between the pronoun inventory and verbal agreement: For first and second person, there are clear person morphs that can be identified across perfective and imperfective. In pronouns, first and second person are realized by bound morphs and require morphosyntactic support (in most cases *ʔan-*). Third person morphs on the other hand are free, and agreement morphology in third person either does not exist (perfective) or is at the very least oddly complicated (imperfective, discussion of (5)). The simplest explanation for the fact that verbs only bear person morphs when the person morphs in DP are bound is that the abstract 1/2-morphemes on verbs and in pronouns are the same. Which kind of bound morphemes are they then? Agreement heads are expected to have a fixed order with respect to the verb (modulo post-syntactic reordering processes e.g., Arregi & Nevins 2012). This is the behavior we find for plural, dual, feminine /-i/ and masculine /-m/. Clitics might be able to appear in more varied positions with respect to their hosts, due to their ability to undergo phrasal movement. This matches the profile of 1/2-markers (and feminine /t/, see below), which can appear as prefixes or suffixes.

In syntactic terms, this means that 1/2-person markers are heads that bear valued features and move like phrases (e.g., Anagnostopoulou, 2003; Nevins, 2011). Specifically, I adopt the Big DP analysis of Nevins (2011), where DPs are dominated by a Case projection (K), and clitics are D-heads adjoined to K, Table 7a. This derives the structure for the 2SG.F pronoun *ʔan-t-i* in Table 7b. The movements of φ-heads shown in Table 5 happen in the DP complement of K. To

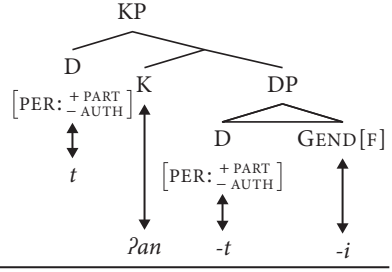
reduce clutter, they are not shown and the exponents of D and GEND are shown in surface order. The supporting morph *ʔan-* is in K. Support for this interpretation comes from the fact that the presence of *ʔan-* is case sensitive. It is absent with free pronouns in object position and present, depending on one's interpretation of the data, when the pronoun receives nominative or no case at all (Fassi Fehri, 1993). The clitic, bearing only PER-features, is in the specifier of K. The discussion of gender will further explore the relation between the properties of the clitic and the φ-heads inside DP.

Table 7. Clitics in the Big DP

a. Big DP (Nevins, 2011:952).



b. Structure for 2SG.F *ʔan-t-i*.



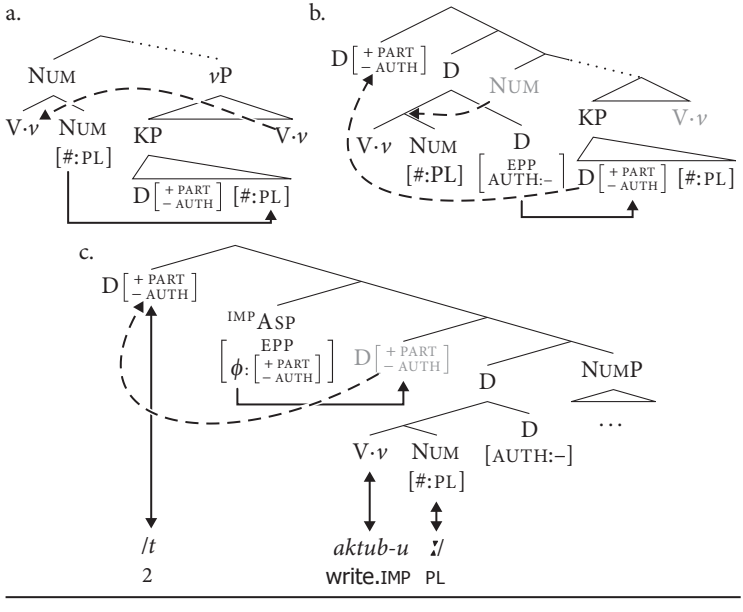
With a structure for DPs in place, we turn to the structure of the clause. The structure in (6) introduced the clause level projections for D, NUM and GEND. To accommodate the idea that 1/2-markers are clitics, the clause level D-head has an EPP feature that attracts clitics with a [±AUTH(OR)] specification. Third person is assumed to be underspecified for this feature. The next question is how the difference between pre- and post- verbal 1/2-clitics is derived, i.e. how the difference between perfective and imperfective is coded. In descriptive terms, I propose that the occasionally used characterization of the imperfective conjugation as the *prefix* conjugation is correct in the following way: Part of what characterizes the imperfective form is the presence of a prefix to the stem. Syntactically, the perfective/imperfective distinction is coded in the ASP-head:

(7) [ASP… [D[$^{\text{EPP}}_{\text{PER:\_\_}}$]… [NUM[#:__]… [GEND[G:__]… V·*v*

In the perfective, the verbal complex moves to ASP. The position of ASP above all the φ-heads accounts for the purely suffixal agreement. In the imperfective on the other hand, ASP does not trigger verb-movement, but movement of a φ-clitic to its specifier instead. The need of imperfective ASP (IMP ASP) to fill its specifier accounts for the obligatory presence of a prefix. This correlation of aspect and syntactic height is also observed in Benmamoun (2000). The prefix requirement is implemented as IMP ASP having an EPP and a φ-probe that is specified for all φ-features.

To illustrate, Table 8 shows the derivation for 2PL.M *t-aktubu-*: 'you.-PL.M are writing.' Here and in the following trees, solid angled arrows indicate AGREE relations, curved arrows indicate movement relations and double arrows show the result of lexical insertion. The clausal GEN-head is omitted in Table 8 to reduce clutter. The first step in the derivation, Table 8a, is movement of the complex V·*v*-head from inside *v*P to NUM, and number agreement between NUM and the PL-feature of the clitic D inside *v*P. Next in Table 8b, the clausal D-projection enters the derivation. The complex head in NUM moves to the D-head, and D AGREES with the [– AUTH]-feature of the clitic D. As a result, the clitic moves to the specifier of D. The final step of the syntactic derivation and the lexical insertions are shown in Table 8c. The structure below NUMP is omitted to reduce clutter. IMP ASP AGREES with and moves the person clitic that in the specifier of clausal D. In the post-syntactic component, phonetic content is assigned to these syntactic nodes. NUM[#:PL] is realized as μ, which in this context is realized as lengthening of the final vowel of the verbal head. Simplifying slightly, *aktub-u* is inserted into the V·*v*-head. Finally, /t/ is inserted into the D-clitic in the specifier of ASP.

Table 8. Deriving ta-ktub-u-: 'you.PL.M are writing.'



Against this background, we turn to gender. Gender markers show a split: /t/ appears in pre- and post-verbal position, but -/i/, /-na/ and /-m/ do not. Within the current proposal this would indicate that /t/ is a clitic, but the others are agreement markers. This brings us to the relation between the properties of the clitic in K's

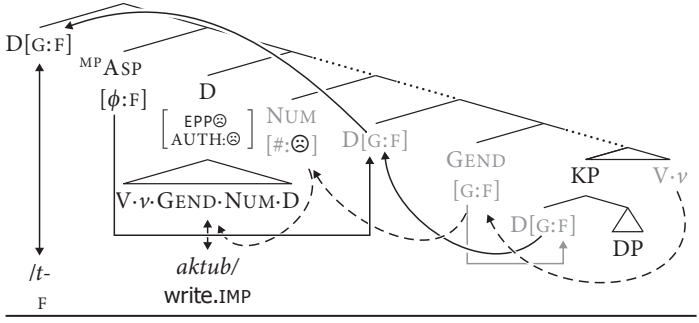
specifier and the DP in its complement. When both second person and feminine gender are present, verbs bear person marking via the clitic /t/ and gender marking via the agreement marker /-i/: t-… -i '2-… -F,' Table 4, rather than *t-… -t. This indicates that only one clitic can appear within the verbal domain, and that the clitic that appears here is person. This can be understood in terms of the Big DP structure in Table 7. There is only a single clitic at the clausal level, because only a single clitic is generated in the specifier of K. The clitic is person rather than gender, plausibly because the relation between the clitic in K's specifier and the head it takes its features from is governed by closest c-command. Analogously, there is only one clitic inside a DP, i.e., the 2SG.F-pronoun is *ʔan-t-i* rather than **ʔan-t-a-t*. This suggests that the relation between K's specifier and the φ-heads in its complement does not just feed the properties of DP external clitics, but also licenses the realization of clitics inside DP. Put differently, a φ-morph, internal or external to DP, can only be realized as a clitic if it is in some relation with the specifier of K. Taken together, this explains the allomorphy of /(a)t/ and /-i/ described in § 2.4. This proposal is implemented as follows. K has a specifier that has feminine features exactly when there is no D[+ PARTICIPANT] in its complement. Clausal GEND has EPP in addition to unvalued φ-features to attract gender clitics where they exist. Not covered by this discussion are two other contexts where feminine /t/ is absent: (i) 3-pronouns (3SG.F *hija*, 3PL.F *hun:a*), and (ii) 3PL-agreement (perfective *-na*, imperfective *j-… -na*). The absence of /t/ in 3-pronouns could be due to the D[–PART]-head being unable to host clitics. The absence of /t/ in 3PL.F-agreement will be explained syntactically in§ 4.2.2.

Finally, number marking differs from person and gender in that it is always agreement. The difference between number and the other φ – categories will be implemented by NUM having only a number probe, but no EPP.

An example derivation for a feminine prefix in 3SG.F is in Table 9, showing the derivation for ***t**a-ktub* 'she is writing.' The whole derivation is shown in a single tree. Dashed arrows indicate head movement. Thick solid arrows show the movement of the gender clitic. The first difference compared to Table 8 is that the clitic in KP has gender, but no [±AUTH]-features.

Going bottom up, first GEND AGREEs with the D[G:F]-clitic in the specifier of the subject KP. Since this is a third person singular, this is the only φ-AGREE that is successful. Clausal NUM and D respectively fail to AGREE because subject is singular, thus lacking any number-feature, and third person, which is underspecified for [±AUTH] (see above). Following the arguments in Preminger (2011), I assume that the failure of these AGREE operations does not lead to ungrammaticality. Though clausal NUM and D fail to AGREE, the verb still moves to them, creating the complex head seen in D. When IMP ASP enters the derivation, it probes. Since there is no person clitic in the specifier of D, no person clitic moves. Instead, the

Table 9. Deriving feminine prefix /t/ in ta-ktub 'she is writing.'



feminine clitic in the specifier of GEND can move past NUM to the specifier of IMP ASP, where it is morphologically realized.

4.2.2 *Imperfective third person /j-/ is neither*

I will argue that there are no third person morphs on verbs in CA and that the /j/ in the third person imperfective is a dummy morph that fulfills the prefixation requirement of the imperfective.

The discussion of 1/2-morphemes tied the existence of person affixes on verbs to their bound status in pronouns. The fact that there is a 3-morpheme in pronouns would imply that there should be no third person agreement affixes on verbs in general, not just in the perfective:

(8) NO 3 AGREEMENT: There are no third person morphs on verbs in CA

Indirect support for (8) comes from the fact that it allows the generalization in (9) to be stated:

(9) FEMININE DUAL GENERALIZATION: In the absence of a person morph, both feminine and dual can be morphologically expressed

Feminine dual forms only exist in third person (Table 2). In second person, where person is always morphologically expressed, gender distinctions are lost in the dual. Third person has feminine duals for perfective verbs, imperfective verbs and common nouns, but not for pronouns, which have clear third person morphs.

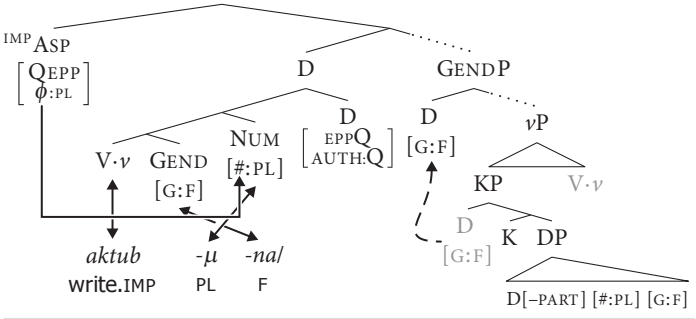
As proposed above, third person Ds are featurally deficient in having a [–PART] specification, but no specification for [±AUTH] (similar to Adger & Harbour, 2007).

The proposal in (8) naturally leads to the question what the /j-/ of the imperfective third person masculine and plural is, if it is not a person morph. It was proposed above that IMP ASP has an EPP. Where available, a φ-clitic satisfies this EPP. In third person, there is no person clitic, and in masculine gender, there is no gender clitic either. I propose that analogous to *it*-expletives, a dummy morph is

inserted into the specifier of IMPAsp when there is no φ-clitic available. /j/, rather than being φ-morph, is an expletive that satisfies IMPAsp's EPP when nothing else can. There are two situations where this happens: (i) third person singular masculine subjects and (ii) third person plural subjects, both masculine and feminine. A dummy morph appears with third person singular masculines, because there is no φ-clitic that could satisfy IMPAsp's EPP. A KP with a third person masculine complement has no specifier, because there is no head in the DP that that has clitic like properties. The knock-on effect of this is that without a clitic specifier to KP there is nothing that can satisfy IMPAsp's EPP. This failure to satisfy the EPP is repaired by inserting the dummy morph /j/. I assume that the process that does this is the same as whatever supplies *it*-expletives or *do*-support.

The second context where /j-/ appears is with all plurals of third person. The most interesting cases here are feminine plurals, because one might expect a feminine clitic to appear, analogous third person feminine singular, as in Table 9. The proposal as developed so far explains the absence of a feminine clitic as the result of syntactic intervention of the valued Num-head with IMPAsp's φ-probe. The failure of IMPAsp to satisfy its EPP does not arise from absence of an appropriate clitic, as it does with third person masculine, but from the syntactic inaccessibility of that clitic to IMPAsp. The full derivation is shown in Table 10 for a third person 3pl.f subject and leading to the form ***ja-ktub-na*** 'they.F are writing.' For reasons of space and readability, Num and Gend along the clausal spine have been omitted, but they and their successfully valued features are shown in the complex head under clausal D. Beginning at the bottom of the tree, we find the DP of the third person ([–part]) subject. The specifier of K has a D[g:f]-clitic, as in Table 9. Clausal gend successfully probes from its original position just above *v*P, values its features to [g:f], and eventually ends up as part of the complex head under clausal D. The D[g:f]-clitic moves from KP's specifier to GendP's (shown by the dashed line), still as in Table 9. Clausal Gend is eventually realized as *-na* in the context of [#:pl]. Next, clausal Num probes and values its feature to [#:pl], analogous to Table 8a, and via head movement eventually moves up to D. [#:pl] is eventually realized as μ. The lines for the lexical insertion of Gend and Num cross here to show the morphs in the order they are predicted to appear in when c-command is mapped to precedence relations. μ does not surface in this context due to restrictions on syllable structure (§ 2.2). When clausal D enters the derivation, it probes. Since the subject is third person and underspecified for [±Auth], there is no clitic that D can Agree with and move to its specifier. D's [Auth] remains unvalued and its EPP fails. Finally, IMPAsp enters the derivation and probes. The highest valued φ-feature in its domain is the valued feature on the Num-head. This allows valuation of IMPAsp's φ-probe to PL, but since Num is not a clitic, it cannot move to satisfy IMPAsp's EPP. As a result, the specifier position of IMPAsp remains

Table 10. Expletive prefix /j-/ in feminine plural ***ja-ktub-na*** 'they.F are writing.'



empty. In this configuration, the expletive element realized as /j-/ is inserted in the specifier of IMPASP. Returning now to the earlier characterization of /j/ as a default morph, it appears whenever IMPASP fails to satisfy its EPP, for whatever syntactic reason. This is analogous to English *do*-support, where, descriptively, affix lowering can fail due to a number of syntactically characterized reasons (intervention by negation, T-to-C-movement, VP-ellipsis, etc.), but always triggers insertion of the same morpheme, *do*.

Taking stock of the proposal, failure to fill the specifier of IMPASP identifies the condition under which /j-/ needs to be inserted. What is missing so far is an explanation of why this only happens for an empty specifier of IMPASP. The proposal here entails that GEND fails to fill its specifier whenever the subject is masculine, and that clausal D fails to fill its specifier whenever the subject is third person, in the perfective as well as the imperfective. Failing to fill a specifier is not a sufficient explanation of the need for /j-/. An explanation comes from the interaction of the EPP and verb movement observed by Alexiadou & Anagnostopoulou (1998). Alexiadou & Anagnostopoulou show that pro-drop languages, Arabic among them, can satisfy the EPP via verb movement. This is possible they argue, because the EPP, as conceived by Chomsky (1995), is a nominal feature on an agreement head and that verbal agreement in pro-drop languages is nominal in the relevant sense. Additionally, they show that modern Arabic languages simultaneously allow heads like T to have specifiers and allow EPP to be satisfied by verb movement. This is exactly the combination of properties necessary for the proposal here. As the verb always moves through D and GEND, it can satisfy any EPP needs that these heads may be left with. So no expletive elements need to be inserted to satisfy them. The verb, however, does not move to IMPASP, so IMPASP cannot satisfy its EPP via head movement. Against this backdrop then, it is sufficient to say that /j-/ is inserted if a head with φ-features fails to satisfy its EPP because IMPASP is the only head that does so.

4.3 Summary

This section set out to do two things: (i) relate the properties of nominal and verbal/clausal φ-morphs to one another and (ii) explain the distribution of verbal/clausal φ-morphology in syntactic terms. As it stands, goal (i) has only been achieved incompletely where clitic morphemes are concerned. The crux of the proposal lies in the relation between the DP internal φ-heads and the clitic D-head in the specifier of K. While the discussion above identified certain properties of this relation (sensitivity to c-command, licensing of DP internal clitics), its nature remains unresolved. Likewise, the DP internal need of person morphemes for a host (the dummy morpheme *ʔan-*) remains to be clarified. I interpreted these morphemes as clitics to establish a natural relation between their DP internal status and their ability to feed clause level clitics. The resolution of this issue is complicated by the fact that little empirical data can be brought to bear on distinguishing several technical implementations that are conceivable. Goal (ii) is approached via two proposals: (i) The perfective/imperfective distinction is coded by the movement properties of ASP. ASP triggers head movement in the perfective and clitic movement in the imperfective, tying together the lower position of the verb in the imperfective with the presence of prefixation. (ii) Person and some feminine markers are clitics and clitic movement derives prefixation in the imperfective. Intervention by NUM[PLURAL] can bleed clitic movement and last resort processes insert a dummy morph realized as /j-/ when clitic movement fails.

Stepping back from the details of CA, it should be noted that the same divisions between person and number as well as local vs third person advocated here is also observed in Nevins (2011) for Georgian, and for certain Mayan languages in Preminger (2011). Similarly, Kayne (2016) argues that person agreement in general is cliticization. Though new in the context of Arabic, the kind of proposal pursued here couches the CA data in larger debates about the syntactic status of different processes descriptively called *agreement*. For example, at first glance it might seem that the proposal that 1/2-markers are clitics and /j/ is a default morph conflicts with the finding of Preminger (2009) that default forms appear for agreement processes, but never for clitcization. This conflict is only apparent, as the default morph at issue here is present to satisfy the EPP, akin to an *it*-expletive. CA then provides a cautionary example of something that seems like a contradiction of Preminger's observation, but isn't once properly analyzed.

5. Summary

There are extensive parallels between the clausal and nominal domains in the forms of φ-morphs (§ 2) and their order with respect to one another (§ 3), as well as a place where the parallels seem to break down: third person (§ 4). The central proposal is that the parallel in order as well as the seeming absence of parallelism with third person can be understood in syntactic terms. The parallel order arises from parallel hierarchical arrangements of φ-feature bearing heads in the clausal and nominal domains. The apparent breakdown of parallelism between the nominal and verbal/clausal domain in third person is argued to arise because the DP internal properties of person morphemes feed the DP external ones. Local person morphs are shown to require morphosyntactic support internal to DP, while third person morphs do not. Mirroring this, 1/2-morphs appear on verbs in the clausal domain as prefixes or suffixes. The ability of a person morph to appear in verbal agreement seems to depend on being a bound morph inside of DP. Consequently, the freedom of the third person morph in DP leads to the absence of third person agreement at the clausal level. The syntactic proposal leads to a reinterpretation of the phenomena descriptively called 'agreement:' Some agreement processes are cliticisation, whereas some of them are true agreement. As a consequence, the distribution of the different kinds of morphemes at the clausal level is controlled by syntactic processes: Head movement, phrasal movement and syntactic intervention.

For the study of CA, and Arabic languages more generally, this paper presents the most detailed analysis of φ-morphology to date. It highlights extensive parallels between the nominal and verbal domains, and offers an analysis for the place where the parallels seemingly break down: third person. Many empirical and conceptual questions remain in this area, such as the status of the /u/-element common to pronouns and agreement suffixes that appears unrelated to any of the φ-categories, or how the proposals here interact with case/definiteness-marking in the nominal domain or mood marking in the verbal domain. The proposal about the nature of verbal morphology, § 4, also introduces a new angle on this phenomenon that has been extensively studied in Arabic in the context of agreement asymmetries. Finally, the proposal speaks to a larger body of work that exploring the syntactic underpinnings of phenomena descriptively called *agreement* (e.g., Nevins, 2011; Preminger, 2009, 2011; Kramer, 2014).

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References

Abney, Steven Paul. 1987. *The English noun phrase and its sentential aspect*. Cambridge, MA: Massachusetts Institute of Technology dissertation.

Adger, David & Daniel Harbour. 2007. The syntax and syncretisms of the Person Case Constraint. *Syntax* 10, 2–37. https://doi.org/10.1111/j.1467-9612.2007.00095.x

Alexiadou, Artemis & Elena Anagnostopoulou. 1998. Parameterizing AGR: Word order, v-movement and epp-checking. *Natural Language & Linguistic Theory* 16, 491–539.

Anagnostopoulou, Elena. 2003. *The syntax of ditransitives, evidence from clitics*. Berlin: Mouton de Gruyter.

Arregi, Karlos & Andrew Nevins. 2012. *Morphotactics: Basque auxiliaries and the structure of spellout*. Dordrecht: Springer. https://doi.org/10.1007/978-94-007-3889-8

Benmamoun, Elabbas. 2000. *The feature structure of functional categories, a comparative study of arabic dialects* Oxfors Studies in Comparative Syntax. Oxford: Oxford University Press.

Chomsky, Noam. 1995. *The minimalist program*, vol. 28 Current Studies in Linguistics. Cambridge, MA: MIT Press.

Eid, Mushira, Alaa Elgibali, Manfred Woidich & Andrzej Zaborski (ed. by). 2007. *Encyclopedia of arabic language and linguistics*, vol. 3 chap. Personal Pronoun (Arabic Dialects). Brill.

Fassi Fehri, Abdelkader. 1993. *Issues in the structure of Arabic clauses and words*, vol. 29 Studies in natural language and linguistic theory. Dortrecht: Kluwer Academic Press. https://doi.org/10.1007/978-94-017-1986-5

Fassi Fehri, Abdelkader. 1998. Layers in the distribution of Arabic adverbs and adjectives and their licensing. *Perspectives in Arabic linguistics XI* ed. by Elabbas Benmamoun, Muchira Eid & Niloofar Haeri, 9–46. Amsterdam: John Benjamins. https://doi.org/10.1075/cilt.167.04feh

Halle, Morris & Alec Marantz. 1993. Distributed Morphology and the Pieces of Inflection. *The View from Building 20: Essays in linguistics in honor of Sylvain Bromberger* ed. by K. Hale & S. Keyser, 111–176. Cambridge, MA: MIT Press.

Harbour, Daniel. 2008. Discontinuous agreement and the syntax-morphology interface. *Phi theory: phi features across interfaces and modules* ed. by D. Harbour, David Adger & S. Béjar, Chapter 7, 183–220. Oxford, UK: Oxford University Press.

Kayne, Richard S. 1994. *The antisymmetry of syntax*, vol. 25 Linguistic Inquiry Monographs. Cambridge, MA: MIT Press.

Kayne, Richard S. 2016. Clitic doubling and agreement in french hypercomplex inversion. Handout of presentation at Linguistic Symposium on Romance Languages 4/2/2016.

Kramer, Ruth. 2014. Clitic doubling or object agreement: The view from Amharic. *Natural Language and Linguistic Theory* 32, 593–634. https://doi.org/10.1007/s11049-014-9233-0

Kratzer, Angelika. 2009. Making a pronoun. fake indexicals as windows into the properties of pronouns. *Linguistic Inquiry* 40(2), 187–237. https://doi.org/10.1162/ling.2009.40.2.187

Kremers, Joost Merijn. 2003. *The Arabic noun phrase. a minimalist approach*. Nijmegen: Katholieke Universiteit Nijmegen dissertation.

McCarthy, John & Alan Prince. 1990. Prosodic morphology and templatic morphology. *Perspectives on Arabic linguistics II* ed. by Muchira Eid & John McCarthy, 1–54. Amsterdam, Philadelphia: John Benjamins. https://doi.org/10.1075/cilt.72.05mcc

McCarthy, John Joseph. 1979. *Formal problems in Semitic phonology and morphology*. Cambridge, Mass: Massachusetts Institute of Technology dissertation.

Nevins, Andrew. 2011. Multiple agree with clitics: Person complementarity vs. omnivorous number. *Natural Language & Linguistic Theory* 29, 939–971. MS, UCL. https://doi.org/10.1007/s11049-011-9150-4

Noyer, Rolf. 1992. *Features, positions and affixes in autonomous morphological structure*. Cambridge, MA: Massachusetts Institute of Technology dissertation.

Preminger, Omer. 2009. Breaking agreements: Distinguishing agreement and clitic-doubling by their failures. *Linguistic Inquiry* 40(4), 619–666. https://doi.org/10.1162/ling.2009.40.4.619

Preminger, Omer. 2011. Agreement as a fallible operation. Cambridge, MA: MIT dissertation.

Rice, Keren. 2000. *Morpheme order and semantic scope*. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511663659

Ritter, Elisabeth. 1995. On the syntactic category of pronouns and agreement. *Natural Language & Linguistic Theory* 13, 405–443. https://doi.org/10.1007/BF00992737

Shlonsky, Ur. 2004. The form of semitic noun phrases. *Lingua* 114, 1465–1526. https://doi.org/10.1016/j.lingua.2003.09.019

Travis, Lisa DeMena. 1984. *Parameters and effects of word order variation*. Cambridge, Mass: Massachusetts Institute of Technology dissertation.

Wright, William. 1874a. *A grammar of the Arabic language*, vol. 1. Cambridge University Press 2nd edn.

Wright, William. 1874b. *A grammar of the Arabic language, vol. 2*. Cambridge University Press 2nd edn.

Zukoff, Sam. 2016. The Mirror Alignment Principle: Morpheme ordering at the morphosyntax-phonology interface. MIT Generals Paper 1/26/16.

PART III

Experimental and computational linguistics

Resumption ameliorates different islands differentially

Acceptability data from Modern Standard Arabic

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Two acceptability experiments are presented which assess whether resumptive pronouns freely alternate with gaps and/or ameliorate island violation effects in wh-questions in Modern Standard Arabic. Both experiments test Complex Noun Phrase Constraint violations, adjunct island violations, and *whether* island violations. The results indicate that resumption is largely only acceptable with structurally complex DP fillers (*which*-NP) and is generally preferred to gapped structures in long-distance dependencies. Resumption is also shown to ameliorate the grammatical component of some island violations (adjunct and *whether* islands), but in different quantitative amounts across different islands. The overall picture which emerges is one in which resumption is quantitatively, but perhaps not qualitatively, helpful in repairing grammatical constraint violations in Modern Standard Arabic.

Keywords: syntax, resumptive pronouns, acceptability judgements, islands

1. Introduction

A hallmark of natural language is the ability for sentences to contain relationships which hold between words at a potentially infinite distance, as in the case of the English wh-question in (1):[1]

1. Throughout this paper we use *italics* to indicate wh-fillers, **bold** to indicate resumptive pronouns, and *t* with coindexing to indicate gap positions of filler-gap dependencies. The use of this notation should not be construed as implicit support for a particular formal theory of the gap position (e.g., traces, silent copies, deleted NPs, etc.).

https://doi.org/10.1075/sal.7.09tuc

(1) *Which sabre fencer*$_i$ was US Olympian and New York City resident Daryl Homer said by the commentators to be widely expected to beat t_i at the 2016 Olympics?

In (1), the syntactic and interpretative relationship between the wh-filler and the embedded verb *beat* licenses the apparent displacement of *beat*'s direct object and in interpretation of the filler (*which sabre fencer*) in the gap position after *beat*. Most notably for theories of formal linguistics and language processing, this wh-dependency can obtain over a potentially infinite distance as the sentence in (1) makes clear (see, e.g., Ross, 1967). This potentially infinite distance and the ubiquity of wh-dependencies cross-linguistically makes their study central to answering questions about the relationship between grammar and parsing.

1.1 The grammatical status of resumption

While most languages share the property of having overt long-distance dependencies, one dimension along which languages vary concerns whether there is widespread availability of another, related construction involving a resumptive pronoun (for an overview, see McCloskey, 2006 and references therein). Examples of resumptive pronouns appear in (2) for both English and a spoken variety of Arabic (Levantine):[2]

(2) a. That's the kind of murderer *who* Columbo usually catches **them** before the end of the episode.

b. *miin/ʔajja*$_i$ *mariid*^{ç} zeerit-**o**$_i$ naadia.
who/which patient$_i$ visited.3FS-**him**$_i$ Naadia
"*Who/which patient* did Nadia visit (**him**$_i$)?"
(Aoun, Benmamoun, & Choueiri, 2010: 132)

Following McCloskey (2006), we take a resumptive pronoun to be any pronoun obligatorily coreferent with a sentence-internal filler which appears in the tail position of a filler-gap dependency.

Resumption is famously known to vary cross-linguistically in the extent to which it is accepted in distinct grammatical constructions and in distinct languages. While theoretical formulations of this distinction differ, a common strand of thought has taken languages to fall into two classes: (i) limited resumption languages where resumption is generally dispreferred and appears only in limited grammatical constructions (such as English and Brazilian Portuguese) and (ii)

2. In this paper we use the following abbreviations in glossing: 1/2/3 = 1st/2nd/3rd person, M/F = masculine/feminine gender, S/P = singular/plural number, COMP = complementizer, NEG = negation.

pervasive resumption languages where resumption is much more pervasive and even required in some contexts (such as Irish, Hebrew, or Arabic).[3]

While English is often touted as an example of a limited resumption language based upon off-line judgments, the picture is not obviously so clearcut as grammaticality judgments would lead one to believe. Resumptive pronouns were noticed to be somewhat widespread in spoken English by Kroch (1981) and Prince (1990). Corpus studies of English also suggest a higher rate of resumption that might have been expected by this categorization of English as a limited resumption language (Bennett, 2008). Perhaps even more perplexingly, despite their widespread appearance in spontaneous speech and writing, it has not been straightforward to demonstrate that their usage correlates with acceptability in the minds of experimental participants. Zukowski & Larsen (2004) and Ferreira & Swets (2005), for instance, have demonstrated that speakers are not willing to accept resumptives that they themselves have previously produced.

On the other hand, languages such as Irish, Hebrew, or Arabic are typically characterized as pervasive resumption languages – so much so that resumption can be shown to be required in particular constructions.[4] Just how pervasive the acceptability of resumptive pronouns is in these languages is also unclear, however, as differences exist among Hebrew and Arabic (Shlonsky, 1992) and among regional varieties of Arabic (Aoun, Choueiri, & Hornstein, 2001; Malkawi & Guilliot, 2007) as to which constructions allow resumptive pronouns, suggesting that these languages do not form a unitary class on distributional evidence alone. Experimentally, the empirical state of affairs is no clearer for these languages. In Hebrew, Meltzer-Asscher, Fadlon, Goldstein, & Holan (2015) showed that speakers are often unwilling to accept written resumptive pronouns (though they will accept auditorily presented resumptives). Similarly, Farby, Danon, Walters, & Ben-Shachar (2010) show that resumption is dispreferred in Hebrew relative clauses and slightly improved compared to gaps in island violations, though overall ratings for sentences with resumptive pronouns in all constructions were quite low. Both of these findings are quite striking from the point of view of theoretical studies

3. Crucially, here we will not distinguish between so-called "intrusive" and "grammaticalized" pronouns based upon the availability of bound readings (Chao & Sells, 1983; Sells, 1984) or "apparent" and "true" resumption based upon the availability of reconstruction (Aoun et al., 2001, 2010; see also the distinction between "Class 1" and "Class 2" languages from Dermidache, 1991). This is done because we will ultimately suggest that this distinction is better viewed as a quantitative, not qualitative, one.

4. These languages are all frequently the focus of studies on resumption. For Irish, see especially McCloskey (1979, 1990); for Hebrew, see especially Borer (1984) and Dermidache (1991); and for Arabic, see especially Aoun (1981); Aoun et al. (2001); and Aoun et al. (2010). For both Hebrew and Arabic together, see Shlonsky (1992).

such as Shlonsky (1992), which take resumptives to be freely varying in these same structural positions in Hebrew and required in Arabic.[5]

The gestalt which emerges from this literature is that while theoretical accounts of resumption have posited good reasons to believe that there is some difference between pervasive and limited resumption languages, what remains less clear is whether this difference is one of quality or quantity, especially given the results from Hebrew.[6] Moreover, it remains unclear what the relationship is between the grammaticality judgments which underpin the theoretical work on resumption and the acceptability measures used in experimental studies which call the generalizations of this theoretical work into question.

1.2 Resumption and Island amelioration

One place where this heterogeneous literature on resumption coalesces around a consensus is the interaction of resumption with constructions which independently disallow filler-gap dependencies such as syntactic islands (Ross, 1967, et seq.). Attempts to construe a wh-filler with a gap inside of these structures usually results in extreme degradation or wholesale ungrammaticality (3):[7]

(3) * *What*$_i$ did Poirot investigate the cause of [because he couldn't understand the reason for t_i]?

While the bracketed structure in (3) is acceptable without a wh-dependency, as is the independent creation of long-distance wh-filler-gap dependencies, sentences like that in (3) are degraded. The typical explanation for these effects, stemming from the work of Ross (1967), is that the grammatical process responsible for the creation of filler-gap dependencies cannot operate out of these structures.

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5. As a reviewer points out, one issue which is raised by studies which ask for retrospective judgments on resumption is whether linguistically naive speakers employ prescriptive behavior when rejecting a resumptive in favor of a gap. In English, for instance, resumption is certainly prescriptively derided in general. This is potentially an issue in Modern Standard Arabic, a language with a robust classical grammatical tradition which informs modern prescriptive norms. Since our aim is to investigate the interaction of resumption with grammatical islands (see below), we have no choice but to freely consider gaps and resumptive pronouns together in order to provide a comparison between the two options for expressing the tail of the filler-gap dependency.

6. Note that this issue becomes more acute if we also consider the data discussed in note 4 concerning bound readings of resumptive pronouns, which some English speakers from the Midwest (including the first author) do allow (Sells, 1984).

7. Where relevant, we use [brackets] to denote island structures while remaining agnostic to constituency within that structure.

Many researchers have hypothesized that a resumptive pronoun in the place of the gap might ameliorate or even fully rescue island violations (Kroch, 1981, et seq.), a logical theoretical conclusion given the hypothesis that island unacceptability is somehow driven by constraints on the creation or representation of the gap itself. Amelioration is also generally expected in lines of inquiry which take resumptive pronouns to facilitate sentence processing, a procedure which is arguably more difficult in the face of a syntactic island.[8] That resumptives might indeed ameliorate islands is seemingly confirmed by judgments such as those in (4), where the native speaker intuitions indicate that resumption ignores island constraints or improves the resulting grammaticality:[9]

(4) a. *ʔajja sˁaħn*$_i$ baddkun taʃrfo [ʔəza tˁalabit*(-**o**$_i$) laila
which dish$_i$ want.2P know.2P [whether ordered.3FS*(-**it**$_i$) Laila
b-l-matˁʕam]?
in-the-restaurant]
"*Which dish*$_i$ do you want to know [whether Laila ordered *(**it**$_i$) in the restaurant]?"

b. ? *Who*$_i$ did McNulty aggressively question [the rumor that Lester knew **them**$_i$]?

However, experimental confirmation of this intuition has been notoriously hard to come by in the literature, at least from the previous studies on English. The vast majority of studies suggest that resumption does not significantly rescue an island violation (Alexopoulou & Keller, 2007; Heestand, Xiang, & Polinsky, 2011; Clemens, Scontras, & Polinsky, 2012 and Polinsky, Clemens, Morgan, Xiang, & Heestand, 2013).[10] This is not a ubiquitous finding, however, as Ackerman, Frazier, & Yoshida (2015) have shown that forced-choice tasks do reveal some measure of acceptability judgment amelioration in islands, a result which aligns with the theoretical literature's conclusion that gaps are strongly unavailable inside islands. Finally, Beltrama & Xiang (2017) have suggested that grammaticality or acceptability may not be improved by resumption in an island, but comprehensibility

8. See Kroch (1981); Prince (1990); Erteschik-Shir (1992); Asudeh (2004, 2011, 2012); and Hofmeister & Norcliffe (2013); among many others. For the claim that islands are difficult to process, see Sprouse et al. (2012) and references therein.

9. (4a) is from Lebanese Arabic (Aoun et al., 2010: 146). The strongest formulation of this claim is that resumption is required as a last resort when filler-gap dependency formation is blocked and dispreferred otherwise (Kroch, 1981; Shlonsky, 1992; Fox, 1999; and Aoun et al., 2001).

10. Similar conclusions can be drawn from the results in McDaniel & Cowart (1999); McKee & McDaniel (2001); Keffala & Goodall (2011); Keffala (2011); and Han et al. (2012), if one draws a distinction between subject and object gaps in island contexts.

may be, insofar as speakers reported sentences with a resumptive pronoun as more interpretable than those with gaps. Beltrama & Xiang (2017) conclude that there is a processing benefit to resumption inside islands, but that benefit is due to increased understanding of intended meaning, not acceptability.

However, as noted above, English may not be the ideal target language for experimental studies of resumption owing to its status as a limited resumption language. There is only one study that we are aware of that directly addresses the relationship between resumption and islands in pervasive resumption languages. In two experiments, Farby et al. (2010) examined whether Hebrew resumption was preferred to gapping in structures with and without islands and demonstrated that resumption was actually dispreferred in non-island contexts but marginally preferred in island-violating filler-gap dependencies. This dovetails with results from Meltzer-Asscher et al. (2015), who also showed that resumption is disfavored by Hebrew speakers in written presentation, even in non-island contexts.

Stepping back, we can observe a disconnect between the theoretical and experimental literature on resumption: whereas the theoretical literature suggests that island violations should be greatly improved by the presence of a resumptive pronoun, the core finding from each of the English studies is that acceptability does not meet grammaticality threshold criteria even when a resumptive pronoun appears in an island. However, one must ask whether this could be due to the unacceptable nature of resumptive pronouns more generally in limited resumption languages. Against this backdrop it is somewhat curious that previous studies on Hebrew show only a marginal preference for resumption in island contexts, calling into question the characterization of pervasive and limited resumption languages as a qualitative distinction. However, literature from pervasive resumption languages is not the norm in psycholinguistic work and has only begun to emerge in recent years, leaving the vast preponderance of experimental evidence coming from English or other limited resumption languages.

Here, we aim to add to this emerging literature by examining the behavior of resumption in islands in Modern Standard Arabic, a language which allows resumption in constituent wh-questions (5a) and can even employ resumption to amnesty violations of the Empty Category Principle/*that*-Trace Effect (5b):

(5) a. *ʔajja kitaabin*$_i$ ʔiʃtarat-**hu**$_i$ laila min al-maktabati?
which book$_i$ bought.3FS-**it** Laila from the-bookstore
"*Which book*$_i$ did Laila buy **it**$_i$ from the bookstore?"
(Aoun et al., 2010: 136)

b. *ʔajja ʔawladin*$_i$ qult-um ʔanna-*(**hum**$_i$) fi-l-bajti.
which children$_i$ said-2P that-*(**they**$_i$) in-the-house
"*Which children*$_i$ did you say that **they**$_i$ were in the house?"
(Aoun et al., 2010: 137)

Modern Standard Arabic therefore provides a fruitful grammatical context with pervasive resumption which is demonstrably capable of repairing violations of grammatical constraints. All else being equal, one would expect that resumption should have an ameliorating effect on island violations in this language, if such an effect indeed exists.[11]

1.3 The present study

The two experiments reported here attempt to add data concerning three major questions to the literature examining the relationship between resumption and island amelioration: (1) Do pervasive resumption languages such as Arabic show differential results concerning island amelioration by pronominal resumption? (2) Does the amelioration effect of resumption – if it exists – appear differentially by island type? and (3) Can the acceptability improvement induced by resumption (relative to gapped structures) be shown to ameliorate the grammatical constraint on island extractions independent of other acceptability costs associated with islands? These questions are examined in two experiments using three islands: *whether* islands, adjunct islands, and the Complex Noun Phrase Constraint.

1.3.1 *Methodology*

The methodology we use to address these questions, especially the component of acceptability question, is the factorial Likert-acceptability designs reported in Sprouse, Wagers, & Phillips (2012); Almeida (2014); and Sprouse, Caponigro, Greco, & Cecchetto (2016). We opt to use this design due to its demonstrated ability to separate island effects from other known influences on off-line ratings due to extra-grammatical processing concerns. Sprouse et al. (2012) and other researchers note that there are two key processing constraints that every island-violating extraction also violates (see also Kluender & Kutas, 1993 and Hofmeister & Sag, 2010, among others):

11. It is certainly a priori possible that spoken dialectal Arabic could differ in its treatment of resumption and islandhood from the variety that forms the object of our study, Modern Standard Arabic. However, our study uses written stimuli, and there are no conventions for writing spoken Arabic in a uniform way. See Aoun & Choueiri (2000); Aoun et al. (2001); Guilliot & Malkawi (2006); Malkawi & Guilliot (2007); and Aoun et al. (2010) for discussions of dialectal differences in the availability of resumption in general.

(6) a. Length: There is a cost associated with long-distance filler-gap dependency formation/parsing – longer dependencies are harder to create/parse than shorter dependencies.
b. Structure: There is a cost associated with island structures – island structures are complex, and building/parsing them requires more work than building/parsing non-island structures.[12]

Starting with Sprouse et al. (2012), it has been shown repeatedly that one can assess the components of length and structure penalties in island violation structures in fully-crossed experimental designs which manipulate both length and structure simultaneously. As Sprouse et al. (2012) demonstrate (and which was replicated for Brazilian Portuguese by Almeida, 2014 and Italian by Sprouse et al., 2016), island violations do not incur ratings which are a simple linear addition of the penalties incurred by long dependency length and island structure alone (see Figure 1). In contrast to what one would expect if island violations were simply the combination of long dependencies from difficult structures (the "linear additive" scenario; left sub-plot), island violations in English, Italian, and Brazilian Portuguese have been shown to be greater than the sum of length and structure penalties alone (the "super additive" scenario; right sub-plot).

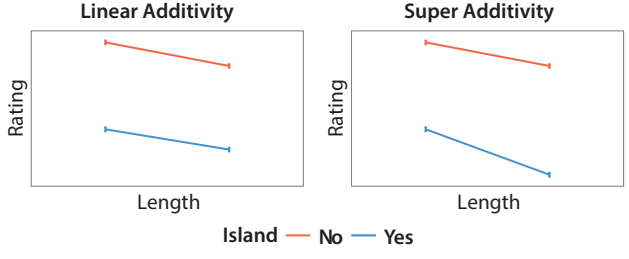

Figure 1. Predicted factorial plots for a linearly additive (no island, left) result and a superadditive (island, right) result

While the studies in Sprouse et al. (2012); Almeida (2014); and Sprouse et al. (2016) were designed to assess the predictions of various grammatical and psycholinguistic models of island effects, here we focus on another application of this design

12. Throughout this paper, we leave the precise nature of the complexity underlying island structures somewhat vague, since its specification is not necessary for the claims we ultimately make –we simply follow the general assumption that some property of island structures makes them hard to construct and/or process. See Kluender & Kutas (1993) and Hofmeister & Sag (2010) for specific proposals about this complexity in terms of general processing constraints such as a lexical semantic complexity attributed to the members of the island construction. However, these specific complexity effects are sometimes not present in experimental studies which directly assess their presence; see the discussion in Sprouse et al. (2012).

and reasoning: its ability to define the presence of an island effect in rating studies. If a crossed design yields a superadditive result, then by the logic in Sprouse et al. (2012), et seq., an island is present and being violated in the stimuli. If, on the other hand, a linearly additive pattern results, then one cannot conclude that any observed decrease in rating is attributable to more than processing considerations (defined in terms of length and structure) alone.

Here we employ this line of reasoning to assess whether resumptive pronouns in Arabic ameliorate the unacceptability of syntactic islands. We begin by attempting to demonstrate that island effects obtain in three structures in Modern Standard Arabic (MSA): (1) *whether* islands, (2) adjunct islands, and (3) Complex Noun Phrase Constraint (CNPC, Ross, 1967) violations. We then ask whether the addition of a resumptive pronoun in the tail position of the dependency changes the resulting picture from a superadditive to linearly additive one, a picture which is consistent with the grammatical idea that resumption has an ameliorating effect.

2. Experiment 1

Experiment 1 attempts to replicate as closely as possible, for MSA, the constituent question designs in Sprouse et al. (2012) and Sprouse et al. (2016) with the addition of resumptive pronoun conditions which allow assessment of the impact of resumption on superadditivity.

2.1 Participants

Participants were 123 native speakers of Arabic and proficient readers of Modern Standard Arabic by self report (81 female; mean age 22.5 years). Participants were all either students or faculty at the United Arab Emirates University (UAEU), New York University Abu Dhabi (NYUAD), or members of their families recruited by word-of-mouth.[13] Nearly all participants were self-reported native speakers of Emirati Arabic, a variety of the Gulf spoken dialect of Arabic.[14]

13. The recruitment at the UAEU also explains the discrepancy in gender balance – instruction at the UAEU is conducted on gender-segregated campuses and the majority of recruitment was conducted by a female research assistant on the female campus.

14. We include this detail because the spoken Arabic dialects are well-known for displaying differences in the acceptability of resumption across constructions (Malkawi & Guilliot, 2007; Aoun et al., 2010), and it is almost certainly the case that a participant's spoken dialect exerts influence on judgments of MSA sentences, especially in rare or marginal constructions. However, since Emirati Arabic resumption has never been the focus of detailed theoretical work, we must

All participants provided informed consent and were compensated for 45 minutes of time. This and the subsequent experiment were approved by both the NYUAD Institutional Review Board as well as the UAEU Ethics Committee.

2.2 Materials & design

For this experiment, three islands were selected from the set created for the experiment in Sprouse et al. (2012) and Sprouse et al. (2016): (i) *whether* islands, (ii) adjunct islands, and (iii) violations of the CNPC. Equivalent sentences with a constituent wh-question dependency that spanned these islands were constructed in Modern Standard Arabic:[15] (i) *whether* islands involved complement question CPs headed by ما إذا/*maa iðaa*, (ii) adjunct islands involved adjunct CPs headed by إذا/*iðaa* ("if"), and (iii) CNPC violations involved a noun with a CP complement. Examples of each of these islands (with resumption) appear in the sentences in (7)–(9):

(7) *Whether* Islands:

ماذا يتساءل الشرطي ما إذا كان محمود سرقه؟

maaðaa$_i$ jatasaaʔalu aʃ-ʃurtˤii [maa ʔiðaa aana maħmood saraqa-**hu**$_i$]?
what$_i$ wonders the-policeman [whether had Mahmoud stole-**it**$_i$]?
"*What*$_i$ does the policeman wonder [whether Mahmoud stole (**it**$_i$)]?"

(8) Adjunct Islands:

ماذا تقلق إذا نسيه المحامي في المكتب؟

maaðaa$_i$ taqlaqu [ʔiðaa nasiija-**hu**$_i$ ʔal-muħaamii fii-l-maktab]?
what$_i$ worry.2MS [if forgot.3MS-**it**$_i$ the-lawyer at-the-office]
"*What*$_i$ do you worry [if the lawyer forgot (**it**$_i$) at the office]?"

(9) CNPC Violations:

ماذا أنكرتَ الحقيقة أن احمد أكله؟

maaðaa$_i$ ʔankarta [ʔal-ħaqiiqa ʔanna ʔaaħmed ʔakala-**hu**$_i$]?
what$_i$ denied.2MS [the-fact comp Ahmed ate.3MS-**it**$_i$]
"*What* did you deny [the fact that Ahmed ate (**it**$_i$)]?"

For each of the six experimental sentences in each island, six conditions were created by varying three experimental factors: (1) Length of the filler-gap dependency

leave this matter for future research, noting only here that our data represent the judgments of a largely Emirati population. To our knowledge, the only other dialects represented in our participant pool are Palestinian and Sudanese Arabic.

15. wh-constituent questions were chosen in order to maximize parallels with the Sprouse et al. (2012, 2016) stimuli. We take up the issue of other types of extractions (such as relativization and left dislocation/topicalization) in the conclusion.

(Short, where extraction took place from the matrix subject position and Long, where extraction took place out of the embedded object position), (2) the presence or absence of an Island structure (NoIsland, Island), and (3) the presence or absence of a resumptive pronoun in the tail of filler-gap dependency (NoResumption, Resumption). Factors (1–2) were fully crossed in our design. However, since a resumptive pronoun in the Short conditions would involve a wh-filler immediately followed by a pronoun which resumes it (e.g., **Who he wonders if Shawn saw Gus*), we elected to use a deficient design and manipulate the Resumption variable only inside the Long conditions. The result is a 2 × 2 + 2 experimental design where resumptive pronouns alternate with gaps only in the Long extraction conditions where the moved wh-word is the thematic direct object.[16] A complete item set for one *whether* island condition appears in (10) and a complete list of all items and conditions appears along with all data and analysis code in a the online supplementary materials.[17]

(10) a. Short/No Island/No Resumption
man jaʃtaqidu ʔanna maħmood saraqa ʔal-miħfaðˤa?
who thinks.3MS comp Mahmoud stole.3MS the-wallet
"Who thinks that Mahmoud stole the wallet?"

b. Long/No Island/No Resumption
maaðaa jaʃtaqidu ʔaʃ-ʃurtˤii ʔanna maħmood saraqa?
what thinks.3MS the-policeman comp Mahmoud stole
"What does the policeman think that Mahmoud stole?"

c. Long/No Island/Resumption
maaðaa jaʃtaqidu ʔaʃ-ʃurtˤii ʔanna maħmood saraqa-hu?
what thinks.3MS the-policeman comp Mahmoud stole-it
"What does the policeman think that Mahmoud stole (it)?"

d. Short/Island/No Resumption
man jatasaaʔalu maa ʔiðaa kaana maħmood saraqa ʔal-miħfaðˤa?
who wonders whether had.3MS Mahmoud stole.3MS the-wallet
"Who wonders whether Mahmoud stole the wallet?"

e. Long/Island/No Resumption
maaðaa jatasaaʔalu ʔaʃ-ʃurtˤii maa ʔiðaa kaana maħmood saraqa?
what wonders the-policeman whether had Mahmoud stole?
"What does the policeman wonder whether Mahmoud stole?"

16. Crucially, this is a position in which resumption is typically characterized as optional in MSA. See Aoun et al. (2010); Alotaibi & Borsley (2013).

17. Available at the first author's *figshare* account: https://figshare.com/authors/Matthew_Tucker/700594.

f. Long/Island/Resumption
maaðaa jatasaaʔalu ʔaʃ-ʃurtˤii maa ʔiðaa kaana maħmood
what wonders the-policeman whether had Mahmoud
saraqa-hu?
stole-it?
"What does the policeman wonder whether Mahmoud stole (it)?"

Alongside these items we created 64 filler sentences with a uniform distribution of acceptability ratings (mean rating: 3.4 as rated by four native speakers including the second author). The combined fillers and items were distributed across six lists in a Latin Square design such that a given participant only saw one experimental sentence from each island item set and each list had a 3.5:1 filler-to-item ratio. Each participant therefore saw one observation per condition. Finally, since these items were written in Modern Standard Arabic, it is worth noting that we employed diacritic short vowel/case markers only where needed to disambiguate lexically ambiguous strings in context –exactly the same use of diacritics which is common in everyday written MSA in the Arab world.

2.3 Procedure

Assembly of the experimental surveys was completed by computer software written by the authors.[18] Participants met with an experimenter who provided them with a paper copy of the survey and explained the directions verbally as well as answered any questions the participants had. Participants were then allowed to complete the survey at their leisure and arranged for follow-up appointment with the experimenter to return the survey and receive compensation.

The survey itself consisted of a set of instructions (in MSA) which directed the participant to carefully read the following set of sentences and rate them in terms of their acceptability from 1/١ ("You cannot imagine a speaker of Arabic saying or writing that sentence"/لا تستطيع التخيل أن ناطقاً باللغة العربية يكتب أو يقول جملةً كهذه) to 7/٧ ("this sentence is very natural to you"/هذه الجملة تبدو لك طبيعية جداً). Participants were instructed to take as much time as they needed and to indicate their choice by circling the appropriate number below the sentence. Results of both the acceptability and demography data were digitized by hand.

18. This software is available at https://github.com/matthew-tucker/Likertator.

2.4 Analysis & predictions

Since our experimental design was a 2 × 2 + 2 reduced design, there was no a priori obvious way to analyze all the conditions together in a single statistical model. Since we were primarily interested in the presence or absence of an island effect with or without resumption, we fit two linear mixed effects regression models for each island type to subsets of the conditions with and without resumptive pronouns. Thus data were entered into two linear mixed models, both with Length and Island as fixed effects, one for Resumption conditions (the "resumption model") and another for NoResumption conditions (the "gap model"). Short dependencies were included in both models. Fixed effects were dummy-coded with the Short, NoIsland, and NoResumption levels as reference. In order to directly compare gaps and resumptive pronouns, we also conducted a planned comparison between the Long/Island conditions with and without resumption.

For both these models it was also not possible to construct a fully-crossed random effects structure with subjects and items as random effects owing to the lack of multiple observations per condition per subject. Both models, therefore, contained only subjects as random effects. In this and the subsequent condition we first fit a random maximal effects structure (Barr, Levy, Scheepers, & Tily, 2013). In order to avoid concerns about interpretability and overparameterization (Bates, Kliegl, Vasishth, & Baayen, 2015), we then compared this model to a model with only random intercepts for subjects. Since in all cases these models were qualitatively identical, we report here only the models with random intercepts for subjects for all islands and all experiments. Finally, owing to the difficulty in estimating degrees of freedom for *t*-tests of fixed effect significance in mixed effects models, we simply report the *t*-value without an accompanying *p*–value. A fixed effect is considered significant if the absolute value of its *t*-ratio was greater than two, a reasonable heuristic for its 95% confidence interval not including zero (Gelman & Hill, 2006). We report and comment on marginal effects (based upon the 90% confidence interval) when the absolute value of *t* is greater than 1.65, as well. All the data and analysis code for this project is available with the online supplementary materials.

If the grammatical and acceptability patterns in MSA are similar to those studied in English (Sprouse et al., 2012), Portuguese (Almeida, 2014), and Italian (Sprouse et al., 2016), then we would expect to find effects of both the Length and Island variables such that long sentences and island-containing sentences should be rated lower than their short and non-island counterparts, respectively. Additionally, the presence of a grammatical island effect should manifest as an interaction of these two variables, such that the Long/Island conditions are much worse than would be predicted by the sum of the Long and Island penalties alone.

For resumption, what we expect depends upon the grammatical and psychological reality of resumption as an ameliorating grammatical process. If resumption is preferred in Arabic, as the grammaticalized resumption hypothesis supposes, then the Resumption conditions should show higher ratings than the corresponding NoResumption conditions, both with and without islands. In island contexts, if it is indeed the case that islands are ameliorated by resumption, then we expect a rating increase in the Long/Island/Resumption contexts which is equal to or greater than the increase seen in non-island long dependencies with resumption. If either of these hypotheses about Arabic are incorrect, then we expect to find no significant effect of the resumption manipulation in this experiment.

2.5 Results

Before analysis, raw acceptability ratings were *z*–score transformed. This standardization transformation expresses a given rating in terms of its difference from the by-participant mean in units of standard deviations from that mean. This transformation helps mitigate the effect of individual differences in scale bias from participant to participant.

The normalized (*z*-transformed) means and standard errors for all three island types appear in Table 1 and the results of the linear mixed effects regression for both gap and resumption models appear in Table 2. In this and the results section of Experiment 2, factorial plots for each of the three islands are presented separately. For textual presentation of the results, we comment on factors with *t*-values greater than 1.65 ($p \approx .1$) and 2.00 ($p \approx 0.05$) separately.

Table 1. Means and standard errors of standardized ratings over subject rates for each condition and island in Experiment 1 ($N = 123$)

Condition	**Island type**		
	Whether	***Adjunct***	***CNPC***
Short/NoIsland	0.67 (0.08)	0.35 (0.09)	0.79 (0.08)
Long/NoIsland/NoR	0.65 (0.08)	−0.01 (0.09)	−0.25 (0.08)
Long/NoIsland/R	−0.31 (0.08)	−0.40 (0.07)	−0.53 (0.07)
Short/Island	0.28 (0.08)	0.03 (0.07)	0.36 (0.08)
Long/Island/NoR	−0.45 (0.07)	−0.59 (0.07)	−0.62 (0.07)
Long/Island/R	−0.35 (0.07)	−0.75 (0.07)	−0.59 (0.07)

Table 2. Linear mixed effects model coefficient estimates for Experiment 1. Values in parentheses represent the *t* value against an $H_0 : \beta = 0$

	Island type		
	Whether	***Adjunct***	***CNPC***
	Gap Model		
Length	−0.61(−5.84)	−0.36(−3.20)	−1.04(−9.74)
Island	−0.40(−3.82)	−0.32(−2.86)	−0.43(−4.06)
Length × *Island*	−0.11(−0.77)	−0.26(−1.66)	0.06(0.43)
	Resumption Model		
Length	−0.98(−9.17)	−0.75(−7.03)	−1.32(−12.63)
Island	−0.40(−3.73)	−0.32(−3.02)	−0.43(−4.12)
Length × *Island*	0.35(2.33)	−0.03(−0.23)	0.37(2.51)

2.5.1 whether *islands*

A factorial plot of the standardized rating scores for *whether* island conditions appears in Figure 2.[19] For *whether* islands, the statistical analysis revealed an effect of Length such that Long sentences were rated lower than Short sentences in both the gap ($\hat{\beta} = -0.61$; *s.e.* = 0.10; $t = -5.84$) and Resumption ($\hat{\beta} = -0.98$; *s.e.* = 0.10; $t = -9.17$) models. Similarly, there was also a effect of Island such that Island structures were rated lower than NoIsland structures in both the gap ($\hat{\beta} = -0.40$; *s.e.* = −0.10; $t = -3.82$) and Resumption ($\hat{\beta} = -0.40$; *s.e.* = 0.10; $t = 3.73$) models. The interaction of Length and Island was not significant in the gap model ($\hat{\beta} = -0.11$; *s.e.* = 0.15; $t = -0.77$) but was in the resumption model ($\hat{\beta} = 0.35$; *s.e.* = 0.15; $t = 2.33$) such that island status had less of an effect in long conditions than in Short conditions. A planned comparison between the means in the Long/Island/NoResumption and Long/Island/Resumption conditions did not reach significance ($t(121) = -1.17$; $p = 0.24$).

19. With this and all subsequent plots, we assume that short conditions are equal in both Resumption and NoResumption conditions for the sake of more coherent plots, despite the absence of a true Resumption contrast in Short conditions.

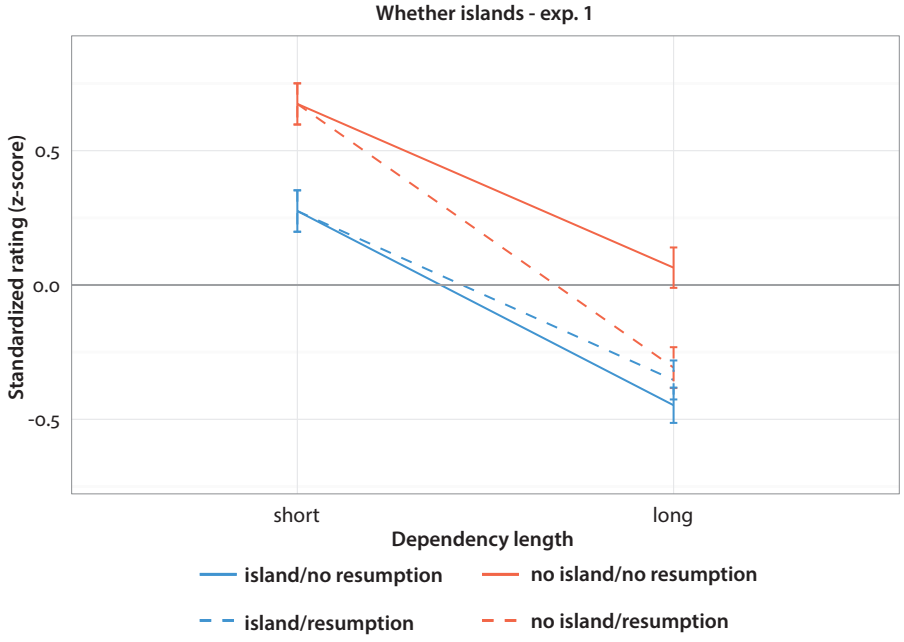

Figure 2. Mean standardized (*z*-transformed) ratings by condition for *whether* islands in Experiment 1. Error bars represent the standard error of the mean across subject ratings

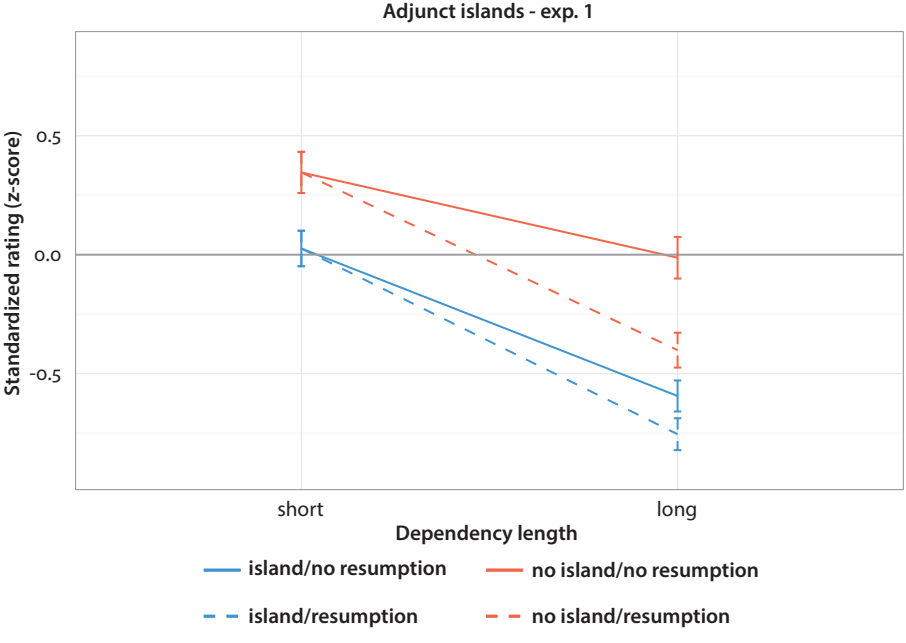

Figure 3. Mean standardized (*z*-transformed) ratings by condition for adjunct islands in Experiment 1. Error bars represent the standard error of the mean across subject ratings

2.5.2 *Adjunct islands*

A factorial plot of the standardized rating scores for the adjunct island conditions appears in Figure 3. For the these is lands, the statistical analysis revealed a effect of Length such that Long sentences were rated lower than Short sentences in both the gap ($\hat{\beta} = -0.36$; *s.e.* = 0.11; $t = -3.20$) and resumption ($\hat{\beta} = -0.75$; *s.e.* = 0.11; $t = -7.03$) models. There was also a effect of Island such that Island sentences were rated lower than NoIsland structures in both the gap ($\hat{\beta} = -0.32$; *s.e.* = 0.11; $t = -2.86$) and resumption ($\hat{\beta} = -0.32$; *s.e.* = 0.11; $t = -3.02$) models. The interaction of Length and Island status was marginal in the gap model ($\hat{\beta} = -0.26$; *s.e.* = 0.16; $t = -1.66$) such that the Length × Island interaction was superadditive, but this did not reach significance in the resumption model ($\hat{\beta} = -0.03$; *s.e.* = 0.15; $t = -0.23$). A planned comparison between sentences in the Long/Island/NoResumption condition and Long/Island/Resumption condition revealed that the former were rated significantly higher than the latter ($t(122) = 2.03$; $p = 0.04$).

2.5.3 *CNPC violations*

A factorial plot of the standardized rating scores for the CNPC violations appears in Figure 4. For the CNPC violations, the statistical analysis revealed a significant effect of Length such that Long sentences were rated lower than Short sentences

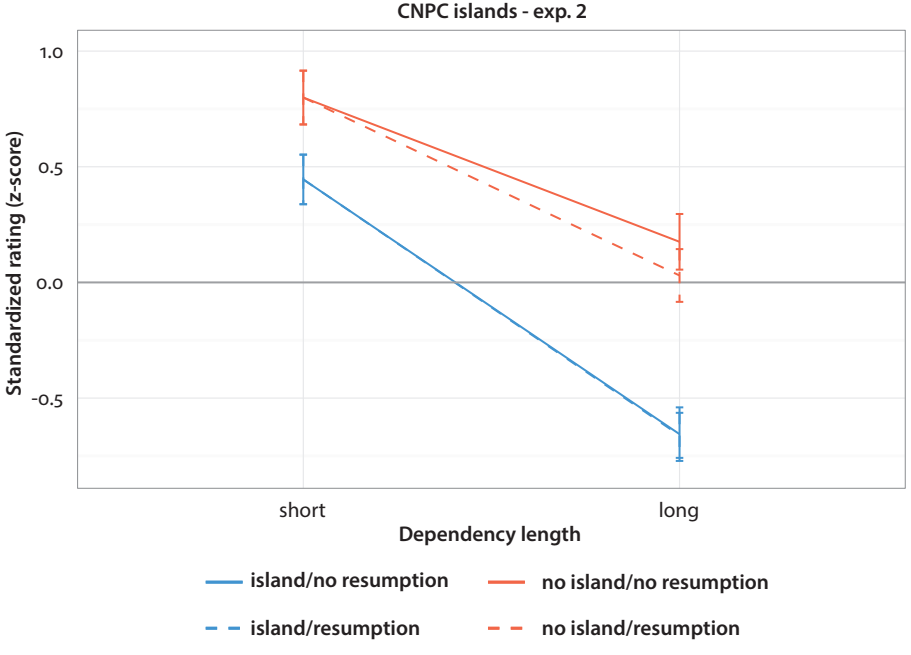

Figure 4. Mean standardized (*z*-transformed) ratings by condition for CNPC violations in Experiment 1. Error bars represent the standard error of the mean across subject ratings

in both the gap ($\hat{\beta} = -1.04$; *s.e.* = 0.11; $t = -9.74$) and the resumption ($\hat{\beta} = -1.32$; *s.e.* = 0.10; $t = -12.63$) models. Furthermore, there was also an effect of Island such that sentences containing island structures were rated lower than those without island structures in both the gap ($\hat{\beta} = -0.43$; *s.e.* = 0.11; $t = -4.06$) and resumption ($\hat{\beta} = -1.32$; *s.e.* = 0.11; $t = -4.12$) models. The interaction of Length and Island was not significant in the gap model ($\hat{\beta} = 0.06$; *s.e.* = 0.15; $t = 0.43$) but was significant in the resumption model ($\hat{\beta} = 0.37$; *s.e.* = 0.15; $t = 2.51$) such that the effect of island structure was diminished in the long conditions relative to the short conditions. A planned comparison between the scores in the Long/Island/NoResumption and Long/Island/Resumption conditions did not reveal a significant difference between sentences with and without a resumptive pronoun in the Long/Island conditions, given that the two were rated very close to equal ($t(122) = -0.22$; $p = 0.81$).

2.6 Discussion

The results of Experiment 1 are somewhat mixed with respect to the question of island amelioration by resumptive pronouns, and this is in part due to the muddled nature of our acceptability results with respect to both islandhood in MSA and the acceptability of resumption in these items. We take up each issue separately.

It is clear from our results that not all three of the island constructions – *whether* islands, adjunct islands, and CNPC violations – show superadditivity in either a quantitative or qualitative way. Leaving resumption to the side for a moment, one can observe that all three of our islands show the effects of length and structure on rating scores, but not the superadditive phenomenon associated with islands in Sprouse et al. (2012); Almeida (2014); and Sprouse et al. (2016). While the *whether* and adjunct islands do show the correct sign/qualitative pattern on the interaction of Length and Island status, only the adjunct islands approach qualitative significance and only marginally. It is true that there was a significant interaction of length and structure in the resumption models for adjunct and *whether* islands, but this is due to a massive rating penalty for sentences in the Long/NoIsland/Resumption conditions and as such, the sign is incorrect for a superadditive island effect.

What does this mean for theories of islandhood? The simplest and most radical conclusion here would be that MSA simply lacks these three islands. However, we believe this would miss the point somewhat, as all three structures involve very low ratings ($-0.75 \leq z \leq -0.25$) in long dependency conditions without resumption. Moreover, this conclusion would run counter to every theoretical study of islands in Arabic that we are aware of (see, e.g., Aoun et al., 2010: Chapter 6 and references therein). What is not clear from our results is whether there is a

superadditive component to this unacceptability that is unattributable to length or structure alone. Based on just these results, one might be tempted to conclude that MSA places a premium on short dependency length out of simple structures, and that this just happens to dovetail with structures that are superadditive islands in other languages.

However, we believe that something else is clearly at play in our data, given the strange behavior of resumption in our results. Nearly every theoretical and descriptive treatment of MSA filler-gap constructions concludes that resumption is preferred or at least possible in long dependencies. Yet resumption is clearly strongly penalized in our results, regardless of island status. In all three syntactic structures, sentences in the Long/NoIsland/Resumption condition are hugely dispreferred relative to the equivalent gapped structures. Given the size of this penalty, it is reasonable to wonder whether the sentences in the Long/Island/Resumption condition are possibly at floor (a numerical value which is so low as to preclude observation of lower values of any qualitative use), mitigating any ameliorative effect of the pronoun in general.

The experimental items for this study were constructed to be the closest possible MSA analogues of the items used in Sprouse et al. (2012) and Sprouse et al. (2016). However, in doing so, we adopted without discussion a difference in the wh-fillers used in those materials. Specifically, all the Long conditions had filler-gap (or filler-pronoun) dependencies whose filler was the wh-word ماذا/*maaðaa*, "what," whereas the Short conditions were all with من/*man*, "who."

As Aoun et al. (2010: 130–9) point out, however, this is not an innocuous difference. According to their judgments, *maaðaa* is unacceptable as the head of a dependency whose tail is a resumptive pronoun, whereas *man* is much better. Those authors give several sets of judgments on which fillers are acceptable in MSA with resumption, but crucially for our purposes the relevant contrast to *maaðaa* is أي/*ʔajja*, "which" combined with an overt NP restrictor (11):[20]

(11) a. *maaðaa*$_i$ ʔiʃtarat(*-**hu**$_i$) laila min al-maktabati?
what$_i$ bought.3FS(*-**it**$_i$) Laila from the-bookstore
"*What*$_i$ did Laila buy (***it*$_i$) from the bookstore?"

b. *ʔajja kitaabini* ʔiʃtarat(-**hu**$_i$) laila min al-maktabati?
which book$_i$ bought.3FS(-**it**$_i$) Laila from the-bookstore
"*Which book*$_i$ did Laila buy (**it**$_i$) from the bookstore?"

20. How exactly to characterize this difference is a matter of some importance that we will not take up here. See Aoun et al. (2010) for some discussion of why d(iscourse)-linking (Pesetsky, 1987) and referentiality (in the sense of Cinque, 1990) are not precisely correct notions. We will use the term "complex," in line with Aoun et al.'s (2010) suggestion that the correct cut has to do with whether the DP in question has articulated syntactic structure.

While this judgment contrast is not widely reported in the literature on Arabic, the second author and our consultants all share it, meaning that our items from Experiment 1 contain a clear confound in the Long conditions. We therefore can only make limited conclusions from those items concerning the ability of resumption to ameliorate islands. Experiment 2 is designed to test the same thing as Experiment 1 while controlling for the (in)appropriateness of the wh-filler associated with the resumptive pronoun.

3. Experiment 2

One of the striking general findings in Experiment 1 was that resumptive pronouns in the long dependency length conditions were quite marked for speakers, even independently of the presence of a syntactic island structure which the filler-pronoun dependency spanned. In fact, the acceptability cost of resumptive pronouns was larger in non-island contexts than in island contexts. This is an odd finding given that resumption is typically characterized as at least optional in filler-gap dependencies in Arabic when grammatical constraints do not preclude a gap and obligatory when such constraints do preclude a gap (Shlonsky, 1992; Aoun et al., 2001, 2010). Experiment 2 addresses the question of whether or not this could have been due to confounds in the design of our experimental materials related to the inclusion of wh-fillers that are not easily linked to resumptive pronouns.

Experiment 2 seeks to remedy this confound by replacing all instances of the confounding *maaðaa* with *ʔajja* + NP, fulfilling the *wh*-filler identity requirement discussed by Aoun et al. (2010) and allowing us to properly assess the ameliorative effect of resumption.

3.1 Participants

Participants were 119 native speakers of any variety of Arabic recruited to an online survey via advertisement at the UAEU, NYUAD, and via the arabic-L mailing list. Native speaker status was assessed via presentation of the survey entirely in Arabic as well as via demographic questionnaire. Since the survey was presented online, there was no way to ensure that participants finished the entire experiment. Especially given that no compensation was offered, many participants did not finish. Of the 119 participants which began the study, only 53 completed it (44.5%), so we report results from only those subjects who completed the entire experiment. No other subject exclusion criteria were used. All participants provided informed consent via the online survey. None of the recruitment pools used for Experiment 1 were consulted for the recruitment of participants for Experiment 2.

3.2 Materials & design

Materials for Experiment 2 were constructed by taking the experimental items from Experiment 1 and replacing all the unacceptable instances of ماذا/*maaðaa* with a DP headed by أي/*ʔajja* and containing an NP restrictor which was contextually appropriate for the sentence as a whole – typically this was the noun which appeared in the embedded complement position in the Short conditions. All other constrains on experimental filler and item design from Experiment 1 were duplicated. A complete list of experimental items and conditions appears in the accompanying online supplementary materials.

3.3 Procedure

Participants provided informed consent by clicking on a button before being taken to the directions. The directions were exactly the same as Experiment 1 save for the fact that there was no experimenter present to assess understanding. Subjects indicated their responses to acceptability judgment prompts by clicking on a radio button that displayed all the choices between 1 and 7. All other procedural details were identical to Experiment 1.

3.4 Analysis & predictions

The statistical analysis was identical to Experiment 1. As far as island superadditivity is concerned, our expectations are the same as Experiment 1 – islands should show an acceptability penalty larger in Long/Island conditions not analyzable as the sum of the Length and Island penalties alone (an interaction term). If the confound involving the wh-fillers obliterated the ameliorative effect of resumption in Experiment 1, then we also expect to find that resumptive pronouns linked to *ʔajja* + NP will show a larger measure of acceptability increase than was seen for Long conditions in Experiment 1. This should manifest as an improvement in Long/Island/Resumption conditions relative to equivalent sentences without resumption. Moreover, given that the use of *which*-NP fillers often improves the acceptability of long-distance dependencies more generally (Pesetsky, 1987; Cinque, 1990), we expect that Long conditions should now be above floor and allow us to observe whether superadditivity exists and whether it is ameliorated by the presence of a resumptive.

3.5 Results

As with Experiment 1, the raw scores were first *z*–transformed before analysis. The standardized mean ratings for each of the three islands appear in Table 3 and the coefficients for the fixed effects in both the gap and resumption linear mixed effect regression models appear in Table 4.

Table 3. Means and standard errors of standardized ratings over subject rates for each condition and island in Experiment 2 ($N = 53$)

Condition	**Island type**		
	Whether	***Adjunct***	***CNPC***
Short/NoIsland	0.76 (0.10)	0.47 (0.12)	0.80 (0.12)
Long/NoIsland/NoR	0.11 (0.12)	0.12 (0.12)	0.18 (0.12)
Long/NoIsland/R	0.51 (0.10)	0.65 (0.10)	0.03 (0.11)
Short/Island	0.71 (0.10)	0.34 (0.12)	0.44 (0.11)
Long/Island/NoR	−0.30 (0.09)	−0.80 (0.08)	−0.66 (0.12)
Long/Island/R	−0.19 (0.11)	−0.25 (0.11)	−0.66 (0.10)

Table 4. Linear mixed effects model coefficient estimates for Experiment 2. Values in parentheses represent the *t* value against an $H_0 : \beta = 0$

	Island type		
	Whether	***Adjunct***	**CNPC**
	Gap Model		
Length	−0.65(−4.32)	−0.35(−2.22)	−0.62(−3.86)
Island	−0.05(−0.33)	−0.14(−0.86)	−0.35(−2.19)
Length × *Island*	−0.37(−1.73)	−0.78(−3.44)	−0.48(−2.08)
	Resumption Model		
Length	−0.25(−1.69)	0.18(1.11)	−0.77(−5.03)
Island	−0.05(−0.34)	−0.14(−0.87)	−0.35(−2.29)
Length × *Island*	−0.65(− 3.14)	−0.77 (− 3.43)	−0.34(− 1.54)

3.5.1 whether *islands*

A factorial plot of the standardized rating scores for the *whether* island conditions appears in Figure 5. For the *whether* islands, the statistical analysis revealed an effect of Length such that Long sentences were rated lower than Short sentences in both the gap ($\hat{\beta} = -0.65$; *s.e.* = 0.15; $t = -4.32$) model and marginal in the resumption ($\hat{\beta} = -0.25$; *s.e.* = −0.15; $t = -1.69$) model. There was no effect of Island in

either model (all $|t| < 0.40$). There was, however, a marginal interaction of Length and Island in the gap model ($\hat{\beta} = -0.37$; *s.e.* = 0.21; $t = -1.73$) and a significant interaction in the resumption model ($\hat{\beta} = -0.65$; *s.e.* = 0.21; $t = -3.14$). In both cases this was due to a superadditive pattern in which island status had a greater impact in Long conditions than in Short ones. A planned comparison between sentences without a resumptive in the Long/Island/NoResumption condition and those with a resumptive in the Long/Island/Resumption condition did not reveal a significant difference between the presence or absence of a resumptive pronoun in long dependencies constructed across islands boundaries ($t(44) = 0.48$; $p = 0.64$).

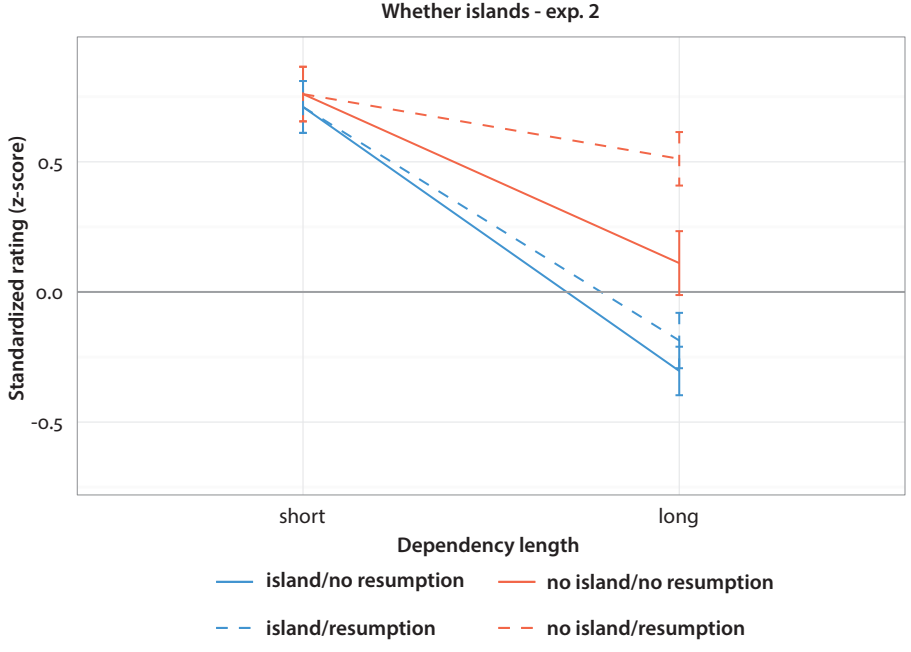

Figure 5. Mean standardized (*z*-transformed) ratings by condition for *whether* islands in Experiment 2. Error bars represent the standard error of the mean across subject ratings

3.5.2 *Adjunct islands*

A factorial plot of the standardized rating scores for the adjunct island conditions appears in Figure 6. For the adjunct islands, the statistical analysis revealed an effect of Length such that Long sentences were rated lower than Short sentences in the gap ($\hat{\beta} = -0.35$; *s.e.* = 0.16; $t = -2.22$) but not the resumption ($\hat{\beta} = 0.18$;*s.e.* = 0.16; $t = 1.11$) model. Neither model showed a significant effect of Island (all $|t| < 0.90$). However, there was a significant interaction between Length and Island in both the gap ($\hat{\beta} = -0.78$; *s.e.* = 0.21; $t = -3.44$) and resumption ($\hat{\beta} = -0.77$; *s.e.* = 0.28; $t = -3.43$) models.

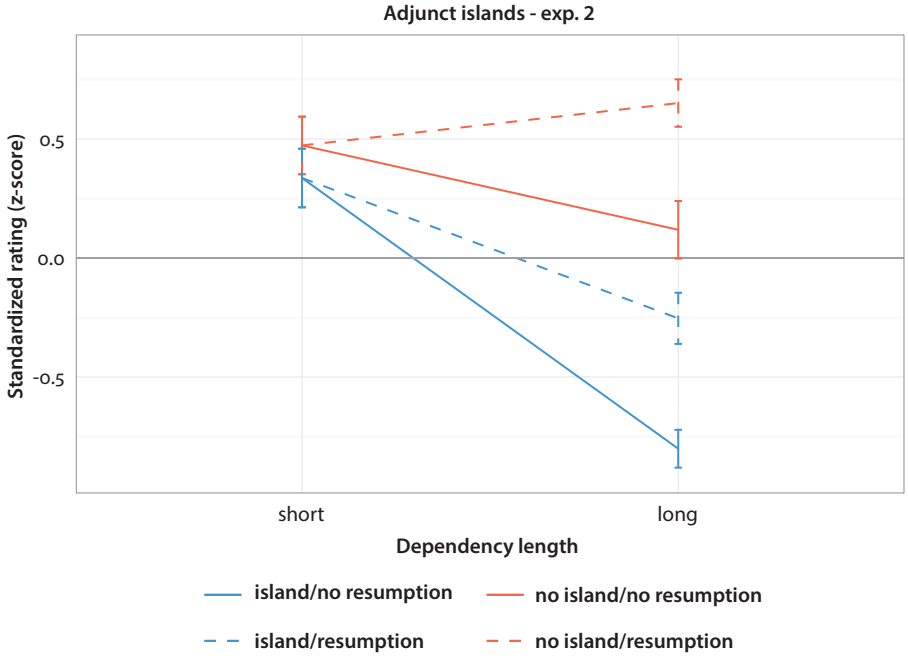

Figure 6. Mean standardized (*z*-transformed) ratings by condition for adjunct islands in Experiment 2. Error bars represent the standard error of the mean across subject ratings

In both cases this was due to a superadditive pattern, like the *whether* island conditions. A planned comparison between sentences in the Long/Island conditions revealed that resumption significantly increased ratings relative to the absence of resumption, a result which was quite robust ($t(45) = 4.57$; $p < 0.0001$).

3.5.3 *CNPC violations*

A factorial plot of the standardized rating scores for the CNPC violation conditions appears in Figure 7. For the CNPC violation sentences, the statistical analysis revealed an effect of Length such that Long sentences were rated lower than Short sentences in both the gap ($\hat{\beta} = -0.62$; *s.e.* = 0.16; $t = -3.86$) and resumption ($\hat{\beta} = -0.77$; *s.e.* = 0.15; $t = -5.03$) models. Furthermore, there was also an effect of Island such that Island sentences were rated lower than NoIsland sentences in both the gap ($\hat{\beta} = -0.35$; *s.e.* = 0.16; $t = -2.19$) and resumption ($\hat{\beta} = -0.35$; *s.e.* = 0.16; $t = -2.29$) models. Additionally, there was an interaction between Length and Island in the gap model ($\hat{\beta} = -0.48$; *s.e.* = 0.23; $t = -2.08$) that was not present in the resumption model ($\hat{\beta} = -0.34$; *s.e.* = 0.22; $t = -1.54$). A planned comparison between sentences without a resumptive pronoun in the Long/Island/NoResumption condition and those with a pronoun in the Long/Island/Resumption condition did not reach significance ($t(45) = -0.03$; $p = 0.97$).

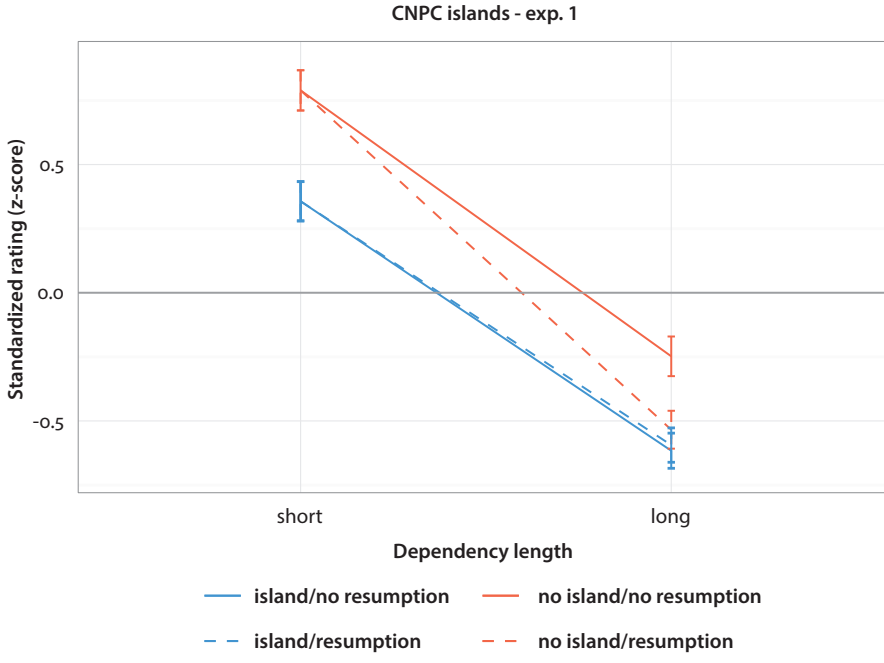

Figure 7. Mean standardized (*z*-transformed) ratings by condition for CNPC violations in Experiment 2. Error bars represent the standard error of the mean across subject ratings

3.6 Discussion

The results of Experiment 2 are suggestive of the idea that the confound of inappropriate wh-fillers did contaminate the results from Experiment 1. In all three structures – *whether* islands, adjunct islands, and CNPC violations – the data in this experiment show a superadditive effect beyond the contributions of length and (where it is present) island structure alone. In each of these three structures, the gap model shows a significant interaction of Length and Island such that the effect of structure is larger in the long dependency conditions than in the short dependency conditions – exactly the superadditive effect documented in Sprouse et al. (2012); Almeida (2014); and Sprouse et al. (2016).

What is particularly interesting about these data, however, is that this superadditivity is different in size for each of the three islands. While it is well-known in the theoretical literature that islands do not form a homogeneous class of constructions, our data suggests that the extent to which island violations manifest in acceptability rating studies is a function of individual island identity: adjunct islands display the largest superadditive effect, followed by CNPC violations and *whether* islands. We do not believe this contrast is reducible to known subcategorizations of island structures, since it does not conform to any subcategorization

of which we are aware.[21] Since our experiments were not designed to assess differences in island status across these three constructions directly, further study is clearly needed on this point.

Experiment 2 also shows that resumption can ameliorate islands, but again differentially based upon the island in question. For the adjunct islands, resumption in an island-violating context clearly helps a great deal, as evidenced by the significant planned comparison in that structure. CNPC structures, on the other hand, provide an equally clear, but opposite conclusion: resumption appears as acceptable as gapping. With the CNPC violations, however, the strong unacceptability of long-distance dependencies in the island structure without the gap makes one wonder whether we could again be at floor in these data, making the results difficult to interpret – it is very possible MSA simply does not allow filler-gap dependencies to be constructed inside CNPC complements.[22] For *whether* islands, the results seem somewhat in the middle – qualitatively the pronoun appears to help, but the result is not significant.

Finally, focusing on the adjunct islands and *whether* islands, the ameliorative effect of resumption nearly completely wipes out the superadditive effect of the island when assessing the Island/Resumption conditions against the NoIsland/NoResumption conditions – these lines are nearly parallel in the factorial plots. Here we can see the impetus for theoretical researchers to conclude that resumption ameliorates islands, since this would mean that resumption removes the component of the rating penalty associated with extra-processing (and possibly grammatical) concerns, leaving only the penalties associated with length and structure alone.

21. Crucially, it is not reducible to the notion of "island strength" (see Szabolcsi, 2006; Sprouse et al., 2016; and references therein), since adjunct islands and CNPC islands are both typically taken to be strong islands, yet they show considerable differences in superadditivity in our data.

22. A reviewer raises one plausible explanation, namely that CNPC island structures are perhaps actually expressed as construct state nominals, (see Ryding, 2005: Chapter 8 for a descriptive overview), where the definite determiner is typically ungrammatical on the head noun. Parsing the complex noun phrase as a construct state nominal would suggest a structure where a null copula intervenes between the noun an complementizer (perhaps akin to the "class 2 interrogatives" of Shlonsky, 2002), a parse not available for any of our other islands. We take this point as valid and thank the reviewer for bringing it to our attention – however we are unsure what effect this confound would be expected to have on the CNPC island extractions, so we leave this matter for future theoretical work on the structures underlying complex noun phrase extractions in MSA.

4. General discussion

4.1 Differences within differences

In order to compare our results across islands and experiments, it is helpful to have a numerical estimation of the superadditive component of each island and the effect that resumption has on the superadditivity for a given island. Fortunately, the factorial design we employed throughout both experiments allows for a simple estimation of the superadditive effect using the Differences-in-Differences score (Maxwell & Delaney, 2004; see also the discussion in Sprouse et al., 2012 and Sprouse et al., 2016). The differences-in-differences (DD) score is useful because it provides a clear value of the component of an interaction term not explicable entirely in terms of underlying main or simple effects.

This DD value can be calculated for a two way interaction as follows: first, we calculate the difference between two scores from the four conditions. This value, *D*1, we define as the rating for the Long/NoIsland condition minus the rating for the Long/Island condition. Second, we calculate the difference between the two remaining conditions in the interaction. This value, *D*2, is therefore the rating for the Short/NoIsland condition minus the rating for the Short/Island condition. Straightforwardly, then, $DD = D1 - D2$. This value can be computed for each subject individually and then averaged across subjects to give an estimate of the DD size in a given experiment.

In our study, however, we do not have a 2×2 design with a two-way interaction but a defective $2 \times 2 + 2$ design. We therefore compute two DD scores. The first is computed exactly as described above, using the NoResumption conditions throughout. This DD score gives a straightforward estimation of the superadditivity component of an island modulo resumption. The second DD score is designed to assess a change in the superadditivity effect engendered by resuming the gap position with a resumptive pronoun. To that end, it is identical to the first DD score, except that *D*1 is computed by taking the difference of both the Long/NoIsland conditions with respect to values of the Resumption manipulation. This allows us to assess whether there is a superadditive component in resumed island filler-gap dependencies when compared to a long distance dependency with a gap and, if it is present, to compare it directly to the identical DD score for a dependency with gaps across the board. These DD values for all three islands in both experiments are shown in Table 5.

When the DD value is positive, this implies that a superadditive pattern is present and trends in the expected direction for a grammatical island. A number close to zero or negative implies that no superadditive component appears in the ratings for that island/experiment pair. We report standard errors for these DD

Table 5. Differences within differences scores for all three islands in both experiments, separated by the presence or absence of a resumptive pronoun (RP). Values in parentheses represent the standard error of the mean

Island	Experiment 1		Experiment 2	
	No RP	RP	No RP	RP
Whether	0.13 (0.14)	0.05 (0.15)	0.20 (0.21)	0.19 (0.19)
Adjunct	0.25 (0.14)	0.40 (0.15)	0.78 (0.18)	0.21 (0.21)
CNPC	−0.05 (0.14)	−0.06 (0.15)	0.39 (0.23)	0.40 (0.20)

values but interpret them cautiously, as each subject saw only one item per condition per island in each experiment. We use these DD values in drawing conclusions about the magnitude of island and amelioration effects in what follows.

4.2 Islands in MSA

One of the striking facts in our results is the variability of the presence and magnitude of superadditive island effects across the three constructions and both experiments in our results. In Experiment 1, only *whether* and adjunct islands show superadditive effects, and *whether* islands do so with a smaller magnitude (0.13) than adjunct islands (0.25). In Experiment 2, this general pattern of larger effects for adjunct islands (0.78) than *whether* islands (0.20) remains, but the CNPC violations also showed a superadditive component (0.39).

In theoretical work, which syntactic constructions qualify as islands are often cited as a point of crosslinguistic variation. For instance, Rizzi (1982) notes that relative clause dependencies can show crosslinguistic variation in islandhood across Italian and English, a fact which is confirmed by the quantitative studies in Sprouse et al. (2016). If superadditivity in quantitative acceptability studies is used as definitional of island effects in the grammar (Almeida, 2014), then our results could be taken to indicate that there is some crosslinguistic variability in the expression of islands when MSA is compared to other languages.

This is an important result since no formal studies that we are aware of discuss the relationship between island acceptability and grammaticality in MSA. We can entertain two hypotheses to account for this heterogeneity in our data. The first would hold that *whether* islands are simply not barriers to the formation of wh-filler gap dependencies in Arabic. This would be a somewhat surprising result given the general property that MSA holds many constituents to be barriers to dependency formation with gaps (such as overtly headed CPs and PPs) which are not barriers in, for instance, Indo-European languages. It strikes us as somewhat odd, therefore, to maintain that MSA is more conservative in wh-dependency

formation in most cases, except in adjunct islands. The other option maintains a more quantitative approach to dealing with the differences between adjunct and *whether* islands. Given that we did not have any a priori reason to doubt that Arabic contains the same inventory of island constructions as English, the somewhat weaker status of *whether* islands in our results could be taken as indicative of a quantitative heterogeneity among distinct types of islands in MSA.

However, in our results this issue is possibly confounded by one of population and proficiency in MSA. Experiment 1 demonstrated that only adjunct islands showed a superadditive effect and they only did so marginally. This is true even in the gap statistical model, where the issue of linking a bare wh-filler to a resumptive pronoun should not be an issue. We believe that this discrepancy is at least partially attributable to differences in population across the two studies. Experiment 1 mostly surveyed a sample of university students in the United Arab Emirates and their families, whereas Experiment 2 surveyed the arabic-L email list, which is comprised of people who, on the whole, have some formal training in the grammar of MSA. The diglossic situation between MSA and the spoken Arabic varieties entails that proficiency in MSA can be an issue in places where other languages are commonly spoken; the UAE is such a place given the prevalence of English. Since English makes much heavier use of the gap strategy relative to MSA, a speaker who is bilingual in spoken Arabic and English with little instruction in MSA beyond primary school may be more inclined to reject resumption in general relative to monolingual speakers of a spoken variety of Arabic who have more familiarity with MSA. We think it possible that at least subsets of participants from Experiment 1 may differ in their MSA proficiency from the speakers sampled in Experiment 2, given the possible discrepancy in MSA proficiencies between the two populations. This concern itself underscores the urgent need for work on the psycholinguistics of the spoken Arabic varieties.

4.3 The grammaticality of resumption and gapping

One general issue raised by our study is the grammatical status of resumption and gapping in MSA, even modulo the presence of an island. As noted in the introduction, MSA – and Arabic more generally – is generally described as a pervasive resumption language insofar as it makes widespread grammatical use of resumption. Our results suggest that reifying this quantitative difference from English into a qualitative one may be too simplistic, as resumption can appear quite unacceptable even in MSA. In addition to the constraint resumption places on the content of the wh-filler, we also see that resumption is dispreferred in certain long-distance dependencies, such as the Long/NoIsland/Resumption conditions in the CNPC islands in our data. It therefore appears that in certain grammatical corners, a

language such as Arabic which otherwise makes widespread use of resumption can behave like English, a language where resumption is generally dispreferred. More generally, this suggests a conception of resumption where typological differences are situated in the representational particulars of the context in which a resumptive pronoun finds itself, not in core grammatical differences between languages.[23] This conception of resumption dovetails with theoretical work that argues that resumption is not a unitary phenomenon, even inside Arabic (Aoun & Choueiri, 2000; Aoun et al., 2001, 2010; Guilliot & Malkawi, 2006; Malkawi & Guilliot, 2007).

However, there is clearly a core validity to the claim that resumption is somehow special in Arabic, as our results in Experiment 2 from *whether* and adjunct structures confirm. There, even in the absence of an island, resumption is preferred to gapping, a result which can be seen as dovetailing with theoretical claims that gapping is generally marked in MSA, but in contrast to the results for Hebrew reported by Meltzer-Asscher et al. (2015). Our results suggest that a long dependency with a gap in a non-island context reduces acceptability more or less to the mean acceptability for a speaker. However, we are hesitant to conclude that this means gapping is unacceptable in MSA given that a sufficiently articulated theory does not exist that specifies the linking between acceptability and grammaticality in such a way that we can assess the status of a mean acceptability rating. Again here, further work is necessary, and we believe much could be gained from assessing these same patterns in relative clauses in addition to constituent wh-questions, since those constructions formed the empirical basis of initial studies into the grammatical status of resumption in Semitic (Borer, 1984; Sells, 1984; Shlonsky, 1992; Aoun et al., 2010).

4.4 Amelioration in islands

Finally, we return to the larger question which motivated this study: does resumption ameliorate an island violation in MSA? The answer appears to be, "It depends." It depends, firstly, upon the nature of the wh-filler which is co-construed with the resumptive pronoun – if this is a bare wh-item such as "what," then resumption is simply unacceptable. Provided that a complex wh-phrase is used, then resumption can be supportive of otherwise very un-acceptable filler-gap dependencies.

23. This conclusion is no doubt supported by the existence of languages such as Swedish, Vata, and Gbadi, where resumptive pronouns appear in contexts which do not align with the "intrusive" versus "grammaticalized" resumption typology (see McCloskey, 2006 for discussion and references). Note that Egyptian Arabic is also claimed to allow Swedish-type resumption in limited contexts (Wahba, 1984).

It depends, also however, upon the island out of which the dependency is formed. Dependencies spanning the CNPCs employed in our study receive no help from resumption (0.39 with a gap versus 0.40 with a pronoun), a fact we have tentatively linked to the unacceptability of any filler-gap dependency with CNPC constructions more generally.

However, even within the remaining adjunct and *whether* islands, it also depends. The amelioration effect is clear in adjunct islands (no resumption at 0.78 versus resumption at 0.20), and not so clear in *whether* islands (no resumption at 0.20 versus resumption at 0.19). It therefore seems as though the kind of island is relevant to the ameliorative effect of resumptive pronouns in ways which largely mimic the extent to which the type of island affects superadditivity in general. However, we must note that even with a resumptive pronoun, adjunct island violations are still rated below the mean acceptability for these speakers. It is therefore possible to describe the ameliorative effect as "mak[ing] the best of a bad job" (Langendoen, 1970). Whether this qualifies as grammatical amelioration depends upon one's syntactic theory, but we can note that this might be the principle underlying the occasional report that resumption ameliorates islands in English (Ackerman et al., 2015), since those studies involved force-choice tasks between gapping and resumption structures.

4.5 Conclusions

We have demonstrated that superadditivity can be observed in islands in Arabic, both with and without resumptive pronouns in the tail position of a filler-gap dependency. The amount to which quantitative superadditive acceptability penalties appear with islands in MSA depends on the type of island and possibly the proficiency with MSA of the subject population. Where resumption is present, our results show that the acceptability of resumption more generally depends on the type of filler associated with the dependency. Where these constraints are respected, resumption has been shown to increase the acceptability of dependencies spanning island boundaries, especially for adjunct islands. Where amelioration does occur, the resulting improvement nearly obliterates the superadditive component of the island violation, meaning that resumption can be seen to improve the non-processing component of acceptability penalties in Arabic.

These results help to clarify the contribution of various known components of difficult sentence processing at play in filler-gap dependency formation inside island structures, allowing us to understand the theoretical import of claims that resumption facilitates understanding and acceptability in island violations. At the same time, the resulting sentences are still well below average acceptability to speakers, leading to the conclusion that, even in a grammaticalized resumption

language such as MSA, resumption still makes the best of two very bad situations – both dependencies in an island with a gap and dependencies in an island with a resumptive pronoun. The result is a picture of the grammar-processing interface which takes islands to be a multifaceted phenomenon made up of both grammatical and processing concerns, each part of which can be manipulated independently by changes in the nature of the filler-gap or filler-pronoun dependency.

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References

Ackerman, L., Frazier, M., & Yoshida, M. 2015. *Resumptive pronouns can ameliorate illicit island extractions*. (Ms., Northwestern University).

Alexopoulou, T., & Keller, F. 2007. Locality, cyclicity, and resumption: At the interface between the grammar and the human sentence processor. *Language*, 83(1).

Almeida, D. 2014. Subliminal wh-islands in Brazilian Portuguese and the consequences for syntactic theory. *Revista de ABRALIN* 13(2), 55–93.

Alotaibi, M., & Borsley, R. D. 2013. Gaps and resumptive pronouns in Modern Standard Arabic. In S. Müller (Ed.), *Proceedings of the 20th international conference on head-driven phrase structure grammar* (pp. 6–23). Stanford, CA: CSLI Publications.

Aoun, J. 1981. The formal nature of anaphoric relations (Unpublished doctoral dissertation). Massachusetts Institute of Technology, Cambridge, MA.

Aoun, J., Benmamoun, E., & Choueiri, L. 2010. *The syntax of Arabic*. Cambridge: Cambridge University Press.

Aoun, J., & Choueiri, L. 2000. *Epithets. Natural Language and Linguistic Theory* 18(1), 1–39.

Aoun, J., Choueiri, L., & Hornstein, N. 2001. Resumption, movement, and derivational economy. *Linguistic Inquiry* 32(3), 371–403. https://doi.org/10.1162/002438901750372504

Asudeh, A. 2004. Resumption as resource management (Unpublished doctoral dissertation). Stanford University, Palo Alto, CA.

Asudeh, A. 2011. Local grammaticality in syntactic production. In E. Bender & J. Arnold (Eds.), *Language from a cognitive perspective: Grammar, usage, and processing: Studies in honor of Thomas Wasow*. Stanford, CA: CSLI Publications.

Asudeh, A. 2012. *The logic of pronominal resumption*. Oxford: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199206421.001.0001

Barr, D. J., Levy, R., Scheepers, C., & Tily, H. J. 2013. Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language* 68(3), 255–278. https://doi.org/10.1016/j.jml.2012.11.001

Bates, D. M., Kliegl, R., Vasishth, S., & Baayen, R. H. 2015, June. *Parsimonious mixed models*. (Ms., arXiv).

Beltrama, A., & Xiang, M. 2017. Ungrammatical but comprehensible: The facilitation effect of resumptive pronouns. *Glossa* 1(1).

Bennett, R. 2008. *English resumptive pronouns and the highest subject restriction*. (Handout of a talk given at the Trilateral Linguistics Weekend (TREND), University of California, Santa Cruz, 11 May 2008).

Borer, H. 1984. Restrictive relatives in modern hebrew. *Natural Language & Linguistic Theory* 2(2), 219–260. https://doi.org/10.1007/BF00133282

Chao, W., & Sells, P. 1983. On the interpretation of resumptive pronouns. In *Proceedings of nels* (Vol. 13, pp. 47–61).

Cinque, G. 1990. *Types of A′-dependencies*. Cambridge, Mass.: MIT Press.

Clemens, L., Scontras, G., & Polinsky, M. 2012. *English does not have resumptive pronouns: A cross-sentential account of English resumption*. (Talk presented at the *87th Annual Meeting of the Linguistic Society of America*).

Dermidache, H. K. 1991. Resumptive chains in restrictive relatives, appositives, and dislocation structures (Unpublished doctoral dissertation). Massachusetts Institute of Technology, Cambridge, MA.

Erteschik-Shir, N. 1992. Resumptive pronouns in islands. In H. Goodluck & M. Rochemont (Eds.), *Island constriants: Theory, acquisition, and processing* (pp. 89–108). Dordrecht: Kluwer. https://doi.org/10.1007/978-94-017-1980-3_4

Farby, S., Danon, G., Walters, J., & Ben-Shachar, M. 2010. The acceptability of resumptive pronouns in Hebrew. In Y. N. Falk (Ed.), *Proceedings of IATL 26*. Israeli Association for Theoretical Linguistics.

Ferreira, F., & Swets, B. 2005. The production and comprehension of resumptive pronouns in relative clause island contexts. In A. Cutler (Ed.), *Twenty-first century psycholinguistics: Four cornerstones* (pp. 101–122). Lawrence Erlbaum Associates.

Fox, D. 1999. *Relative clauses and resumptive pronouns in Hebrew: An optimality theoretic approach*. (Ms., Massachusetts Institute of Technology).

Gelman, A., & Hill, J. 2006. *Data analysis using regression and multilevel/hierarchical models*. Cambridge, UK: Cambridge University Press. https://doi.org/10.1017/CBO9780511790942

Guilliot, N., & Malkawi, N. 2006. When resumption determines reconstruction. In D. Baumer, D. Montero, & M. Scanlon (Eds.), *Proceedings of the 25th West Coast Conference on Formal Linguistics* (pp. 168–176). Somerville, MA: Cascadilla Proceedings Project.

Han, C.-H., Elouazizi, N., Galeano, C., Gorgulu, E., Helberg, N., Hinnell, J., … Kirby, S. 2012. Processing strategies and resumptive pronouns in English. In N. Arnett & R. Bennett (Eds.), *Proceedings of the 30th West Coast Conference on Formal Linguistics (WCCFL 30)*. Somerville, MA: Cascadilla Proceedings Project.

Heestand, D., Xiang, M., & Polinsky, M. 2011. Resumption still does not rescue islands. *Linguistic Inquiry* 42(1), 138–152. https://doi.org/10.1162/LING_a_00032

Hofmeister, P., & Norcliffe, E. 2013. Does resumption facilitate sentence comprehension? In P. Hofmeister & E. Norcliffe (Eds.), *The core and the periphery: Data-driven perspectives on syntax inspired by Ivan A. Sag* (pp. 225–246). Stanford, CA: CSLI Publications.

Hofmeister, P., & Sag, I. A. 2010. *Cognitive constraints on syntactic islands*. *Language* 86(2), 366–415.

Keffala, B. 2011. Resumption and gaps in English relative clauses: Relative acceptability creates an illusion of "saving". In C. Cathcart, I. H. Chen, G. Finley, S. Kang, C. S. Sandy, & E. Stickles (Eds.), *Proceedings of the 37th annual meeting of the berkeley linguistics society* (pp. 140–154). Berkeley, California: University of California Press.

Keffala, B., & Goodall, G. 2011. *Do resumptive pronouns ever rescue illicit gaps in English?* (Poster presented at CUNY 2011 Conference on Human Sentence Processing).

Kluender, R., & Kutas, M. 1993. Subjacency as a processing phenomenon. *Language and Cognitive Processes* 8(4), 573–633. https://doi.org/10.1080/01690969308407588

Kroch, A. S. 1981. On the role of resumptive pronouns in amnestying island constraint violations. In *Papers from the 17th regional meeting of the Chicago Linguistic Society* (pp. 125–135). University of Chicago.

Langendoen, D. T. 1970. The accessibility of deep structures. In R. A. Jacobs & P. S. Rosenbaum (Eds.), *Readings in English transformational grammar* (pp. 99–104). Waltham, MA: Ginn and Company.

Malkawi, N., & Guilliot, N. 2007. Reconstruction and islandhood in Jordanian Arabic. In M. Mughazy (Ed.), *Perspectives on Arabic linguistics XX* (pp. 87–104). Amsterdam: John Benjamins. https://doi.org/10.1075/cilt.290.09mal

Maxwell, S. E., & Delaney, H. D. 2004. *Designing experiments and analyzing data: A model comparison perspective*. New York: Psychology Press.

McCloskey, J. 1979. *Transformational grammar and model theoretical semantics*. Dordrecht: Reidel. https://doi.org/10.1007/978-94-009-9495-9

McCloskey, J. 1990. Resumption, successive cyclicity, and the locality of operations. In S. Epstein & T. D. Seely (Eds.), *Derivation and explanation* (pp. 184–226). Oxford: Blackwell.

McCloskey, J. 2006. Resumption. In M. Everaert & H. van Riemsdijk (Eds.), *The Blackwell companion to syntax* (pp. 84–117). Blackwell. https://doi.org/10.1002/9780470996591.ch55

McDaniel, D., & Cowart, W. 1999. Experimental evidence for a minimalist account of English resumptive pronouns. *Cognition* 70(2), B15–B24. https://doi.org/10.1016/S0010-0277(99)00006-2

McKee, C., & McDaniel, D. 2001. Resumptive pronouns in English relative clauses. *Language Acquisition* 9(2), 113–156. https://doi.org/10.1207/S15327817LA0902_01

Meltzer-Asscher, A., Fadlon, J., Goldstein, K., & Holan, A. 2015. Direct object resumption in Hebrew: How modality of presentation and relative clause position affect acceptability. *Lingua* 166, 65–79. https://doi.org/10.1016/j.lingua.2015.08.011

Pesetsky, D. 1987. Wh-in-situ: Movement and unselective binding. In E. J. Reuland & A. G. B. T. Meulen (Eds.), *The representation of (in)definiteness*. Cambridge, Massachusetts: MIT Press.

Polinsky, M., Clemens, L. E., Morgan, A. M., Xiang, M., & Heestand, D. 2013. Resumption in English. In J. Sprouse (Ed.), *Experimental syntax and island effects* (pp. 341–360). Cambridge, UK: Cambridge University Press. https://doi.org/10.1017/CBO9781139035309.017

Prince, E. F. 1990. Syntax and discourse: A look at resumptive pronouns. In *Proceedings of the sixteenth annual meeting of the Berkeley Linguistics Society: General session and parasession on the legacy of Grice* (pp. 482–497). Berkeley, California: Department of Linguistics, Unversity of California, Berkeley.

Rizzi, L. 1982. *Issues in Italian syntax*. Dordrecht, Holland: Foris Publications. https://doi.org/10.1515/9783110883718

Ross, J. R. 1967. Constraints on variables in syntax (Unpublished doctoral dissertation). Massachusetts Institute of Technology.

Ryding, K. C. 2005. *A Reference Grammar of Modern Standard Arabic*. Cambridge, UK: Cambridge UP. https://doi.org/10.1017/CBO9780511486975

Sells, P. 1984. Syntax and semantics of resumptive pronouns (Unpublished doctoral dissertation). University of Massachusetts, Amherst.

Shlonsky, U. 1992. Resumptive pronouns as a last resort. *Linguistic Inquiry* 23(3), 443–468.

Shlonsky, U. 2002. Constituent questions in Palestinian Arabic. In J. Ouhalla & U. Shlonsky (Eds.), *Themes in Arabic and Hebrew syntax* (pp. 137– 160). Dordrecht, The Netherlands: Kluwer Academic Publishers. https://doi.org/10.1007/978-94-010-0351-3_5

Sprouse, J., Caponigro, I., Greco, C., & Cecchetto, C. 2016. Experimental syntax and the variation of island effects in English and Italian. *Natural Language & Linguistic Theory* 34(1), 307–344. https://doi.org/10.1007/s11049-015-9286-8

Sprouse, J., Wagers, M., & Phillips, C. 2012. A test of the relation between working memory capacity and island effects. *Language* 88(1), 82–123. https://doi.org/10.1353/lan.2012.0004

Szabolcsi, A. 2006. Strong vs. weak islands. In M. Everaert & H. van Riemsdijk (Eds.), *The Blackwell companion to syntax* (Vol. 4). Malden, MA: Blackwell Publishing. https://doi.org/10.1002/9780470996591.ch64

Wahba, W. A. -F. B. 1984. Wh-constructions in Egyptian Arabic (Unpublished doctoral dissertation). University of Illinois at Urbana-Champaign.

Zukowski, A., & Larsen, J. 2004. *The production of sentences that we fill their gaps*. (Poster Presented at the 2004 CUNY Conference on Human Sentence Processing, University of Maryland College Park).

A probabilistic approach to stress assignment in Arabic

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Unlike previous rule/constraint-based analyses, this study approaches the stress system in Arabic from a completely probabilistic perspective. In this view of language, the stress system can be understood as interaction between various relevant types of conditioning factors for stress, which is given comprehensive quantitative description in this study. Using this statistical information, a probabilistic language model is constructed to simulate and examine whether stress could be acquired purely by learning from the statistical information without any presumed rules or constraints. The simulation results show that the probabilistic language model is very successful in acquiring stress in Arabic, which in turn gives strong support for a probabilistic view on stress acquisition and its viability as a language learning mechanism in general.

Keywords: lexical stress, Arabic, probabilistic language modeling, frequency effects, statistical learning

Introduction

Lexical stress in Arabic is a topic that has been extensively discussed in the past few decades. The popularity of this topic is perhaps due to its quantity-sensitive nature and the sheer amount of dialectal variations in Arabic. Most previous work has been dedicated to capturing the complex interplay between metrical and syllabic constraints on stress assignment, either within the same variety of Arabic or across different varieties of Arabic. Ample description has also been given of stress rules for the respective variations of Arabic, such as Modern Standard Arabic (Angoujard, 1990), Palestinian (Kenstowicz, 1983), Damascene (Cowell, 1964), and Egyptian (Mitchell, 1975). These analyses began with a focus on rule-based analysis (e.g., Broselow, 1976) then transitioned to the more recent Optimality Theory framework (Prince & Smolensky, 2008). Whichever approaches are taken,

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these analyses remain under the realm of generative phonology where analyses are based upon rules, constraints and grammars.

Although these rule-based or constraint-based analyses have been successful in tackling various topics in Arabic stress, the focus has been on the inner-workings of grammar, i.e., rule composition or constraints ranking a set of surface forms, while discussion on how these rules and constraints emerge and how the stress system is acquired are generally lacking. More importantly, this predisposition in the literature toward rule/constraint-based analyses does not adequately address factors that are specific to language processing and language learning, such as effects from recency, redundancy, and input frequency. Among these three factors, the effect of input frequency (henceforth frequency) has been increasingly examined in the field of psycholinguistics. Frequency has been found to have a significant effect on various facets of language acquisition and processing. Ellis (2002) summarized aspects of language learning and processing that are sensitive to frequency effects, including phonology (Treiman & Danis, 1988), phonotactics (Frisch et al., 2001), syntax (Martin, Church, & Patil, 1987), morphosyntax (Brooks, Braine, Catalano, Brody, & Sudhalter, 1993), reading and spelling (Coltheart, Curtis, Atkins, & Haller, 1993), word recognition (Forster & Chambers, 1973), and formulaic language (Biber et al., 1999), to name a few.

According to the generative perspective on language, language acquisition and, more specifically, stress acquisition in Arabic means learning the rules and constraints pertaining to the metrical and positional characteristics of stress as well as the order of these rules and constraints. In contrast, from a frequency-based perspective, learning is bottom-up, statistical, probabilistic, and might not involve Universal Grammar. This can be loosely understood as learning the statistical information and the likelihood of the target structure in the target language, where language, its idiosyncratic patterns, and grammar – are emergent properties. Learners learn from the language that they are exposed to and from the array of various linguistic inputs that are available to them during the course of learning. Learners track the frequency of these linguistic inputs, notice elements that occur frequently, and notice elements that occur frequently with other specific elements. The learners extract regularities and likelihood in the language from the abstractions of these frequent linguistic elements and chunks of elements. Learners repeat this process of tracking and abstracting characteristics of the language from the frequency distribution of linguistic elements. Over the course of a lifetime, the language that emerges has approximate regularities similar to the input language.

The argument that learning could be bottom-up and statistical is not a novel notion in the field of psycholinguistics and cognitive science. Studies have taken this perspective on language learning and have shown that acquisition can be modeled by learning the statistical information or various forms and frequencies

of the target structures, such as the auxiliary fronting rule in interrogative formation (Prefors, Regier, & Tenenbaum, 2006), or word acquisition (Regier, 2003, 2005). These studies normally implement various statistical modeling tools such as n-gram models (e.g., Legate & Yang, 2002; Pullum & Scholz, 2002) and Bayesian Models (Perfors, Tenenbaum, & Regier, 2011) – tools that have also been widely implemented in other disciplines such as Natural Language Processing (NLP) and Machine Learning (ML).

However, although frequency effects have been reported to influence various aspects of language learning and processing as mentioned before, its effect on stress acquisition has not been extensively explored in either first language (henceforth L1) or second language acquisition literature. It is understandable why the topic draws little attention in L1 acquisition studies, since native speakers have rather consistent performance on both the perception and production of stress in real words. It is rarely the case that they mishear the stress or place the stress on the wrong syllable due to low frequency. However, when presented with nonsense words of varying frequency, the otherwise consistent performance exhibited by native speakers for real words can be remarkably inconsistent. In a rare study investigating frequency effects on stress production in Russian, Jouravlev and Lupker (2015) presented a probabilistic Bayesian model for stress assignment in Russian, a language with complex and relatively unpredictable stress. The model considered the frequency of both lexical and non-lexical parameters and a modeled posterior probability to compute the position that is most likely to be stressed in any given word. With this model, Jouravlev and Lupker tested the model's prediction of the stress pattern (either iambic or trochaic) for bisyllabic nonsense words in Russian. The probability of the stress pattern predicted was later correlated with the proportion of productions of the corresponding stress pattern by native speakers of Russian. A significantly positive correlation was found, suggesting that the participants were more accurate when the stress pattern is frequent. Additionally, a negative correlation was found between the probability of the predicted stress pattern and the latency (i.e., reaction time) of production, indicating that the participants took less time to respond to items that are of higher frequency. These findings showed that the model was capable of predicting stress from a purely probabilistic and frequency-informed approach, and the accuracy and latency of speakers' production seems to be highly informed by the frequency of the parameters, as well.

In the same vein, a similar trend is found in the second language literature, as little research has been conducted on L2 stress acquisition which takes frequency effects into account. Most of the L2 stress acquisition studies have focused on the effect of learners' native language on their ability to perceive and produce stress in the target language. Only recently have the effects of frequency received more attention (e.g., Post da Silveira, 2011). One notable study that is particularly relevant

to the present study is Lin (2018) and Lin & Alhawary (2018), which investigated frequency effects on the accuracy and fluency of stress perception and production by learners of Arabic in an experimental setting. The experiment's results showed that learners' production of stress was significantly influenced by the frequency of a given stress pattern. Specifically, the study showed that learners' production of stress was more accurate (i.e., placing stress on the correct syllable) and fluent (i.e., faster response time) when the stress pattern of the word is frequent, and less accurate as well as more disfluent when the pattern is infrequent. However, significant differences in performance were more evident in stress patterns that have a greater frequency contrast (i.e., between stress patterns that are rather frequent and ones that are rather infrequent) but less evident between stress patterns with a lesser degree of frequency contrast. This is perhaps due to the individual variability in language input from the participants in the study.

In sum, the discussion of lexical stress in Arabic has been mainly within the realm of generative phonology where rules and constraints that condition the stress system are most relevant, while discussion has been limited as to how the rules and constraints emerge and acquisition of the stress system is conducted. Additionally, the role of input frequency in Arabic stress acquisition and the statistical learning mechanism associated with it have not been adequately examined until recently in experimental settings. To examine whether stress in Arabic is attainable from a statistical, probabilistic, and frequency-based learning mechanism, as well as to avoid potential biases introduced either from experiment design or the internal factors of the participants, the present study implemented a basic bigram model (i.e., a basic language model commonly used in the field of ML and NLP for less complicated tasks). This model simulates a completely probabilistic language learning mechanism within a theoretical and fully controlled space, without any interference from the individual variability as found in most language experiments. It is important to note that the objective of the present study is not to promote new techniques in language modeling, nor is it to optimize the language model and maximize the learning outcome. Instead, the purpose of the present study is to probe into whether the stress system in Arabic is learnable by only attending to the statistical information in the input, as well as the role of statistical/probabilistic information – or the flipside of it, frequency – during the process of acquisition. In other words, the study is interested in examining whether such a probabilistic approach to stress acquisition could yield learning outcomes comparable to what is assumed in a generative approach.

Method

The training data

The next immediate question is: what statistical information is relevant for learning stress in Arabic? Romberg & Saffran (2010) conclude that learners, even in their earliest stage of acquisition, can utilize a variety of statistical information, such as frequencies of occurrence, frequencies of co-occurrence, conditional probability, and relevant statistics to accomplish various tasks that are essential to L1 learning. Examples of these tasks would be word segmentation (e.g., Goodsitt, Morgan, & Kuhl, 1993), lexical categorization (e.g., Gómez & Gerken, 2000), and form-meaning mapping (e.g., Smith & Yu, 2008). For language modeling, these frequencies are understood as unigram frequency (i.e., occurrence) and bigram frequency (i.e. co-occurrence) of conditioning factors of the model. As mentioned before, the present study implements a bigram model; however, unigram frequencies of conditioning factors are also explored to better understand the trends of lexical stress in Arabic.

The training data used in the study is extracted from a respected frequency dictionary (Buckwalter & Parkinson, 2014) for Arabic in terms of the number of entries and the size of the corpus that is used to make this dictionary (cf., Kouloughli, 1991). This frequency dictionary is compiled from a 30-million-word corpus of various genres, consisting of 10 percent spontaneous speech (i.e., informal exchanges between individuals) and 90 percent written texts of various genres (see Buckwalter & Parkinson, 2014: 3 for a detailed description).

A total of 5000 entries are included in the dictionary. Each entry in the dictionary includes information that is relevant to understanding the word, such as the part of speech, English gloss, sample sentence, and two types of frequency counts. The two types of frequency counts are rank frequency (relative frequency relative to other entries) and raw frequency (i.e., token frequency).

From dictionary entries into frequency distributions

The token frequency is crucial to the analysis of this study, as it helps to estimate the frequency distribution of various conditioning factors for Arabic stress. In the following sections, I demonstrate how these entries were converted into the training data for the bigram model.

The first step of converting the data was to transcribe each entry into IPA based on its pronunciation in MSA. Since consonantal features (e.g., whether the consonant is guttural) do not influence the position of stress, these IPA representations were directly converted into minimal representation consisting of symbols:

"C"s for consonants and "V"s for vowels. Note that [VV] is used here to represent long vowel instead of [V:], since it has better readability.

The next step was to determine where the location of stress in the word as stress information was provided in the dictionary. As mentioned earlier, although there are several algorithms that could determine where the primary stress falls in a word for different varieties of Arabic dialects, this study used the algorithm for MSA for annotating stress, given the fact that the corpus is composed of written texts, mainly in MSA. The algorithm follows the steps illustrated in (1) and could perfectly identify the position of stress for any given stress pattern.

(1) a. Stress the final syllable if it is superheavy (CVVC, CVCC, or CVVCC);
b. Otherwise, stress the penultimate syllable if it is heavy (CVV or CVC);
c. Otherwise, stress the antepenultimate syllable

Interestingly, only less than 10 entries in the dictionary have more than four syllables. Due to this small number, these entries were not included to make the dataset more consistent. Furthermore, monosyllabic words were not considered either, since they are invariable in stress position. As a result, I focused on entries that are either bi-syllabic, trisyllablic and quadrisyllabic, with a total of 4283 entries.

The last step is to merge the frequency count for entries that share the same stress pattern. For example, the word *mil.ʕa.qa*, "a spoon" and the word *sil.si.la*, "a series" share the same stress pattern [ˈCVC.CV.CV]. Their frequency counts, 873 and 1894 respectively, were added up, resulting in a frequency count of 2770 for the stress pattern [ˈCVC.CV.CV]. A total 104 stress patterns were identified from the 4283 entries. A complete list of stress patterns identified from the dictionary along with their token frequency is presented in the Appendix.

Figure 1 gives this unigram frequency of stress patterns in Arabic, according to the syllable count of the stress pattern. The first observation regarding the distribution is that it is not homogeneous, as some stress patterns are rather more frequent than others. This confirms the variability in the frequency of stress patterns in Arabic, which is the reason why frequency has been regarded as an important factor that could inform language learning and processing.

Secondly, it becomes clear that the number of bisyllabic stress patterns is significantly fewer than trisyllabic and quadrisyllabic stress patterns. To be precise, 21 stress bisyllabic stress patterns were identified whereas 42 and 41 stress patterns were identified for trisyllabic and quadrisyllabic words, respectively. This result is no surprise, as words that have more syllables intrinsically have more "slots" for possible syllable combinations. That is, given the fact that there are five major types of syllabic structures for; i.e., CV, CVV, CVC, CVVC, and CVCC, the theoretical maximal number of combinations is 25 (5^2), 125 (5^3), and 575 (5^4) and bisyllabic stress patterns have almost reached the theoretical maximal number (21 of 25) of

types of stress patterns. What comes as a surprise is the fact that trisyllabic and quadrisyllabic words have nearly identical number of stress patterns and have a relative low utilization rate of possible syllable combinations with approximately 33% (42/125) and 7% (41/575) utilization rates for trisyllabic and quadrisyllabic words, respectively. Such low utilization rates of possible syllable combinations might suggest stronger pressure towards the sequencing of certain types of syllables, i.e., words that are composed of only heavy or short syllables. However, this topic is beyond the scope of this paper, and shall be discussed in future studies.

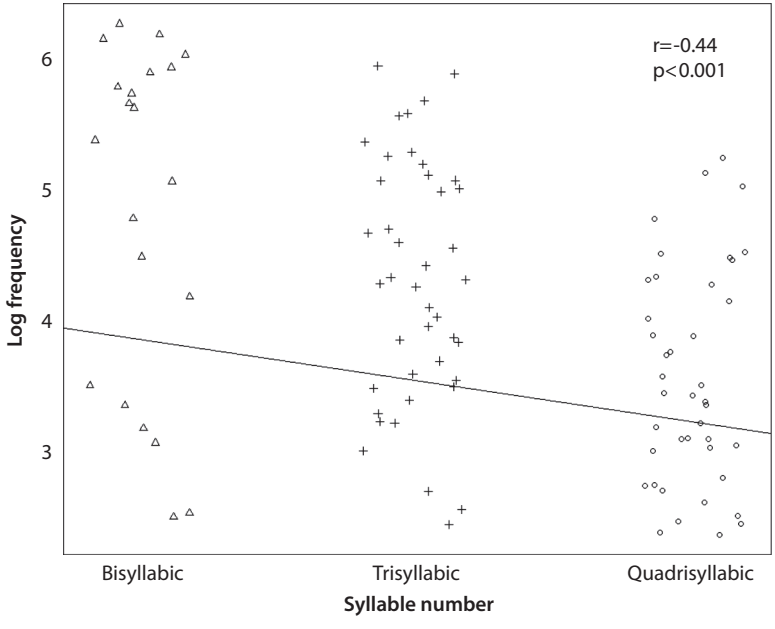


Figure 1. Frequency distribution of stress patterns in Arabic

The third observation about the frequency distribution is the relative frequency among bisyllabic, trisyllabic and quadrisyllabic words. Although it might not be immediately apparent, token frequency and syllable count of the stress patterns were moderately negatively correlated ($r(104) = -.42$, $p < 0.001$), suggesting that stress patterns with lower syllable counts tend to be more frequent whereas stress patterns with higher syllable counts tend to be less frequent.

This frequency distribution of stress patterns was used as the base for deriving more frequency distributions of other conditioning factors for stress, allowing for better observation of how stress interacts with other syllabic contexts. These conditioning factors include: (1) the position, (2) the syllabic structure, and (3) the conditional probability of the stressed syllable.

To derive the frequency distribution of these conditioning factors for stress, the same approach that was used to merge dictionary entries was used again. For instance, to calculate the frequency distribution for stress position, each stress pattern was examined to determine whether the stressed syllable is on either the final, penultimate or antepenultimate syllable. If the stress patterns have the same stress position, their frequency counts were merged. By repeating the same process for all stress patterns, we are able to see how stress is distributed across different positions, as shown in Figure 2.

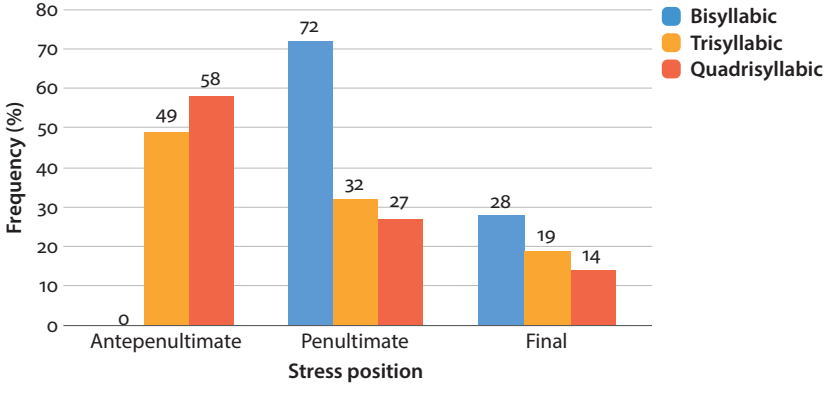


Figure 2. Frequency distribution of the position of stressed syllable

Figure 2 presents the frequency distribution of the position of stress according to the syllable count of the stress patterns. This figure shows that for bisyllabic words, stress predominately falls on the penultimate position, which is on the first syllable where stress is possible. The same tendency is observed for trisyllabic and quadrisyllabic words, as most frequent stress position for these two types of words is also on the first syllable that can receive stress, namely, on the antepenult. The frequency decreases as we move from the first to the second syllable where stress is possible, and then decreases again from the second to the third syllable where stress is possible. This pattern seems to be true for both trisyllabic and quadrisyllabic words, which in turn seems to suggest a preference towards having stress word-initially.

The second conditioning factor examined is the syllabic structure of the stressed syllable, which is presented in Figure 3 according to the syllabic count of the stress pattern. In the figure, the first notable finding is the low percentage of the so-called superheavy syllables [CVCC]. This syllabic structure is infrequent by a large margin compared to other syllabic structures, where they seem to only appear in bisyllabic and trisyllabic words. Secondly, although there is no apparent difference in [CVC] among bisyllabic, trisyllabic and quadrisyllabic words,

[CVVC] and [CV] seem to be more preferred by bisyllabic words, whereas [CVV] is preferred by quadrisyllabic words.

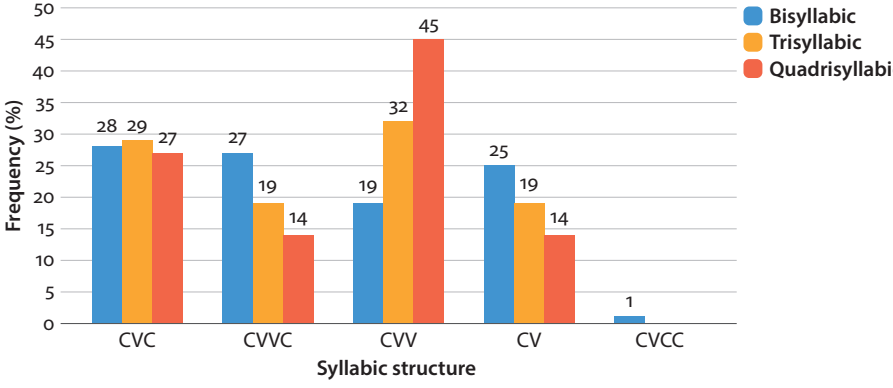


Figure 3. Frequency distribution of the syllabic structure of stressed syllable

In an alternative presentation of the same set of data according to the stress position in Figure 4, it is clearly shown how stress position can influence the preference for the syllabic structure of the stressed syllable. To begin with, [CVC], [CV] and [CVV] seem to be limited to only the antepenultimate and penultimate positions. Secondly, although [CVVC] is predominately found to appear in word-final position, it does occur in the penultimate position with a significantly lower frequency. Lastly, [CVCC], albeit not entirely visible in the figure, seems to only appear in word-final position.

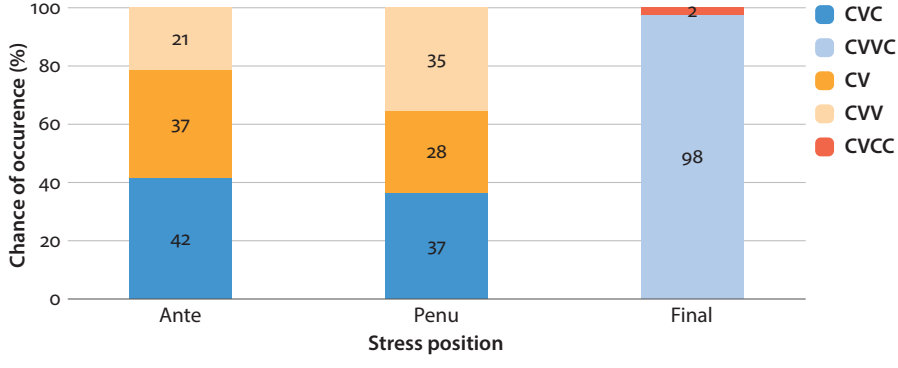


Figure 4. Frequency distribution of syllabic structures of stressed syllable across positions

Following the categorization (Watson, 2007) for light (CV), heavy (CVV, CVC) and superheavy (CVVC, CVCC) syllables, Figure 5 shows the interaction between the weight and the position of the stressed syllable. Overall, it can be concluded that heavier syllables seem to be preferred over light ones, and such preference

increases as the distance from the first stress-able syllable increases. This conclusion is exemplified by the increasing preference for heavy syllables from antepenultimate position to penultimate position, and eventually to final position where stress exclusively falls on superheavy syllables.

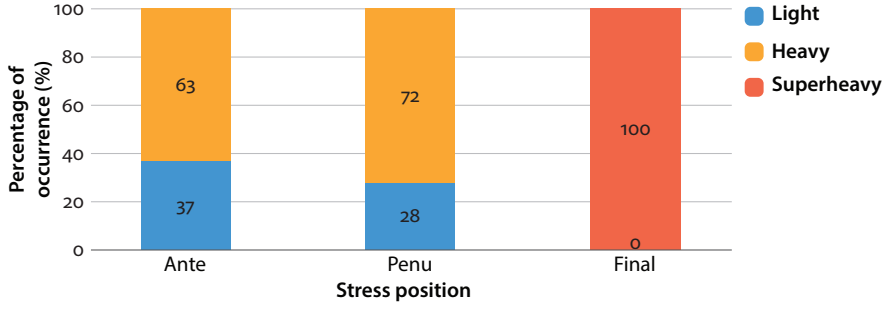


Figure 5. Frequency distribution of syllable weight of stressed syllables

The last conditioning factor derived from the frequency distribution of stress patterns is the conditional probability of the stressed syllable. To elaborate, the conditional probability of a stressed syllable means the probability of having a stressed syllable B, given a known preceding syllable A, written as *P*(B|A). For example, if we were to calculate the conditional probability for the stressed syllable for the word سِلْسِلَة [ˈsil.si.la] "a series" ([ˈCVC.CV.CV]), we are calculating the probability of a stressed [CVC], given that there is no preceding syllable (represented as **, meaning the beginning of the word), namely, *P*(ˈCVC|**). The conditional probability is a conditioning factor that is different from the previous two conditioning factors, as what it involves is the bigram frequency of the stress patterns stated over

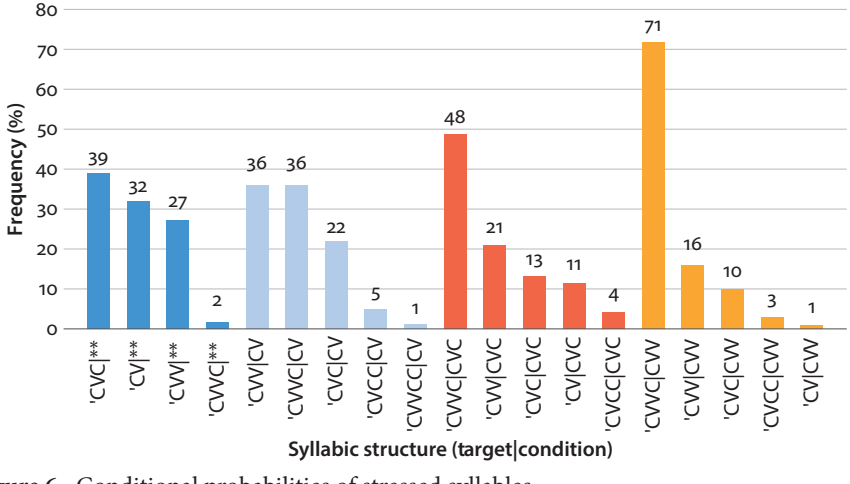


Figure 6. Conditional probabilities of stressed syllables

syllables – the statistical information that the language model implemented in the present study learns from.

Figure 6 gives the distribution of conditional probability for the stressed syllable in Arabic. It is shown that for the first syllable of any given word (given the syllable is not preceded by any syllable; i.e., **), stress most likely would fall on a [CVC], less so for a [CV], then [CVV], and significantly less likely to stress a [CVVC]. Similarly, given that the preceding syllable is an unstressed [CV], it is more likely to be followed by a stressed [CVV], less so by a [CVVC], then a [CVC], and significantly less likely by a [CVVCC] or a [CVVCC].

To conclude this section, an extensive quantitative description of the conditioning factors for stress in Arabic is presented here. Overall, unbalanced frequency distributions were found in each conditioning factor, suggesting that the contexts for stress are not equally preferred: some conditioning factors seem to be preferred in some contexts but disfavored in some others. Because of these dynamic distributions, it becomes possible to examine whether a purely probabilistic learning mechanism could and emerge from such unbalanced conditioning factors.

From frequency distributions to a probabilistic language model

What is a purely probabilistic language learning mechanism, then? As the name suggests, the learning mechanism could be an individual learner or an artificial one that learns and produces certain structures based on the frequency/probabilistic knowledge learned from past experience. In the case of acquiring stress patterns, this learning mechanism would imply that it learns from its past encounters with stress patterns and utilizes this experience to generate a sense about what is more probable or less likely to occur in stress patterns. Working off this sense, the learner produces whichever is deemed to be most probable of various combinations of either stressed or unstressed syllables. For example, if the learner were to produce words whose syllabic structure is [CV.CVVC], the learner will use either one of the frequency distributions mentioned in the preceding section as a reference to determine which syllable will get stressed. The learner might think the stress will fall on the first syllable [CV] because the penultimate position is a frequent position to have stress or because it is common to have a stressed [CV] at the beginning of the word. The same considerations could apply for choosing [CVVC] to have stress given that an unstressed [CV] is very likely to be followed by a stressed [CVVC] or because word-final position seems to strongly prefer heavy syllables. Whatever decision that learner might make, it should be based upon probability. This basic assumption brings us back again to the very fundamental question: which one is more likely to occur?

This question requires a measure to weigh the array of probabilities from each conditioning factor for stress and compute the likelihood for the different possible ways of stressing the same word; that is, a measure that could determine whether it is more likely to have [ˈCV.CVVC] or [CV.ˈCVVC]. As mentioned in earlier sections, the present study adopted and implemented a basic bigram language model due to its simplicity and relatively straightforward implementation. The more state-of-the-art language modeling and machine learning tools such as neural networks (Demuth, Beale, De Jess, & Hagan, 2014) or long short-term memory models (Hochreiter & Schmidhuber, 1997) were not selected simply because maximizing learning outcomes is not the purpose of the study. Instead, the goal is to examine whether stress acquisition is possible or not by only attending to the statistical information in the input. Put in more extreme terms, a less capable modeling tool is perhaps better for the purpose of the present study, as it provides an even stronger argument supporting the probabilistic learning mechanism if learning is indeed possible with such simple and basic modeling tool.

To create a bigram model, the present study followed the instruction described in the NLP textbook of Jurafsky and Martin (2014) with the Natural Language Toolkit in Python (Bird, 2006). First, a language model can be viewed as a probability distribution of a sequence of elements. In our case here, a language model for stress would be a probability distribution of sequences of all sorts of syllables in terms of stress, syllabic structure, and relative position. A bigram would imply that the sequence is composed of two elements. The training data were converted into bigrams to derive conditional probability.

With this language model, it becomes possible to calculate and then compare the probability between [ˈCV.CVVC] or [CV.ˈCVVC]; or in bigram view, to compare P(ˈCV|**) x *P*(CVVC|ˈCV) x *P*(##|CVVC) and *P*(CV|**) x *P*(ˈCVVC|CV) x *P*(##|ˈCVVC). A probabilistic learning mechanism will calculate then compare the probability of the two candidates and output whichever has the highest probability to be the predicted stress pattern. It has been noted that the probability here utilizes maximal-likelihood-estimation based probabilities, rather than some more complex notion of probability (e.g., Bayesian statistics)

From a probabilistic language model to acquisition simulation

The next immediate question is then how well this bigram language model performs. Before examining its performance, two major parameters need to be taken into consideration: the amount of exposure and biases towards this exposure. Just as when learning any new skill, the amount of experience has major influence on the degree of expertise. Learning a language is no different, as the more input one receives, the more proficient one becomes in general. Secondly, sometimes the

ideal amount of input does not match with the actual amount of input one has received. When learning a language, there are some occasions where input is not received even though it is available. Instances of this could occur because of a lack of attention, absence, or any other distractions that occur during the course of acquisition. In second language acquisition terms, this is the situation where input is not entirely equal to intake (Watanabe, 1997). Therefore, to simulate a more natural learning environment, these two parameters were carefully controlled and incorporated when examining the performance of the language model.

To assess the performance, an acquisition simulation was conducted, following the algorithm laid out in Figure 7 that proceduralizes every consideration that has been discussed.

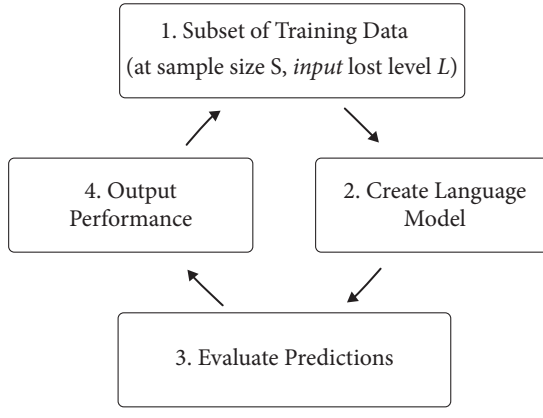


Figure 7. Procedure for stress acquisition simulation

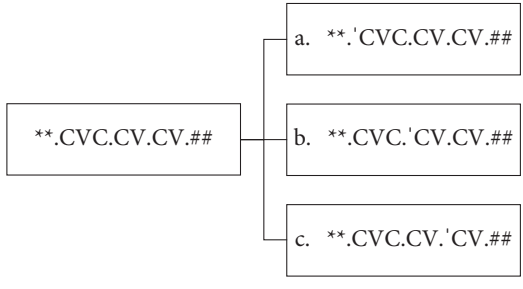
The very first step in the simulation was to determine the size of the training data (i.e., the frequency distribution of stress patterns) that the language model learns from. These stress patterns were randomly selected to create a subset of training data with the size *S*, where *S* has 27 levels, ranging from 1 to 60000, which were arbitrarily determined by the author. Note that the size *S* was not the final training data, it only suggested the number of times where random selection was executed. Each time before a stress pattern was selected, it had to be determined whether this stress pattern was perceived as input or not, simulating the situation where input does not transfer into intake as in natural language learning. The probability of this input lost *L* had 6 levels, ranging from 0% to 40%, which means that the sampled stress pattern has 0%, 5%, or even 40% chance of not becoming the input from which the language model derives. This range of chances of lost input were again arbitrarily determined by the author, representing the most ideal situation where no input is lost, to somehow extreme yet not entirely impossible situation where 40% of the time the sampled stress patterns are not perceived as input and

are not incorporated to the subset of training data. These two parameters *S* and *L* interact during the course of simulation to exhaustively examine the performance of the language model in all possible situations.

The second step of the algorithm was to go through every single stress pattern sampled in from the training data and generate bigrams. The frequency count of the bigrams was merged if the bigrams were identical, which are then converted into a conditional probability distribution that forms the language model.

In the third step of the algorithm, the language models generated from the input sample were evaluated using all possible candidates for every stress pattern identified in the frequency dictionary as test cases, choosing one that the language model deems most probable. To illustrate, let us use سِلْسِلَة ['sil.si.la] "a series" ['CVC.CV.CV] as an example. This word is trisyllablic, which suggests that there are three positions where stress is possible. First, stress patterns with identical syllabic structure but varying stress position to our possible candidates are generated. As shown in (2), candidates a, b and c all have the same syllabic structure [CVC.CV.CV] but vary in stress positions.

(2)



Accordingly, the language model calculated the probability for each candidate, which is tantamount to calculating $p('CVC|**)$ x $p(CV|'CVC)$ x $p(CV|CV)$ x $p(\#\#|CV)$ for candidate a, $p(CVC|**)$ x $p('CV|CVC)$ x $p(CV|'CV)$ x $p(\#\#|CV)$ for candidate b and $p(CVC|**)$ x $p(CV|CVC)$ x $p('CV|CV)$ x $p(\#\#|'CV)$ for candidate c. After the calculation, the language model choses the candidate that has the highest probability and outputs this candidate as the predicted stress pattern.

Lastly, this predicted stress pattern was compared with the stress pattern attested in the frequency dictionary. If the predicted stress pattern matches with the attested pattern, this means that the language model successfully produced the correct output; the count of correct prediction was then recorded. The same process was repeated for each stress pattern to examine the overall accuracy of prediction (henceforth accuracy). At the end of the process, the accuracy rate was calculated and outputted and the algorithm then moved to the next repetition; i.e., step 4 of the algorithm. 1000 repetitions were conducted for each size of the training data *S* at each level of input lost *L*.

As a result, this simulation generated 6 groups distinguished by various levels of input lost, capturing situations that were the most ideal to the least. Within each group, there were 27 subgroups varying in the amount of input from which language model was derived. Within each subgroup, there were 1000 accuracy rates outputted by 1000 distinctive language models. That is to say, through this simulation, I simulated 166 (6 x 27) groups of artificial learners that varied in the amount of input that they received with different degrees of input lost and 1000 individuals within each group. With this distribution of accuracy rates, this simulation allowed us to examine the developmental path of stress acquisition within a completely probabilistic setting.

Results

In Figure 8, the distribution of accuracy rates is grouped with 6 levels of input lost (shown in the line type) for all stress patterns identified in the frequency dictionary. In addition, the distribution of accuracy rates for chance was included in the figure. This distribution gives the accuracy of prediction given that all predictions are randomly made instead of going through a language model. That is, if the test case is a trisyllabic stress pattern, the chance model has 33% chance to choose either the first, the second, or the third as the stressed syllable without evaluating the syllabic structure and position of the word. The chance distribution serves as the baseline with which we can compare the performance among language models generated with various training data size *S* and input lost *L*.

Figure 8 shows that as the size of the training data *S* increases, the overall accuracy rate increases. This trend applies at all levels of input lost. The bigram model has higher accuracy than chance when the size of the training data is at 100 by a small margin and exceeds chance performance afterwards. In addition, language models with no input lost have slightly higher accuracy than language models with input lost, and the extent of performance seems to be negatively correlated with the degree of input lost, with the exception of input lost at the level of 40 as it seems to have similar accuracy as models without any input lost. As a result, the rate of correct prediction reaches approximately 90% assuming no input lost as opposed to approximately 80% assuming some input lost. Another interesting observation about the distribution is the decrease of variance as sample size *S* increases. It appears to be the case that at the very beginning, the performance of the language models is rather unstable where the rates of correct prediction yielded by the model have wider range of variance, demonstrated by the longer boxplot. The variance significantly decreases as the sample size increases, which is shown by the relatively shorter boxplot on the

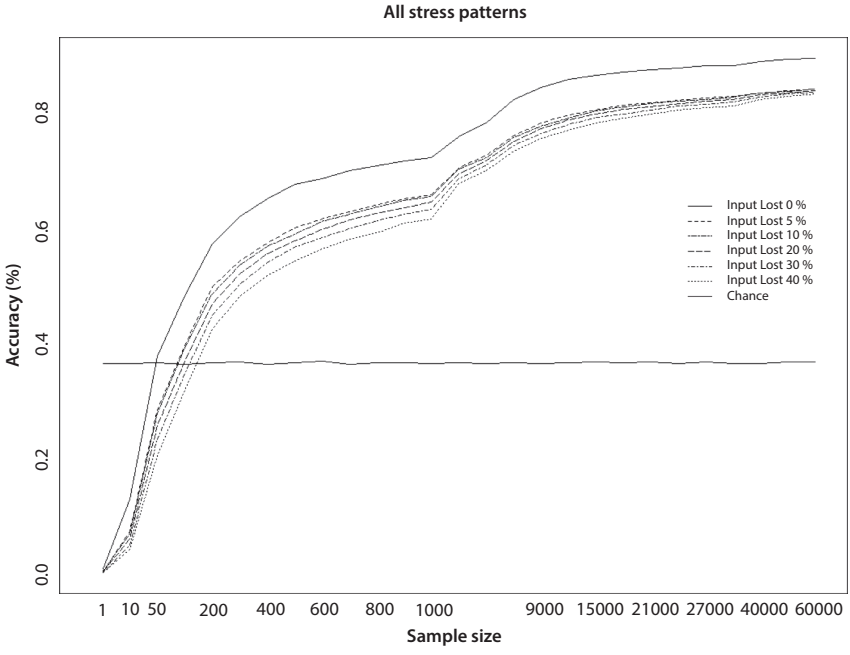


Figure 8. Accuracy of bigram models at various levels of sample sizes and input lost

right side of the graph. This pattern also seems to be true across different levels of input lost as well.

Looking at the results respectively for bisyllabic, trisyllabic and quadrisyllabic stress patterns, similar trends are found: performance beats chance at sample size 100, overall performance is better with no input lost, and performance increases/variance decreases as sample size increases. One interesting finding is that for bisyllabic stress patterns, the language models seem to perform very well. In the last stage of simulated acquisition when sample size is 60000, the accuracy of the language models is almost at ceiling and perfectly predicts where the stress should fall. As for the performance of the bigram for trisyllabic and quadrisyllabic words, a capable yet less strong performance was found, as the accuracy rates were, regardless of the level of input lost, approximately 80% at the last stage of simulation

To summarize this section, it could be said that the probabilistic language models perform rather well in predicting the position of stress. For most stress patterns, the language models could give a near perfect rate of correct prediction, whereas for some others, i.e. trisyllabic and quadrisyllabic, the language models could yield around 80% accuracy at later stages of simulation. The variance in performance also reduces as the model receives more input. These two trends seem to suggest that the language models do learn from the input and the underlying probability information, exhibiting improved and more stable accuracy

along the developmental path. This result is taken as an indication of grammar-like behavior, which does not actually involve rules or constraints in the first place. The result gives strong support for the viability of a completely probabilistic stress learning mechanism, one that could yield a comparable learning outcome as that of Universal Grammar.

Discussion

After the acquisition simulation, the first question which arises concerns the accuracy rate of the predictions. Precisely, why is it that the language model cannot reach 100 percent in prediction for all stress patterns? As seen in the previous section, the language model overall delivered accurate predictions approximately 90 percent of the time, where accuracy drops to approximately 80 percent when dealing with trisyllabic and quadrisyllabic words. There are a few possible explanations for this gap.

To begin with, the most obvious limitation is the lack of morphology involved in the training data, as the data were extracted from the frequency dictionary and dictionaries normally do not list all possible conjugations or permutation of the entries due to length constraint. This is particularly true for the frequency dictionary used in the study. Generally speaking, the dictionary presents the verbs as 3rd person singular, and only singular form is available if the entry is a noun. This minimal involvement of morphology could have introduced bias towards the frequency distribution of stress patterns derived from the dictionary, as it limits word length as well as possible combinations of different types of syllables, which could accordingly influence the simulation results. In the same vein, more involvement of morphology could introduce biases as well. The limited involvement of morphology in the data might be better as it creates a more controlled environment, since the influence from the morphological variation is better controlled. Moreover, more involvement from morphology could result in instances of stress shift, which might make the task even harder.

Secondly, although it has been more or less captured by the frequency distribution of the stress patterns, some stress patterns might need stronger weight than others. To be precise, bisyllabic and some trisyllabic stress patterns might need to appear more frequently than they actually appear in the frequency dictionary. This is due to the fact that the dictionary is composed of written texts which represent mature language use. The frequency distribution of stress patterns that a mature language user is exposed to should be different from that of a newly developed learning mechanism, as it is hard to expect that a newborn would hear trisyllabic or quadrisyllabic words more frequently than shorter ones from parents. Therefore,

equally taking the frequency distribution as it is at each stage of acquisition could be another bias that might influence performance.

The same bias applies to the assumed levels of input lost. It remains unclear whether input lost should be assumed across the board for all stress patterns. It is likely that some stress patterns would tend to stick better than the other; therefore, these stress patterns might not tend to be lost while some do. The input lost variable might be more dynamic than what is assumed in this study. To capture this variability, a more sophisticated and dynamic co-efficient, such as the adaptive learning algorithm (i.e., AdaGrad, Duchi, Hazan, & Singer, 2011) could be incorporated into the simulation.

Moreover, the bigrams derived from the stress patterns might need extra layers of contextual information. That is, the same bigram derived from a bisyllabic stress pattern might need to be marked as different from an identical bigram derived from a trisyllabic or quadrisyllabic stress pattern. This extra layer of contextualization would help disambiguate stress patterns that are intrinsically ambiguous. This ambiguous structure mostly happens in longer words with more than more than one repeated syllable internally. For example, if hypothetical stress pattern [CV.CV.CV.CV] is submitted to the language model, the model will not tell the difference between [CV.ˈCV.CV.CV] and [CV. CV.ˈCV.CV] since they are both P(CV|**) x P(ˈCV|CV) x P(CV|ˈCV) x P(CV|CV) x P(##|CV). Although this stress pattern is not attested in Arabic, such extra contextual information could be necessary for more precise prediction. However, it has to be noted that the even though more context could improve accuracy in some situation, it could also have the danger of overfitting the language model to the training data – an adverse situation which should be generally avoided.

Furthermore, it might be worthwhile to look at the frequency of stress patterns that the bigram model fails to predict. Figure 9 gives the average frequency count

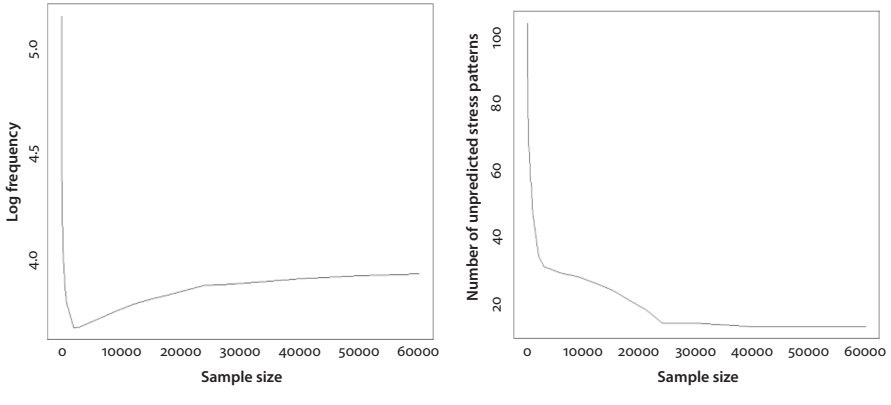


Figure 9. Number of unlearned stress patterns and its average frequency

in log space for the unpredicted stress patterns. It is shown that as sample size increases, the average log frequency of the unpredicted stress patterns decreases. In addition, Figure 9 gives the number of types of stress patterns that the language model failed to predict. Again, the number of unpredicted stress patterns seems to be negatively correlated with sample size. Put together, the two figures suggest that at the later stage of simulation, the stress patterns that still cannot be accurately predicted by the language model are the ones that are relatively infrequent. Due to the infrequent nature of these stress patterns, it might be the case that they were not sampled as input or at least not sufficiently sampled. As a result, the language model failed to learn to produce these stress patterns because of lack of sufficient exposure

Lastly, it remains unclear how the developmental path taken by the language model aligns with natural language acquisition. After all, artificial language acquisition is conducted in a relatively ideal environment where social and individual variables are not present. Besides, although the performance converges at later stages of simulation, it remains unknown whether the performance would improve by going beyond 60000 in sample size.

At this point, we seem to have raised more questions than what we have answered. However, the issues raised are concerned more about the performance of the model rather than the main objective of the present study. The purpose of the study, which needs to be highlighted again here, is not to optimize the language model, but to examine whether a fully probabilistic learning mechanism for Arabic stress is a viable one. Crucially, the results of the simulation support such probabilistic model, as the model exhibited learning through improved accuracy and reduced variance in prediction along the developmental path as more input was given to the model. These results of this artificial stress acquisition simulation provide great potentials and insights into natural language learning, in that a probabilistic language learning mechanism, in addition to other widely accepted learning paradigms, might in fact be at play in the process of acquisition as well.

References

Angoujard, J.-P.1990. *Metrical structure of Arabic* (Vol. 35). Walter de Gruyter GmbH & Co KG. https://doi.org/10.1515/9783110862959

Biber, D., Johansson, S., Leech, G., Conrad, S., Finegan, E., & Quirk, R. 1999. *Longman grammar of spoken and written English* (Vol. 2). MIT Press Cambridge, MA.

Bird, S. 2006. NLTK: the natural language toolkit. In *Proceedings of the COLING/ACL on Interactive presentation sessions* (pp. 69–72). Association for Computational Linguistics. https://doi.org/10.3115/1225403.1225421

Brooks, P. J., Braine, M. D., Catalano, L., Brody, R. E., & Sudhalter, V. 1993. Acquisition of gender-like noun subclasses in an artificial language: The contribution of phonological markers to learning. *Journal of Memory and Language 32*(1), 76–95. https://doi.org/10.1006/jmla.1993.1005

Broselow, E. I. 1976. *The phonology of Egyptian Arabic*. University of Massachusetts Amherst.

Buckwalter, T., & Parkinson, D. 2014. *A frequency dictionary of Arabic: Core vocabulary for learners*. Routledge. https://doi.org/10.4324/9780203883280

Coltheart, M., Curtis, B., Atkins, P., & Haller, M. 1993. Models of reading aloud: Dual-route and parallel-distributed-processing approaches. *Psychological Review* 100(4), 589. https://doi.org/10.1037/0033-295X.100.4.589

Cowell, M. W. 1964. *A reference grammar of Syrian Arabic: based on the dialect of Damascus*. Washington: Georgetown University Press. Retrieved from http://hdl.handle.net/2027/[u]:mdp.39015002674748.

Demuth, H. B., Beale, M. H., De Jess, O., & Hagan, M. T. 2014. *Neural network design*. Martin Hagan.

Duchi, J., Hazan, E., & Singer, Y. 2011. Adaptive subgradient methods for online learning and stochastic optimization. *Journal of Machine Learning Research* 12(Jul), 2121–2159.

Ellis, N. C. 2002. Frequency effects in language processing. *Studies in Second Language Acquisition* 24(02), 143–188.

Forster, K. I., & Chambers, S. M. 1973. Lexical access and naming time. *Journal of Verbal Learning and Verbal Behavior* 12(6), 627–635. https://doi.org/10.1016/S0022-5371(73)80042-8

Frisch, S. A., Large, N. R., Zawaydeh, B., Pisoni, D. B., & others. 2001. Emergent phonotactic generalizations in English and Arabic. *Typological Studies in Language* 45, 159–180. https://doi.org/10.1075/tsl.45.09fri

Gómez, R. L., & Gerken, L. 2000. *Infant artificial language learning and language acquisition*. *Trends in Cognitive Sciences* 4(5), 178–186.

Goodsitt, J. V., Morgan, J. L., & Kuhl, P. K. 1993. Perceptual strategies in prelingual speech segmentation. *Journal of Child Language* 20(2), 229–252. https://doi.org/10.1017/S0305000900008266

Gordon, M. 2000. Re-examining default-to-opposite stress. In *Annual Meeting of the Berkeley Linguistics Society* (Vol. 26, pp. 101–112). https://doi.org/10.3765/bls.v26i1.1153

Hochreiter, S., & Schmidhuber, J. 1997. Long short-term memory. *Neural Computation* 9(8), 1735–1780. https://doi.org/10.1162/neco.1997.9.8.1735

Jouravlev, O., & Lupker, S. J. 2015. Lexical stress assignment as a problem of probabilistic inference. *Psychonomic Bulletin & Review* 22(5), 1174–1192. https://doi.org/10.3758/s13423-015-0802-y

Jurafsky, D., & Martin, J. H. 2014. *Speech and language processing* (Vol. 3). Pearson London.

Kenstowicz, M. 1983. Parametric Variation and Accent in the Arabic Dialects in Papers from the Nineteenth Regional Meeting, Chicago 21–22 April 1983. In *Papers from the … Regional Meeting. Chicago Linguistic Society Chicago, Ill.* (pp. 205–213).

Kouloughli, D. E. 1991. *Lexique fondamental de l'arabe standard moderne*. Editions L'Harmattan.

Legate, J. A., & Yang, C. D. 2002. Empirical re-assessment of stimulus poverty arguments. *The Linguistic Review* 18(1–2), 151–162.

Lin, C.-W. 2018. The Perception and Production of Arabic Lexical Stress by Learners of Arabic: A Usage-Based Account (Ph.D Dissertation). University of Michigan, Ann Arbor.

Lin, C.-W., & Alhawary, M. T. 2018. Frequency Effects for the Perception and Production of Arabic Lexical Stress by L1 English and L1 Chinese Learners of Arabic as an L2. In M. T. Alhawary (Ed.), *The Routledge Handbook of Arabic Second Language Acquisition*. Routledge, 19–47.

Martin, W. A., Church, K. W., & Patil, R. S. 1987. Preliminary analysis of a breadth-first parsing algorithm: Theoretical and experimental results. In *Natural language parsing systems* (pp. 267–328). Springer. https://doi.org/10.1007/978-3-642-83030-3_8

Mitchell, T. F. 1975. *Principles of Firthian linguistics*. Prentice Hall Press.

Perfors, A., Tenenbaum, J. B., & Regier, T. 2011. The learnability of abstract syntactic principles. *Cognition* 118(3), 306–338. https://doi.org/10.1016/j.cognition.2010.11.001

Post da Silveira, A. 2011. Frequency as (dis) advantage to word stress acquisition. In *Proceedings of the ICPhS XVII 2011* (pp. 1634–1637). Hong Kong.

Prefors, A., Regier, T., & Tenenbaum, J. B. 2006. Poverty of the stimulus? A rational approach. In *Proceedings of the cognitive science society* (Vol. 28).

Prince, A., & Smolensky, P. 2008. *Optimality Theory: Constraint interaction in generative grammar*. John Wiley & Sons.

Pullum, G. K., & Scholz, B. C. 2002. Empirical assessment of stimulus poverty arguments. *The Linguistic Review* 18(1–2), 9–50.

Regier, T. 2003. Emergent constraints on word-learning: A computational perspective. *Trends in Cognitive Sciences* 7(6), 263–268. https://doi.org/10.1016/S1364-6613(03)00108-6

Regier, T. 2005. The emergence of words: Attentional learning in form and meaning. *Cognitive Science* 29(6), 819–865. https://doi.org/10.1207/s15516709cog0000_31

Romberg, A. R., & Saffran, J. R. 2010. Statistical learning and language acquisition. *Wiley Interdisciplinary Reviews: Cognitive Science* 1(6), 906–914. https://doi.org/10.1002/wcs.78

Smith, L., & Yu, C. 2008. Infants rapidly learn word-referent mappings via cross-situational statistics. *Cognition* 106(3), 1558–1568. https://doi.org/10.1016/j.cognition.2007.06.010

Treiman, R., & Danis, C. 1988. Short-term memory errors for spoken syllables are affected by the linguistic structure of the syllables. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 14(1), 145.

Versteegh, K. 2014. *The Arabic Language* (2 edition). Edinburgh University Press.

Watanabe, Y. 1997. Input, intake, and retention. *Studies in Second Language Acquisition* 19(3), 287–307. https://doi.org/10.1017/S027226319700301X

Watson, J. C. E. 2007. *The Phonology and Morphology of Arabic*. Oxford: Oxford University Press.

Appendix: Stress patterns and token frequencies for input data

Syllable Count	Stress Pattern	Frequency
2	'CVC.CV	1802718
2	CV.'CVVC	1447416
2	'CV.CVV	1434855
2	CVC.'CVVC	1040953
2	'CVV.CV	840941
2	'CVV.CVC	768614
2	'CV.CVC	600169
2	'CVC.CVC	530708
2	'CV.CV	448369
2	'CVC.CVV	416998
2	'CVV.CVV	233736
2	CVV.'CVVC	113578
2	CV.'CVCC	59463
2	'CVVC.CV	30412
2	CVC.'CVCC	15083
2	CVVC.'CVVC	3173
2	CVV.'CVCC	2237
2	'CCVV.CVC	1497
2	'CV.CVVCC	1153
2	'CVVC.CVC	339
2	'CCVV.CVV	314
3	'CV.CV.CV	864067
3	CV.'CVV.CV	755900
3	'CVC.CV.CV	467422
3	'CVV.CV.CV	360346
3	'CVC.CV.CVV	346827
3	CVC.CV.'CVVC	227574
3	CV.CVV.'CVVC	189205
3	CV.'CVC.CVC	177882
3	CV.'CVC.CVV	173685
3	'CVC.CV.CVC	162490
3	CVC.CVV.'CVVC	127696
3	CV.'CVV.CVC	115801
3	CV.'CVC.CV	95309
3	CVC.'CVV.CV	82425
3	CVC.CVC.'CVVC	53937
3	CVV.'CVC.CV	45859
3	CVV.CV.'CVVC	38997
3	CV.'CVV.CVV	35489
3	CVV.CVV.'CVVC	25837
3	CVC.'CVV.CVC	21029
3	'CVV.CV.CVV	18788
3	CV.CVC.'CVVC	17930
3	CVC.'CVC.CVC	12406
3	CVV.'CVV.CV	10566
3	CVC.CV.'CVCC	8903
3	CVC.'CVC.CVV	7356
3	CVV.CVVC.'CVVC	7003
3	CVC.'CVC.CV	6768
3	CCVV.CV.'CVVC	5140
3	'CVC.CCVV.CVC	3888
3	'CVC.CV.CCVVC	3461
3	'CV.CV.CVV	3080
3	CVV.'CVV.CVV	3005
3	'CVC.CCVV.CVV	2454
3	CVC.'CVVC.CVC	1930
3	'CV.CV.CVC	1628
3	CVV.'CVC.CVV	1024
3	CVV.CVV.'CVCC	1005
3	CVV.CVC.'CVVC	663
3	CVV.'CVV.CVC	492
3	CVC.'CVV.CVV	357
3	CV.CVVC.'CVVC	245
4	CV.'CVV.CV.CV	173118

Syllable Count	Stress Pattern	Frequency
4	CV.ˈCVC.CV.CV	131478
4	CVC.ˈCV.CV.CV	103996
4	CVC.CV.ˈCVV.CV	58926
4	CVC.CV.CVV.ˈCVVC	33031
4	CV.CV.ˈCVC.CVC	31820
4	CV.CV.ˈCVV.CV	30205
4	CV.CVC.CVV.ˈCVVC	28613
4	CVV.CV.ˈCVV.CV	21456
4	CVC.CVV.CVV.ˈCVVC	20134
4	CVC.CVV.ˈCVV.CV	18521
4	CVC.ˈCVC.CV.CV	13980
4	CVC.CV.ˈCVC.CV	10219
4	CV.CVC.ˈCVV.CV	7661
4	CV.CV.ˈCVV.CVC	7567
4	CVV.CVC.CVV.ˈCVVC	5737
4	CVC.CVV.ˈCVC.CV	5404
4	CV.CVV.ˈCVV.CV	3729
4	CV.CVV.CVV.ˈCVVC	3192
4	CVC.CVC.CVV.ˈCVVC	2779
4	CV.CVC.CCVV.ˈCVVC	2644
4	CV.CVV.CV.ˈCVVC	2386
4	CVC.CCVV.CVV.ˈCVVC	2258
4	CVV.ˈCVV.CV.CVV	1636
4	CVV.ˈCVV.CV.CV	1532
4	CVC.ˈCVC.CV.CVV	1258
4	CVV.CV.CV.ˈCVVC	1243
4	CVV.CV.CVV.ˈCVVC	1243
4	CVV.CVV.ˈCVV.CV	1110
4	CVC.CVC.ˈCVV.CVV	1061
4	CV.ˈCVC.CV.CVV	998
4	CVC.CCV.ˈCVC.CVV	622
4	CV.CV.CVV.ˈCVVC	550
4	CVV.CVV.CV.ˈCVVC	548
4	CVC.CV.ˈCVV.CVV	501
4	CVC.ˈCV.CV.CVC	409
4	CV.CV.ˈCVC.CVV	320
4	CVV.ˈCV.CV.CVC	291
4	CVC.ˈCVV.CV.CVV	281
4	CVC.CV.CV.ˈCVVC	241
4	CVC.CV.ˈCVVC.CVC	231

Subject index

This volume contains selected papers from the Thirtieth Annual Symposium on Arabic Linguistics that was held at Stony Brook University in 2016, as well as two articles that are based on papers presented at the Thirty-First Annual Symposium on Arabic Linguistics, held at the University of Oklahoma in 2017. The chapters are theoretical and experimental explorations of a variety of linguistic topics and engage ideas ranging over three broad areas of research: phonetics and phonology, syntax, and experimental and computational linguistics. They deal with Classical and Modern Standard Arabic as well as a variety of dialects, including Iraqi, Egyptian, Moroccan, and Syrian Arabic.

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