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The relationship between prosodic structure and pitch accent distribution: evidence from Egyptian Arabic.

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1. Introduction

The notion of a relationship between prosodic structure and the distribution of intonational pitch accents is well-established, although authors vary as to whether that relationship is more accurately conceived of as direct or indirect (Ladd 1996). This paper argues in favour of a direct relationship between prosodic structure and pitch accent distribution, along the lines of Ladd's (1996) prosodic-structure based, or "stress-first", analysis, but sets out empirical evidence suggesting that it is not always *phrase*-level prosodic structure that is at issue. In Egyptian Arabic (EA) every content word routinely bears a pitch accent (Hellmuth 2006b), but it is also a language with relatively large prosodic phrases (Hellmuth in press), and thus appears to challenge a phrase-level prosodic-structure-based analysis of pitch accent distribution. The patterning of pitch accents in EA can however be analysed by appeal to the Prosodic Word as the constituent level of the Prosodic Hierarchy which functions in EA as the domain of pitch accent distribution.

The outline of the paper is as follows: Section 2 reviews arguments that have been put forward in favour of a direct relationship between pitch accent distribution and prosodic structure and sets out briefly what is known to date about prosodic phrasing in EA; Section 3 describes the methodology used to collect and analyse the corpus data, presents the facts of pitch accent distribution and phrasing choices observed, and offers a constraint-based account of observed EA phrasing within Optimality Theory (Prince and Smolensky 1993); Section 4 explores the relative accentuation of content vs. function words in the corpus and shows that pitch accent distribution in EA can be captured by appeal to a prosodic domain (the Prosodic Word) rather than a morphosyntactic one (content words); Section 5 concludes the paper with discussion of some implications of potential cross-linguistic variation across levels of the

Prosodic Hierarchy in the relationship between prosodic structure and pitch accent distribution.

2. Prosodic phrasing and pitch accent distribution in Egyptian Arabic

2.1. The relationship between prosodic structure and pitch accent distribution

This paper defends a "prosodic-structure-based" approach to the relationship between pitch accent distribution and prosodic phrasing. In this approach, which has been termed a "stress-first" view (Ladd 1996: 221-223, cf. Selkirk 1984: 265), the positioning of pitch accents in an utterance reflects the utterance's prosodic structure. The *Designated Terminal Element* (DTE[1]) of each prosodic constituent at some relevant level of the prosodic hierarchy bears an intonational pitch accent, marking it out as relatively prominent within, or as the "head" of, some constituent, most often a phrase-level domain.

I adopt here a conception of prosodic structure in which prosodic constituents are mapped from morphosyntactic structure (Nespor and Vogel 1986, Selkirk 1986), and in particular of the constituents of the Prosodic Hierarchy (and the morpho-syntactic constituents they map from if applicable) as illustrated in the table in (1), after Selkirk (2005).

(1) The Prosodic Hierarchy

constituent		equates to:	maps from:
Utterance	U		
Intonational Phrase	IP		root sentence or sentence-external clause
Major Phonological Phrase	MaP	phonological phrase intermediate phrase	maximal projection (XP)
Minor Phonological Phrase	MiP	accentual phrase	syntactically branching constituent (two PWds)
Prosodic Word	PWd	phonological word	morphosyntactic word
Foot	Ft		
Syllable	σ		
Mora	μ		

[1] In metrical grid structure, the most prominent constituent within X is the *DTE* of X (Hayes 1995).

The particular set of individual constituent levels proposed is not crucial to a prosodic-structure-based analysis of pitch accent distribution. However, in order to encode relative prominence at one level as the marking of one element of the "next layer down", a prosodic-structure-based account does rely on two key elements of what has become known as the "Strict Layer Hypothesis" (Selkirk 1984: 26), namely that prosodic constituents are "layered" ("no constituent dominates a constituent at a higher level") and "headed" ("every constituent dominates a constituent at the next lower level") (Selkirk 1996).

The prosodic-structure-based view contrasts with two further views of pitch accent distribution in which the positioning of pitch accents reflects (more or less directly) the meaning of the utterance. In the syntactic-/semantic-structure-based view (dubbed "accent-first" Selkirk 1984: 265), the position of pitch accents is determined by the focus structure (rather than the prosodic structure) of the sentence, and in case of mismatches between the position of a focus and the position of default prominence, the prosodic structure adjusts accordingly (Gussenhoven 1983, Selkirk 1984). The third view departs completely from any grammatical involvement in the positioning of pitch accents, taking what might be termed a "functional" approach, in which speakers place pitch accents on whichever part of the utterance they wish to highlight at any particular time (Bolinger 1972, Chafe 1974, Halliday 1967), and has thus been dubbed the "highlighting based" view (Ladd 1996: 163-166).

Rich pitch accent distribution is not easily reconciled with either of the two meaning-related approaches to pitch accent distribution: if every content word is routinely accented (even in unemphatic contexts) this is hard to equate with a "highlighting" view of pitch accent distribution (in EA speakers routinely accent content words which are not particularly highlighted), nor with a semantic-syntactic structure-based analysis (EA speakers accent content words regardless of their focus status or predicate/argument status). Indeed a key

piece of evidence that Ladd (1996) cites against both of these views, and in favour of the prosodic-structure-based view, is that there are languages in which the presence of pitch accents does not necessarily mark focus, as has been shown to be the case in Egyptian Arabic (Hellmuth 2006a, 2006b).

However, this paper argues further that the accent distribution and phrasing facts of EA provide additional independent evidence in favour of the prosodic-structure-based view, if it is modified to allow pitch accents to mark prosodic heads at different levels of the Prosodic Hierarchy. The key notion in the prosodic-structure-based hypothesis is that there is a direct correlation between the pitch accent distribution and prosodic constituency. For example, Ladd (1996: 199,233) illustrates how it can explain otherwise puzzling cases of changes in pitch accent distribution. The sentence in (2) has two possible positions for the main accent, resulting in two interpretations of the sentence (Ladd 1996: 199,233, citing Halliday 1970). Gussenhoven (1980) characterised the two interpretations as an eventive reading, in (2a) "You must have a dog and carry it", vs. a contingency reading in (2b) "If you have a dog, you must carry it".

(2) a. DÓGS must be carried.
b. Dógs must be CÁRRIED.

Ladd (1996: 233) argues that the number of pitch accents here indicates the number of phrases into which the sentence is divided: when the sentence is composed of a single phrase, there is a single primary accent: |DÓGS must be carried|; when the sentence is composed of two phrases however there are two primary accents, of which the rightmost receives main relative prominence in the utterance: |Dógs|must be CÁRRIED|. The definition of primary accent that Ladd gives for these English examples is the main prominence (DTE) of the Intermediate Phrase (equates here to the Major Phonological Phrase, though see Gussenhoven (2004: 167) for a different view).

Similarly, Ladd suggests that in a very emphatic rendition of an English sentence, where every word bears a primary accent, each word is mapped to an individual phrase: again, the number of phrases equals the number of accents (Ladd 1996: 249):

(3) A: Everything OK after your operation?
B: Don't talk to me about it.
H* L H* L H* L H*L-L%
The bútcher chárged me a thóusand búcks!

The idea that the distribution of tonal events directly reflects prosodic structure is inherent also to ideas proposed in work on intonational phonology regarding the distribution of pitch events. Pierrehumbert & Beckman (1986, 1988) suggested that the position of pitch accents and phrase-/boundary-tones *directly* reflects the position of the heads and edges of a hierarchy of intonationally defined prosodic constituents (Accentual Phrase, Intermediate Phrase and Intonational Phrase). Pierrehumbert & Beckman do not specify to what extent their hierarchy of prosodic constituents is the same as that which in other theories is constructed as a result of the interface with syntactic structure (Nespor and Vogel 1986, Selkirk 1986). Many authors have however adopted what Frota (2000) terms an "integrated view", in which the prosodic hierarchy which results from the interface with syntax is indeed the same prosodic structure to which intonational pitch events are sensitive[2], and this hypothesis is adopted here.

In this integrated view of prosodic structure, pitch accent distribution can be used as a diagnostic for prosodic phrasing. In a study of phrasing and focus in European Portuguese (EP) Frota (2000: 186-9) appeals to the relationship between pitch accent distribution and prosodic phrasing, to distinguish between the predictions of the relation-based and edge-based theories of prosodic phonology (Nespor and Vogel 1986, Selkirk 1986, respectively). She notes that this is possible because: "the way in which a sequence.. is phrased.. determines

[2] Mismatches between the prosodic representations cued by intonation and by other cues are reported by Dresher (1994) and Gussenhoven and Rietveld (1992); cf. also Ladd (1996: 237-246).

which patterns of pitch accent distribution may or may not be implemented" (Frota 2000: 187). Frota analyses variant accentuation patterns observed in complex NPs, elicited in both subject and object position of target sentences. On the assumption that the rightmost word in each Phonological Phrase (≈MaP) must bear an accent, and that all other accents are optional, the possible accent distribution patterns Frota predicts under each theory's phrasing algorithms are as shown in (4) below. Frota uses a different formulation of the Prosodic Hierarchy to that listed in (1) above, and her original terminology is used here, with equivalents noted in brackets in the discussion below. The phrasing pattern predicted by the relation-based mapping in (4a) is argued to yield exactly those patterns of pitch accent distribution that are observed, and predicts as ungrammatical exactly the accentuation pattern which is never observed (Frota 2000: 176):

(4)	a.		|uma progressiva subida|$_{PP}$		|dos preços|$_{PP}$	*relation-based*
			PA	PA	PA	
			-	PA	PA	
		*	PA	-	PA	
	b.		|uma progressiva subida dos preços|$_{PP}$			*edge-based*
			-	-	PA	
			-	PA	PA	
		*	PA	-	PA	
			PA	PA	PA	

Crucially, for our present purposes, Frota's argument turns on the assumption that there must be at least one pitch accent in every Phonological Phrase (≈MaP) (Frota 2000: 188) and she thus successfully appeals to patterns of pitch accent distribution as evidence of prosodic phrasing. Other authors who have used pitch accent distribution as a diagnostic to determine prosodic phrasing include Selkirk (2000) for English and Post (2000) for French.

2.2. Prosodic phrasing in Egyptian Arabic

Egyptian Arabic (EA) is defined here as the dialect of Arabic spoken in Cairo and by educated speakers throughout Egypt. The spoken dialect is used in informal and familiar contexts and has no agreed written form, and co-exists alongside Modern Standard Arabic which is written and spoken in formal settings. The syntax and segmental/metrical phonology of EA are well-described (see surveys in Benmamoun 2000, and Watson 2002, respectively).

In contrast, prosodic structure above the level of the word in EA has receively relatively less attention. An exception is Watson (2002) who, in a survey of segmental phonological rules, notes for each rule the prosodic domain within which it is observed to apply. However, she also notes that most sandhi processes of this type are subject to considerable speaker variation in EA. As an alternative, Hellmuth (in press) sought to identify intonational cues to phrasing in EA and found those listed in (5) below:

(5) Cues to phrasing observed in Egyptian Arabic (Hellmuth in press)

frequent cues to phrasing	*occasional cues to phrasing*
phrase-initial local pitch reset	pause
phrase-final lengthening	failure of epenthesis
phrase-final pitch accent lowering	
high or low phrase tone (H- or L-)	

The phrasing study in Hellmuth (in press) was based on a corpus of read speech SVO sentences from two speakers, in which the syntactic complexity and prosodic weight of both subject and object was systematically varied. In addition to the core dataset, additional sentences were recorded in which parenthetical expressions were inserted to help decide what level of phrasing was being cued, since it has been observed that parenthetical expressions induce a full intonational phrase (IP) boundary at their right edge (Nespor and Vogel 1986, Frota 2000). To supplement the evidence from tonal cues, epenthesis contexts were placed across potential phrase boundaries throughout the stimuli. Epenthesis applies systematically in EA, and robustly across speakers, to break up sequences of three consecutive consonants,

reportedly across word boundaries within a domain larger than the phonological phrase (PP) (Watson 2002: 64).

The aim of the phrasing study was to determine to what extent syntactic complexity and prosodic weight influence prosodic phrasing in EA, patterned on a comparative study of phrasing in Romance languages (Elordieta et al. 2003). The results observed in EA were similar to those observed by Elordieta et al. for Standard European Portuguese (SEP): the majority of sentences in EA were produced within a single large prosodic phrase, regardless of syntactic complexity and prosodic weight. A key question, however, is what constituent level of the Prosodic Hierarchy this phrase represents.

A small number of utterance-internal phrase boundaries, and thus shorter instances of the prosodic phrase, were observed in the phrasing corpus. It was possible to identify these as MaP boundaries on the basis of evidence from epenthesis, which failed only at boundaries flanking epenthetical expressions, suggesting that epenthesis applies across MaP boundaries within the intonational phrase (IP). There is also a theoretical argument that the observed phrase breaks are MaP-level boundaries, since, on the rare occasions when a phrase break was observed, the break invariably fell between the subject and verb (at the right edge of the subject lexical projection). Treating these as MaP breaks is thus consistent with Truckenbrodt's (1999) assertion that cross-linguistically the level of phrasing sensitive to syntactic maximal projections is an instantiation of the Phonological Phrase (notated here as MaP).

Thus the study found that the overwhelming majority (91%) of target SVO sentences were produced in a single, large MaP: |SVO|. Those sentence-internal boundaries that did occur fell between the subject and the verb: |S|VO|. A break in any other position, particularly between verb and object, was never observed: *|SV|O|. The lack of phrasing breaks in EA cannot be explained by reference to morpho-syntactic structure alone, since all of the main

syntax-phonology interface theories predict a phrasing break between subject and verb in SVO sequences with an overt object (Nespor and Vogel 1986, Selkirk 1986, Inkelas and Zec 1995, Selkirk 2000, Truckenbrodt 1999), and it was notable that none of the sentence-internal phrases that were produced contained fewer than four Prosodic Words (PWd). Hellmuth (in press) attributes this to a well-formedness constraint on prosodic structure, favouring phrasings in which all MaPs are minimally branching and thus composed of two Minor Phrases (MiP), each of which is in turn composed of two Prosodic Words (PWd)[3]: BINMAP$_{MiP}$ "A Major Phrase consists of two Minor Phrases" (Selkirk 2000).

The prosodic well-formedness constraint is shown nonetheless to *interact* with syntax-phonology interface constraints, which have been shown to be sensitive to the edges of syntactic maximal projections (Selkirk 1986, Selkirk 2000, Truckenbrodt 1999). The presence of MaP boundaries at the right edge of the subject XP, yielding |S|VO|, and the systematic absence of such boundaries at the left edge of the object XP, *|SV|O|, indicate that right-edge sensitivity is at work in EA, which is captured by means of the constraint: ALIGN R XP,MAP "For each XP there is a MaP such that the right edge of XP coincides with the right edge of MaP" (Selkirk 2000).

In EA then, MaP-level prosodic phrases in read speech sentences have been shown to be large, and this has been attributed to the effects of the constraint BINMAP$_{MiP}$ which outranks ALIGN XP,R: MaP phrase breaks fall at the right edge of XPs, but only when all of the resulting phrases are of sufficient prosodic weight (minimally four PWds)[4]. The indications are then that MaPs in EA are large, and certainly not co-extensive with the PWd, yet already in Hellmuth (in press) it was noted that a pitch accent was observed on every content word in the read-speech sentences. Subsequent studies have confirmed that rich pitch

[3] By analogy with characterisation of MiP in Japanese as a node that branches into two words (Kubozono 1993).

[4] Compare the phrasing facts observed in Hebrew (Shaked this volume) in which ALIGNXP outranks BINMAP.

accent distribution is characteristic of EA across a range of speech styles (Hellmuth 2006b), and it has been noted informally of EA by a number of other authors (Heliel 1977, Mitchell 1993, Rifaat 1991, El Zarka 1997).

This combination of properties (rich pitch accent distribution and large prosodic phrases) conflicts with a purely phrase-level prosodic-structure-based analysis of pitch accent distribution, unless one argues that in EA phrases almost universally contain only a single word. It also contrasts with the array of prosodic properties observed in two varieties of European Portuguese, in which phrasing and pitch accent distribution appear to correlate: Southern/Standard European Portuguese (SEP) has sparse pitch accent distribution and large prosodic phrases, whereas Northern European Portuguese (NEP) has rich pitch accent distribution and small prosodic phrases (Vigario and Frota 2003). The present study explores the empirical facts of EA phrasing and pitch accent distribution further, in a newly-collected corpus, in order to resolve these challenges to the prosodic-structure-based hypothesis.

3. Pitch accent distribution and prosodic phrasing in a corpus of spoken EA

3.1. Methodology

The aim of the present study is to investigate whether or not EA pitch accent distribution can be explained in terms of prosodic structure, in accordance with the prosodic-structure-based hypothesis. A corpus of narrative read and semi-spontaneous speech was collected, with the aim of establishing both pitch accent distribution and phrasing from within one corpus, but in a speech style which would be conducive to accentuation of fewer words, if felicitous[5]. In fully unscripted speech, sentences are in general neither prosodically long nor syntactically complex, and thus not necessarily conducive to elicitation of useful phrasing generalisations. A narrative text was therefore chosen for further investigation because it contains stretches of

[5] Cf. Face (2003) for Spanish, who observed fewer pitch accents in spontaneous speech than "lab" speech

text but without punctuation marks in the orthography (as is usual in written Arabic), so speakers are at liberty to assign whatever prosodic phrasing they choose.

The chosen narrative was a folk tale "Guha and the banana seller", written in Egyptian orthography, taken from an EA textbook (Abdel-Massih 1975). EA orthography is not fully standardised but differs sufficiently from MSA orthography that speakers had no difficulty in producing the desired register of speech, and the colloquial content of the story also helped ensure this. The narrative consists of 30 sentences (13 simplex, 11 complex and 6 conjoined) and contains 15 instances of complex noun phrases. The full text is reproduced in transliteration and translation in Hellmuth (2006b).

The narrative was recorded with two female and three male native speakers of EA, who were born and raised in Cairo. All were at pre-intermediate level or lower in English and without speech or hearing deficits, and were naïve to the purpose of the study. Speakers were asked to read the story naturally, as if to a friend, and were asked to do so three times in order to facilitate the final task, which was to re-tell the folk tale from memory. Digital recordings were made using ProTools 6.0/MBox at 44.1KHz 16bit, re-sampled to 22.05KHz 16bit for analysis.

For each speaker the second reading (usually the most fluent) and the semi-spontaneous re-telling were prosodically transcribed by the author, with reference to F0 track and spectrogram extracted using Praat 4.2. The working hypothesis during transcription was that the basic EA pitch accent is rising, and such accents were provisionally notated as LH* (see Hellmuth (2006b) for discussion of the appropriate phonological representation of this pitch accent). The following boundary and phrase tones were transcribed:

(6)

H%	L%	indicating the right edge of an Intonational Phrase (IP)
H-	L-	indicating the right edge of a Major Phonological Phrase (MaP)

Phrase-final “nuclear” accents in EA often resemble a falling rather than rising pitch movement (for example on the final word in Figure 3 below). Such cases were analysed as early peak alignment of a standard LH* pitch accent, due to tonal crowding from IP-final boundary tones as well as proximity of the strong prosodic boundary (IP) (cf. Chahal 2001, Prieto et al. 1995). Since the primary purpose of the present investigation was to establish the distribution of pitch accents, subsequent re-analysis of the phonological representation of these “nuclear” pitch accents would not alter the facts of their distribution, nor thus the resulting generalisations claimed here.

In addition to these pitch events, other aspects of the pitch contour were also transcribed, the detail of which were deemed to be potentially relevant, as listed in (7) below. These included possible cues to juncture or prominence, such as pause, lengthening, increased/reduced pitch excursion, and the presence of level pitch throughout a word or morpheme. For each word or morpheme which was not associated with a rising pitch movement, the probable direction of cliticisation was transcribed (either leftwards to the preceding content word, or rightwards to the following content word). In reality the direction of cliticisation was frequently hard to establish and so represents only a best estimate.

(7) Notation used during auditory transcription

LH*	pitch accent
H-/L-	phrase tones
H%/L%	boundary tones
>/<	cliticises rightward/leftward
---	level pitch throughout word
=	lengthening
~	pause
↑/↓	H peak in expanded/compressed pitch range
→	suspension of downstep (H peak at same height as previous peak)
xxx	word in written text omitted from spoken rendition.

The most common cues to phrasing observed in the narratives corpus were boundary tones, such as H- or L-, pauses and local pitch reset, and following Hellmuth (in press), as

discussed above, these are analysed here as marking the edges of MaP level phrasal constituents. The transcription yields three levels of analysis: i) a count of the number of content words which bear a pitch accent, ii) a survey of phrasing generalisations, and iii) a survey of the relative accentuation of content vs. function words.

3.2. Results: observed pitch accent distribution

Over 95% of content words in the narratives were accented, as shown in the table in (8) below. Whenever there was a borderline case (accented vs. unaccented) it was counted as unaccented, so these distributional counts represent the most conservative estimate, from the point of view of the hypothesis that EA accents every content word.

(8) Counts/percentages of unaccented content words (all speakers).

	# content words	# unaccented content words	% accented content words
read narratives	1055	32	97.0%
re-told narratives	686	29	95.8%
Total	*1741*	*60*	*96.5%*

Words counted as content words were nouns, verbs, adjectives and adverbs. The verb [kaan] 'to be' can function as an auxiliary verb or copula verb in Arabic and was counted as a function word in both of these roles. The verb [raaH] 'to go' is also used in EA with auxiliary function, but was counted as a function word only when used in this sense; when used as a verb of motion it was classified as a content word (some speakers used [raaH] in the retold narratives). Prepositions were classified as function words.

The generalisation (that every content word is accented) holds across all five speakers: the speaker who left most content words unaccented (speaker *miz*) nonetheless accented over 94% of content words.

(9) Unaccented content words and percentage accented content words, by speaker.

count (unaccented words/total content words):	fna	fsf	meh	miz	mns
read narrative	6/211	7/211	1/211	8/211	10/211
re-told narrative	6/133	1/134	10/158	9/114	3/147
Total accented content words (%)	*96.5*	*97.7*	*97.0*	*94.8*	*96.4*

The degree of consistency across speakers and across the whole dataset suggests that it is not appropriate to consider some of the observed pitch accents as "optional". Instead it seems that in EA in normal speech every content word is required to bear a pitch accent. The corpus successfully elicited idiomatic speech in the colloquial register, as can be seen by comparing read and re-told versions of parallel sections of the story (illustrated in examples 11 vs. 12/13 below); increased naturalness of this kind is the main difference between the two test types. Sample pitch tracks of extracts from the corpus are in Figures 1-3 below.

3.3. Results: observed prosodic phrasing

The phrasing facts observed in the narratives corpus are consistent with the claim that EA has large phrases. For example, moderately long/complex monoclausal sentences are phrased into a single MaP, such as the example in (10), which shows the transcription and phrasing of a 5PWd monoclausal sentence[6].

(10) Speakers' read speech phrasings of a 5PWd monoclausal sentence.

speaker	guħa	kaːn	ʈuːl	ʕumr	-uh	ʕaːjiʃ	fi	-l-	ʔarijaːf
fna	LH*	---	LH*	LH*	<	LH*	<	<	!LH*
fsf	LH*	<	<	LH*	<	LH*	<	<	!LH* L-L%
meh	LH*	<	(LH*)	LH*	<	LH*	<	<	LH* H-
miz	LH*	<	LH*	LH*	<	LH*	<	<	LH* H-
mns	LH*	<	<	LH*	<	LH*	<	<	LH* L-

guħa	kaːn	ʈuːl	ʕumr	-uh	ʕaːjiʃ	fi	-l-	ʔarijaːf
Guha	was	all	life-	his	living	in	the	villages
[[NP]	AUX	[AdvP		]	[V	[PP		]]]$_S$

[6] MaP boundaries are shown here enclosed within vertical lines: |MaP|, and a gloss and syntactic analysis is provided; the transcription conventions used are those set out in (7) above; "xxx" indicates an omitted word.

‘Guha had lived all his life in the countryside.’

There is also evidence to confirm that the right edges of VP-internal XP boundaries do not trigger a MaP phrase boundary, and thus that the effects of the interface constraint ALIGNXP are obscured in EA. For example, in (11) below, which shows speakers’ read narrative phrasings of a 4PWd monoclausal sentence with VP-internal XPs, there is no MaP boundary at the right edge of the NP [kiilu] ‘kilo’.

(11) Read speech phrasings of a complex 4PWd monoclausal sentence.

speaker	ʔana	ʕawz	ʔawzin	-lak	kiːlu	bi-	balaːʃ
fna	>	↑LH*	LH*	<	LH*	<	!LH* L-L%
fsf	>	LH*	LH*	<	LH*	<	!LH* L-L%
meh	>	LH*	LH*	<	LH*	<	!LH* L-L%
miz	>	LH*	LH*	<	LH*	<	LH* L-L%
mns	>	LH*	LH*	<	LH*	<	!LH* L-L%

ʔana	ʕawz	ʕawzin	-lak	kiːlu	bi-	balaːʃ
I	want	to-weigh	for-you	a-kilo	for-	free
[[NP]	[V	[V	[PP]	[NP]	[PP	]]$_{VP}$]$_{vP}$]$_{S}$

‘I will weigh you out a kilo for free!’

This treatment of complex XPs is maintained in speakers’ spontaneous (retold) narrative productions. For example, (12) and (13) show the same sentence, in spontaneous retellings by speakers *fsf* and *meh*, which are phrased into a single MaP.

(12) Single MaP phrasing (retold by speaker *fsf*) of a complex clause.

ʔana	mumkin	ʔakuːn	badːiːk	kiːlu	bi-	balaːʃ
>	LH*	LH*	LH*	H*	<	!LH* L-L%
I	maybe	could	give-you	a-kilo	for	free
[[NP]	ADV	AUX	[V	[NP]	[PP	]]$_{VP}$]$_{S}$

‘I could maybe give you a kilo for free.’

(13) Single MaP phrasing (retold by speaker *meh*) of a complex clause.

ʔeh	raʔjak	ʔadːiːk	kiːlu	moːz	bi-	balaːʃ
LH*	LH*	→LH*	→LH*	LH*	<	!LH* L-L%
what	your-opinion	I-give-you	a-kilo	bananas	for	free

[NP NP t [C [V [NP] [PP]]$_{VP}$]$_{CP}$]$_S$
'How about if I give you a kilo of bananas for free?'

These results are therefore consistent with the analysis that in EA a preference for branching prosodic phrases (BINMAP$_{MiP}$) outweighs the effects of the interface constraint (ALIGNXP). Thus the 5PWd monoclausal sentence in (14a) below (analysis of (10) above) cannot be subdivided at the MaP level because the resulting MaPs would contain less than two MiPs (assuming that MiPs must also be minimally branching), and the sentence is rendered by all speakers in a single MaP[7]:

(14) Phrasing analysis: two observed renditions of a 5PWd monoclausal sentence

a. l([gúɦa]) (ken [ʈúul] [ʕúmr-uh]) ([ʕáajiʃ] [f-il-ʔarijáaf]$_{PWd}$)$_{MiP}$ l$_{MaP}$
b. l([gúɦa] ken ʈul [ʕúmr-uh]) ([ʕáajiš] [f-il-ʔarijáaf]$_{PWd}$)$_{MiP}$ l$_{MaP}$
Guha was all life-his living in-the-country
'Guha had lived all his life in the countryside.'

Note that in (14) there is slight variation in pitch accent distribution between different speakers: speakers *fna* and *miz* accent the word [ʈuːl] 'all', whereas *fsf* and *mns* leave it unaccented (with a possible accent on the word for speaker *meh*). In neither case, however, is there sufficient prosodic material to form more than one well-formed MaP. The same key claim regarding EA phrasing thus hold in the narratives corpus as was proposed in Hellmuth (in press) on the basis of read sentences: prosodic well-formedness constraints outweigh interface alignment constraints (BINMAP$_{MiP}$ >> ALIGN XP,R).

MaP phrases are large in EA, and yet in them each content word is routinely accented. The analysis appeals to MiP as a domain relevant in EA phonology, but again in all cases both content words in an MiP are routinely accented, so it is unlikely to be the domain of pitch

[7] Pitch accents are indicated with an acute accent mark eg [Túul]; PWd boundaries are indicated by square brackets [PWd], MiP boundaries by round brackets (MiP), and MaP boundaries by vertical lines lMaPl.

accent distribution in EA[8]. In terms of the prosodic-structure-based hypothesis then, it is not possible to use pitch accent distribution as a diagnostic of MaP- or MiP-level phrasing in EA, as Frota (2000) did for EP. Revisiting example (10) again, and assuming (as Frota did) that an obligatory pitch accent indicates the right edge of a MaP (or even of a MiP), the observed pitch accent distribution would suggest that in EA each MaP (or MiP) contains only a single content word:

(15) Observed pitch accent distribution in a 5PWd monoclausal sentence in EA.

	guħa	kaːn	tuːl	ʕumr	-uh	ʕaːjiʃ	fi	-l-	ʔarijaːf
a)	*		*	*		*			*
b)	*			*		*			*

Unlike the English example in (3) above, in EA this type of rendition of a sentence is not emphatic at all, but rather the norm, and the consistency of the distribution of pitch accents suggests that it is unlikely that all but one of these accents are "optional".

In EA then, pitch accent distribution seems not to be predictable on the basis of prosodic structure at the phrase-level, as was possible in EP and English. The next section explores accentuation of function and content words in order to determine whether it is possible to maintain the prosodic-structure-based hypothesis by analysing EA pitch accent distribution in terms of an alternative potential candidate member of the Prosodic Hierarchy: the Prosodic Word.

4. The syntax-phonology interface at the word-level in Egyptian Arabic

4.1. Results: accentuation of function vs. content words in a corpus of spoken EA

[8] Compare the facts of Brazilian Portuguese, in which every content word is accented, unless optionally re-phrased into two word groupings; in these cases only one word in the phrase is accented (Tenani 2005).

Function words in the dataset fall into three groups: i) function words which are always unaccented, ii) function words which are usually unaccented, and, iii) function words which are usually accented. A summary list is provided in the table in (16) below.

(16) Treatment of function words in the corpus

always unaccented		usually unaccented (varies)		usually accented	
[il]	the	[min]	from	[ʔinn-uh]	that-it
[fi]	in	[ʕala]	on, at	[ʔinn-ak]	that-you
[bi]	with/by	[fiː]	there is	[ʕalaʃaːn]	in order to
[ma]	[...] as	[miʃ]	not	[lissa]	just/soon
[ja]	vocative	[wala]	or	[ʕalajjːa]	to me
[maː]	negative	[bass]	only	[ʕalajk]	to you
[law]	if	[illi]	that (rel. pron.)	[ʕalajh]	to him
[ʔaw]	or	[ʔinna]	that (comp.)		
[wa]	and	[da]/[di]	that (deictic) m./f.		
		[ɣeːr]	except		
		[ʕaʃaːn]	in order to		
		[bajn]	between		
		[taħt]	under		
		[baʕd]	after		
		[bitaːʕ]	belonging to		
		[ʔana]/[ʔinta]	I/you(m.)		
		[ʔiHna]/[huwwa]/[hijja]	we/he/she		
		[kunt]/[kaːn]/[kaːnit]/	I/he/she was		

Function words which are never accented include the definite article [il] ‘the’, prepositions [bi] ‘with/by’ and [fi] ‘in’, vocative [ja] (e.g. [ja guħa] ‘hey Guha!’), negative particle [ma] ‘not’ (first part of the discontinuous negative circumfix [ma + ʃ]), and connectives [wa] ‘and’, [law] ‘if’ and [ʔaw] ‘or’. Some of these are listed by Watson (2002: 93) as ‘unstressable morphemes’, including [il] ‘the’ and [wa] ‘and’, and Mitchell (1990: 127-8) similarly notes that there are particles which are not themselves stressed but which are usually treated as part of the following noun or verb without affecting accent (he lists prepositions [bi] ‘with/by’, [fi] ‘in’ and the complementizer [ʔan] ‘to’). The property that all

of these "unaccentable" function words share is that they are prosodically subminimal. The minimal word in EA is obligatorily bimoraic, in order to form a stress foot which in EA is a moraic trochee (Broselow 1976, Hayes 1995, Watson 2002), and consonant extrametricality applies, so that in a monosyllable a singleton coda does not render the syllable heavy (Hayes 1995, Watson 2002). There are no surface violations of minimality whatsoever in EA[9], and subminimal cognate words in other dialects, as also subminimal loanwords, are invariably prosodically enhanced in EA, via gemination, vowel lengthening or epenthesis (Watson 2002: 88-9). All of the function words in the corpus which are invariably unaccented are subminimal, and thus are not PWds.

Function words which are prosodically of sufficient size to form a stress foot and thus are inherently stressable but are nonetheless usually unaccented include the "pseudo-verb" [fii] 'there is', the complementizer [ʔinna] 'that', the relative pronoun [illi] 'that', all forms of the auxiliary verb [kaːn] 'to be' and all pronouns. Similarly prepositions which are prosodically large enough and inherently stressable yet are usually unaccented include: [ɣeːr] 'except', [bajn] 'between', [ʕaʃaːn] 'in order to', [taħt] 'under' and [ʕala] 'to/on/at'. Some function words which are occasionally accented are in fact subminimal, such as the preposition [min] 'from', deictics ([da]/[di] 'that' m./f. and the negation particle [miʃ] 'not', which is the continuous form of the discontinuous negative circumfix [ma + ʃ]. However when these are accented they are prosodically enlarged by cliticisation to adjacent material; for example the preposition [min] 'from' is only optionally accented when followed by the definite article as in the sequence [min-il] 'from the'.

Function words which are almost invariably accented include inflected forms of complementizers and prepositions such as [ʔinn-uh] 'that-he'/[ʔinn-ak] 'that-you' and

[9] Hayes (1995: 87) termed this an absolute ban on "degenerate feet".

[ʕalayya] ‘to me’/[ʕalajk] ‘to you’. These are of sufficient prosodic size to form fully stressable words and in addition they share the property that they also incorporate pronominalised arguments, which may make them more prone to bearing an accent[10]. The prepositional phrase [ʕala ʃaːn] ‘in order to’ is routinely accented on the word [ʃaːn] ‘cause/condition’, in contrast to its lexically equivalent abbreviated counterpart [ʕaʃaːn] ‘in order to’, which is usually (though not always) unaccented. This suggests that [ʕala ʃaːn] is analysed by speakers as a full prepositional phrase comprising the preposition [ʕala] plus the lexical word [ʃaːn], whereas the foreshortened version [ʕaʃaːn] is analysed by speakers as a function word.

In summary, subminimal function words in EA are never accented, but even potentially stressable polymoraic function words are usually unaccented. Function words which are usually accented are polymoraic but also inflected and arguably incorporate a lexical head.

(17) Accentuation of function words in EA: summary

	accented if subminimal	accented if bimoraic
uninflected function words	×	× optionally “promotable”
inflected function words	×	✓
lexical (content) words	✓	✓

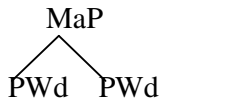
4.2. Results: accentuation of every content word or every Prosodic Word in EA?

Selkirk (1996) offers an analysis of the prosodic realisation of weak monosyllabic function words in English in which she proposes four possible prosodic structures for function words, illustrated in (18) below.

(18) The prosodic realisation of function words (Selkirk 1996)

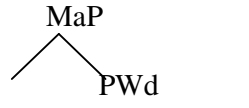
[10] This matches the observation by Mitchell (1990: 127-8) that inflected particles are regularly accented.

i)



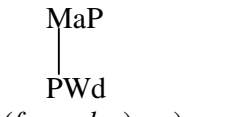
((*fnc*)$_{PWd}$ (*lex*)$_{PWd}$)$_{MaP}$ function word = “PWd”

ii)



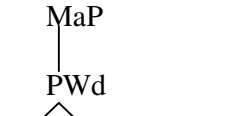
(*fnc* (*lex*)$_{PWd}$)$_{MaP}$ function word = “free clitic”

iii)



((*fnc* *lex*)$_{PWd}$)$_{MaP}$ function word = “internal clitic”

iv)



((*fnc* (*lex*)$_{PWd}$)$_{PWd}$)$_{MaP}$ function word = “affixal clitic”

This section argues for a “free clitic” analysis of unaccented function words in EA, based on empirical evidence to exclude the other structures proposed by Selkirk (1996) for function words: unaccented function words do not attain independent PWd status, nor are incorporated into the PWd with a lexical word as an internal or affixal clitic. As a result it becomes possible to characterise the distribution of pitch accents in EA in terms of the distribution of Prosodic Words (rather than specifically of content words). What is the diagnostic for PWd status in EA? Setting aside the claim of this paper that accentuation itself is a diagnostic of PWd status, another clear diagnostic is available, since in EA as in English the domain of stress assignment is the PWd (Watson 2002). The empirical evidence in favour of a free clitic analysis for EA unaccented function words thus comes from the facts of word stress and related phenomena.

Unaccented words can be shown independently also to be unstressed (and thus not to be PWds) by virtue of the fact that they undergo a process of unstressed vowel shortening (USVS) (Watson 2002: 226-7). As an example, compare accented [túul] ‘all’ vs. unaccented

[ʇul] in (19a) vs. (19b) below (repeated from 14 above). Pitch tracks and spectrograms for a sample of each type of production of this sentence are provided in Figures 1 and 2 below.

(19) Phrasing analysis: two observed renditions of a 5PWd monoclausal sentence

a. l([gúħa]) (ken [ʇúul] [ʕúmr-uh]) ([ʕáajiʃ] [f-il-ʔarijáaf]$_{PWd}$)$_{MiP}$ |$_{MaP}$

b. l([gúħa] ken ʇul [ʕúmr-uh]) ([ʕáajiš] [f-il-ʔarijáaf]$_{PWd}$)$_{MiP}$ |$_{MaP}$

Guha was all life-his living in-the-country

'Guha had lived all his life in the countryside.'

[Figure 1 & 2 go here]

The fact that an unaccented word is also unstressed excludes the possibility of analysing it as an independent PWd. Since function words are almost always unaccented there are no minimal pairs to demonstrate that unaccented function words undergo USVS. However, Watson (2002: 226-7) notes that when the long vowel in question is a mid vowel [eː] or [oː][11], after USVS the resulting short vowel is raised: [eː]> [i]; [oː] > [u]. In instances of the function word /ɣeːr/ 'except', which is almost invariably unaccented, the mid vowel [ɣeːr] is both shortened and raised resulting in [ɣɪr], as illustrated in Figure 3 below. Thus the unaccented function word is shown independently to be also unstressed.

[Figure 3 goes here]

In order to exclude the possibility that unaccented function words are incorporated into the PWd with a lexical word (either as an "internal" or "affixal" clitic) the evidence is again from stress assignment. Affixes which are fully incorporated into the PWd induce

[11] Words containing [ee] and [oo] in EA are cognate with Classical Arabic words containing diphthongs [ay] and [aw] respectively.

stress-shift in EA, in contrast to non-stress-shifting affixes in (rural) Palestinian Arabic (Abu-Salim 1983: 94):

(20) Stress shift under affixation in EA (cf. no stress shift in Palestinian Arabic)[12]:

		EA	PA
'cow'	/baqara(t)/	[ˈbaʔara]	[ˈbagara]
'your cow'	/baqara(t)-ak/	[baˈʔartak]	[ˈbagartak]

Unaccented function words do not induce stress-shift in adjacent lexical words in EA, and thus cannot be analysed as incorporated into a preceding or following PWd (that is, they are neither affixal nor internal clitics). The examples in (21) show that unaccented function words do not induce rightward stress-shift; those in (22) show that although a trisyllabic word composed of three open syllables (CVCVCV) in EA is stressed on the first syllable, stress does not shift leftwards onto a CV monosyllabic function word pro-cliticised to a CVCV disyllable, as in (22b) taken from the narratives corpus.

(21) a. talá:ta sá:ɣ wa ma fí:ʃ ɣe:r kída (three piastres and no more)
b. * talá:ta sáɣwa...
* talá:ta saɣwáma...

(22) a. ʕágala (bicycle) ɣánama (sheep) málika (queen)
b. fa (so) + gúħa (Guha) → fagúħa (so Guha) *fáguħa

I suggest therefore that unaccented function words in EA should be analysed as free (pro-) clitics to an adjacent (accented) lexical word with PWd status. Selkirk's analysis of free clitics places them within a higher phrase-level constituent. What evidence is there in EA that unaccented function words procliticise to the following lexical word (as opposed to enclisis to a previous lexical word)? The consensus in the literature is that Arabic function words form a prosodic unit with following rather than preceding material (see inter alia Al-Ani 1992, Rifaat

[12] The final [t] of /baqara(t)/ is part of the feminine marker 'ta-marbuta' and is unpronounced when not linked to a following genitive. Both [ʔ] and [g] are common dialectal variants of Classical Arabic [q].

2004, Watson 2002), and this is a key argument in favour of a proclitic analysis of unaccented EA function words. The surface phonetic realisation observed on function words in the corpus survey yields little additional evidence. The pitch accent itself takes the form of a rising pitch movement which is closely tied to the stressed syllable, and in most cases, after the rising pitch accent, pitch simply falls gradually towards the start of the next stressed syllable, across whatever unstressed syllables intervene, regardless of which PWd they belong to. The pitch contour thus reveals very little information about the exact position of the edges of PWds, nor, as a result, of the directional affiliation of unstressed syllables.

Proclisis in English is argued to arise due to a constraint which prefers structures with a PWd edge right-aligned to the phonological phrase edge: Align(MaP, R; PWd,R) "For any MaP in the representation, align its right edge with the right edge of some PWd". Given the assumption that the correct direction of cliticisation of function words in EA is rightwards, I suggest that the function word cliticises to the lexical word (which has PWd status) within a constituent of the "next level up" in the Prosodic Hierarchy, and that the correct alignment constraint to capture EA pro-cliticisation is as follows:

(23) Align(MiP, R; PWd,R): For any MiP in the representation, align its right edge with the right edge of some PWd.

4.3 Summary

Although section 3 established that the distribution of pitch accents in EA cannot be captured in terms of the distribution of prosodic constituents at the phrase level, the evidence set out in this section indicates that it is possible to capture the distribution of pitch accents in EA in terms of obligatory accentuation of the head of some prosodic constituent. In EA the relevant constituent is the Prosodic Word, and the generalisation "the head of every PWd must bear an accent" captures the distribution of pitch accents in EA completely. Thus the domain of pitch accent distribution in EA is the Prosodic Word.

5. Discussion and conclusions

The evidence from phrasing and from relative accentuation of content and function words in EA suggests that a prosodic-structure-based analysis can account for pitch accent distribution in EA if we appeal to the Prosodic Word (PWd) as the relevant domain of pitch accent distribution in this language. In turn this suggests that the domain of pitch accent distribution could in principle vary across all of the levels of the Prosodic Hierarchy. What evidence is there to suggest that such variation is in fact observed? As already mentioned, in Brazilian Portuguese (BP) there is mostly a pitch accent on every content word, but under optional phrasing of two adjacent lexical words together only one of these is accented (Tenani 2005); thus the MiP could be the relevant domain of pitch accent distribution in BP. Other languages that appear to mark every PWd include Bininj Gun-Wok (Bishop 2002) and Iwaidja (Birch 2006). Additional research is needed to ascertain whether variation among intonation languages in the domain of pitch accent distribution should be considered the norm or typologically unusual.

Proposing that the domain of pitch accent distribution may in principle vary across different levels of the Prosodic Hierarchy predicts pitch accent distribution to be logically independent of prosodic constituency at the specifically phrasal level. Hence it is possible to have languages in which pitch accent distribution and phrasing appear to be correlated (as observed by Vigario and Frota 2003 for NEP, which has many pitch accents and (many) small phrases, and SEP, which has fewer pitch accents and (fewer) large phrases), and other languages in which these two properties are not related, as observed in EA.

In addition, in languages in which phrasing and pitch accent distribution interact closely, and thus that the domain of pitch accent distribution is a phrase-level constituent and that pitch accents mark relative prominence at the phrase-level, we expect to see interaction

between pitch accent distribution and focus (assuming focus to expressed in terms of structural prominence (Truckenbrodt 1995)). Interaction of this kind is widely reported particularly in the Germanic languages (for a survey see Ladd 1996 chapter 5). In contrast, in languages in which the domain of pitch accent distribution is a word-level constituent, and pitch accents thus mark word-level prosodic prominence, we expect to see alternative means used to indicate phrase-level structural prominence or focus. This has been shown to be the case for EA in which purely gradient means of focus expression are reported (Hellmuth 2006a, 2006b).

In conclusion then, this paper argues that variation in the domain of pitch accent distribution across levels of the Prosodic Hierarchy can only be formalised within a prosodic-structure-based conception of the mechanisms underlying pitch accent distribution. Evidence from EA (and other similar languages which may yet come to light), in which pitch accent distribution is apparently insensitive to prosodic phrasing, in fact strengthens the case in favour of a formal relationship between pitch accent distribution and prosodic structure, at a phrasal or other level.

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Words (including footnotes, figures and abstract): 8728
Characters (including spaces): 56380

Figure 1 Accented /ʈuul/ shows has a long vowel: [ʈuul] (*fna2*)

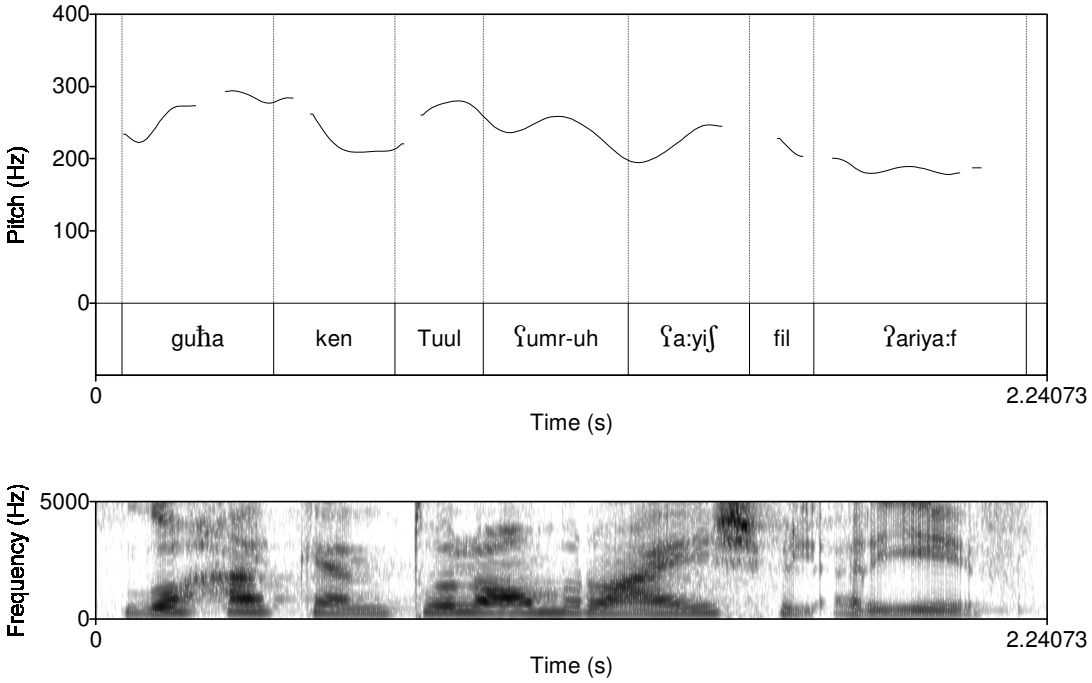


Figure 2 Unaccented /ʈuul/ shows vowel shortening: [ʈul] (*fsf2*)

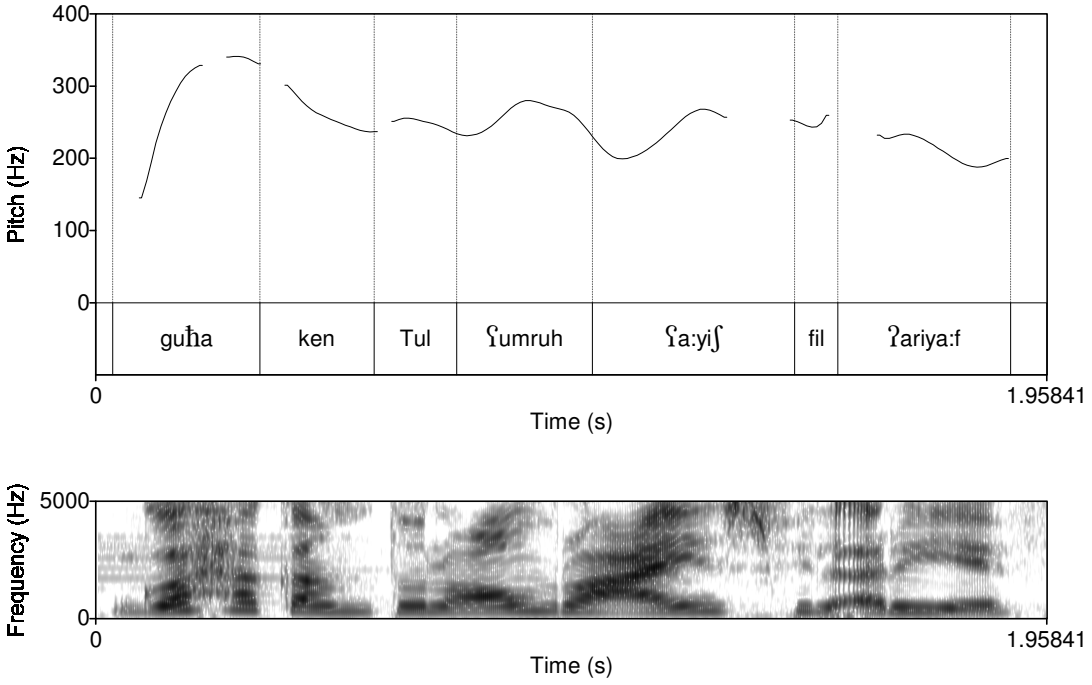
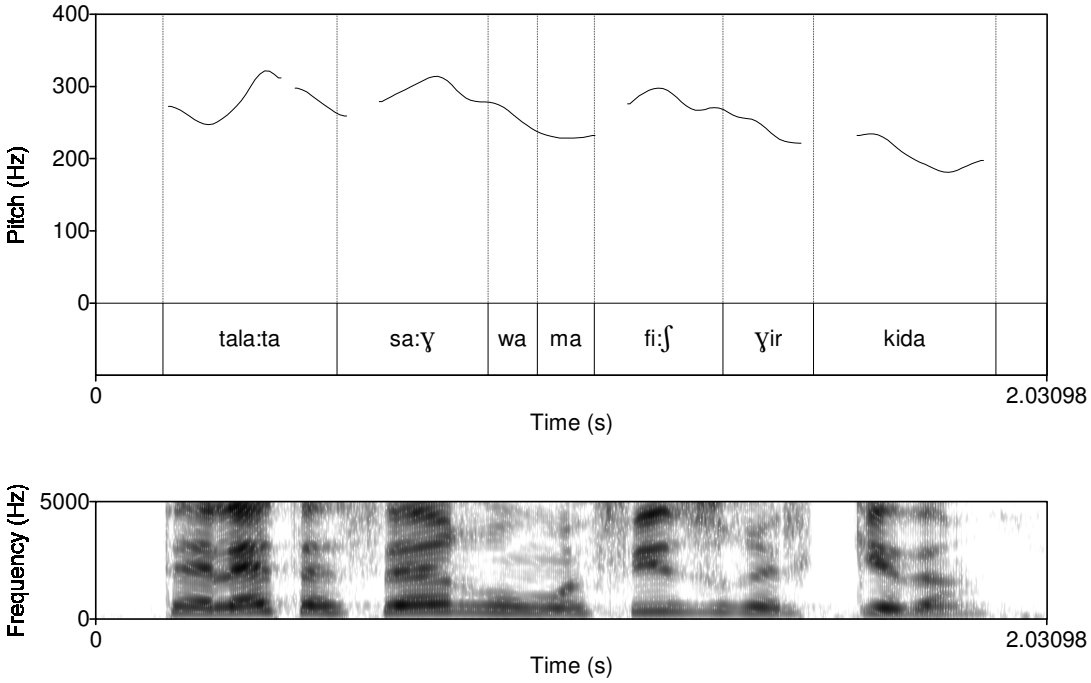


Figure 3 Unaccented /ɣeːr/ shows vowel shortening and raising: [ɣɪr] (*fsf2*)



tala:ta	sa:ɣ	wa	ma	fi:ʃ	ɣeːr	kida
three	piastres	and	NEG	there-is	except	that

'Three piastres, and not a penny more'