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The intonation of Lebanese and Egyptian Arabic*

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X.1 Introduction

In this chapter, we describe aspects of the prosody of two Arabic dialects which have been studied within the Autosegmental-Metrical (AM) framework, namely (Tripoli) Lebanese Arabic and (Cairene) Egyptian Arabic. We do not claim to provide a model for Arabic intonation in general, nor a model of Arabic dialectal intonational variation, since research in this field is still largely unexplored[1]. Instead, we outline our independent findings for Lebanese and Egyptian Arabic (based on Chahal (2001) and Hellmuth (2006b) respectively) and compare the results of this research wherever possible. We show that significant variation between Arabic varieties exists and needs to be taken into account in an overall intonational model of the language.

The LA data reported on in this chapter illustrates the variety spoken in the Northern city of Tripoli as used by seven educated urban speakers. The LA corpus comprises read data obtained from two controlled experiments examining issues of tonal alignment, phonetic correlates of prominence and focus (totaling 2970 utterances) and quasi-natural data elicited from a map-task conversation (in line with the HCRC map-

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[1] For a summary of broad literature findings on various Arabic dialects, see Chahal (2006).

task, Anderson et al, 1991) containing approximately 75 utterances. The EA data comprise read laboratory speech collected with 15 speakers for two controlled experiments (504 read speech utterances, for studies of tonal alignment and focus), a narrative folk tale (Abdel-Massih 1975) read and re-told from memory by six speakers (cf. use of Cinderella in Grabe et al. 1998), containing approximately 300 utterances, and two spontaneous dyadic telephone conversations (Karins et al. 2002) containing approximately 335 utterances. The examples presented here for EA are from spontaneous speech, unless noted.

X.2 Metrical phonology

Arabic is classified as a stress accent language[2] (McCarthy 1979; Watson 2002). In both LA and EA, intonational pitch accents phonologically associate with lexically stressed syllables. As in most Arabic varieties, the location of lexical stress is predictable and quantity-sensitive: Stress falls on a final syllable if it is superheavy (CVVC or CVCC; Table X.1a), else on a heavy penultimate (CVV or CVC; Table X.1b). The varieties also share a tendency towards rightmost stress: since very few dialects allow more than three consecutive open syllables, word stress is rarely found

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[2] We define a stress accent language as one in which pitch does not form part of the lexical specification of any morphemes, but may feature among the phonetic correlates of prominent positions in metrical structure, whether at the word- or phrase-level (Hyman 2001, Yip 2002). We use the term 'stress' to denote a word-level lexical prominence and 'accent' to denote a stressed word which in addition bears an intonational pitch accent.

earlier than on the antepenult[3]. This in turn means that a single level of primary stress is usually posited (e.g. Brame, 1971; Halle & Vergnaud, 1987; Abdul-Karim 1980)[4].

While the stress facts of LA and EA are largely similar, different surface patterns are observed in words without a superheavy final or heavy penult, for example in a word with a heavy antepenult followed by two light syllables (cf. LA [ˈmadrase] vs. EA [madˈrasa] "school" in Table X.1c)[5]. This difference is formalized by Hayes (1995: 181, 69) in terms of foot extrametricality in LA vs. consonant extrametricality in EA. Another difference between the two varieties is that stress assignment is sensitive to word-internal morphological boundaries in LA but not in EA, yielding minimal pairs distinguished by stress in LA, but not in EA (Fischer & Jastrow 1980; Table X.1d).

Table X.1 Word-level stress assignment in LA and EA.

	LA	EA	gloss
a)	ʔaˈmart	ʔaˈmart	I ordered
	xaˈliːg	xaˈliːg	gulf
b)	ˈmʕallim	muˈdarris	teacher
	biˈdeːje	biˈdeːja	beginning
c)	ˈmadrasa	madˈrasa	school
	ˈdarasu	ˈdarasu	they studied

[3] See van der Hulst & Hellmuth (to appear) and Watson (to appear) for an overview of Arabic metrical phonology.

[4] However, rhythmically derived secondary stress has been argued for some varieties including EA (e.g. Welden 1980, Rastegar-El Zarka 1997). See Hayes (1995) for discussion.

[5] For full stress algorithms see AbdulKarim 1980 for LA and Watson 2002 for EA.

d)	ˈʃatəmto	ʃaˈtamto	she cursed him
	ʃəˈtamto	ʃaˈtamto	I cursed him

Descriptions of the phonetics of stress in different dialects of Arabic generally observe that Arabic dialects display tonal (increased F0) as well as non-tonal correlates, such as duration, amplitude and vowel formant characteristics (e.g. Mitchell (1960) for EA; de Jong & Zawaydeh (2002) for Jordanian Arabic; Al-Ani (1992) for Sudanese, Saudi, Moroccan and Iraqi Arabic). A difficulty in many such studies, however, is that of disambiguating whether the reported tonal correlates represent a word-level or phrase-level cue to prominence.[6]

To avoid this problem, for LA, Chahal (2001; 2003) identified three levels of prominence (by auditory analysis) in a corpus of broad and narrow focus utterances: lexically stressed but unaccented syllables, lexically stressed and accented syllables, and nuclear accents (defined as the last, most prominent accent in a phrase). In both focus conditions, and all else being equal, syllables at higher levels of prominence showed higher F0 and/or higher RMS values, and/or longer duration, and more peripheral F1 and F2 vowel formant characteristics than the lower level (ANOVA results significant at $p<0.001$).[7] By differentiating between phrasal (accents and nuclear accents) and word-level prominence (lexically stressed but unaccented

[6] Cf. Beckman & Edwards (1994).

[7] Note that although F0 is found to be the main correlate of prominence level for narrow focus utterances, it is not so for broad focus utterances. This is due to the "flat hat" contours (t'Hart et al, 1990; see Fig. X.3b) employed by speakers, in which all test words (whether auditorily analyzed as unaccented, accented or nuclear accented) are realized with the same high flat F0 stretch (see also X.5).

syllables), these experiments thus confirm that phrasal prominence in LA is cued by both tonal and non-tonal correlates.

In EA, investigation of the correlates of strictly word-level prominence is difficult to investigate, since word-level stress and accentual prominence are conflated (see below). A small study by Hellmuth (2006b), following Keane (2006), compared segmentally parallel syllables in different positions in words,[8] and found that mean values of duration, F0 and intensity were higher in stressed/accented syllables than in unstressed syllables ($p<0.01$).[9]

The evidence to date therefore suggests that phrase-level prominence in LA and EA is cued by both melodic and dynamic correlates, as also reported for other dialects. This matches the typological classification of Arabic as a stress-accent (rather than pitch accent) language, in the sense of Beckman (1986; cf. also Ladd 2008).

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[8] It is not possible to reproduce Beckman's (1986) methodology, which relies on the availability of accentual minimal pairs (which are not found in EA), nor the methodology of more recent studies on stress correlates in other Arabic dialects (Zuraiq 2005, Bouchouia 2006), which rely on the availability of post-focal deaccenting (again, not found in EA; see X.5.2).

[9] The target syllables in this study contained high vowels which when unstressed are expected to undergo vowel reduction (Watson 2002); vowel centralization was indeed observed in such cases but could be seen as phonological rather than as a phonetic correlate of prominence.

X.3 Prosodic structure

X.3.1 LA prosodic structure

X.3.1.1 Prominence hierarchy

As indicated above, three paradigmatic levels of prominence are posited for LA: lexical (or word-level) stress, pitch accent and nuclear accent prominence. Lexical stress denotes lexically stressed but unaccented syllables occurring within the Prosodic Word (PWd, see below) and is assigned phonologically according to the rules discussed in X.2 above. Only one level of word stress is adopted, secondary stress generally assumed not to occur in LA (Abdul-Karim, 1980). This makes the lexically stressed syllable the head of the PWd constituent in the language.

The pitch accent level denotes syllables which, for discourse reasons, receive an intonational tone - a pitch accent - rendering them more prominent than their unaccented counterparts. A phonotactic constraint in LA licenses the association of pitch accents only to syllables that are specified to be stressed at the word-level (although function words may be promoted to accent-bearing status in specific pragmatic contexts). However, unlike in EA, while stressed syllables in PWds form the potential landing sites for pitch accents, not every stressed syllable will bear a pitch accent in LA.

Finally, the nuclear accent level denotes the highest prominence level, whereby among pitch accented syllables within an intermediate phrase (iP), the final pitch accent receives the most prominence. Post-nuclear pitch accents in the same iP are phonotactically impermissible in LA, as evidenced by the deaccenting of accentable material within the same iP following early nuclear accent placement (see X.5.1 0 belowfor further details). The fact that the nuclear accent is the final most prominent syllable within an iP suggests that in LA nuclear accents form the heads of their iPs and that their assignment within these phrases is right-headed.

While lexically stressed and nuclear accented syllables form the heads of PWds and iPs respectively in LA, it is unclear whether pitch accents similarly head a specific prosodic unit such as accentual phrases in languages like Korean (Jun 1996) or French (Jun and Fougeron 1995)[10]. The observation that not every PWd obligatorily bears a pitch accent serves to rule out the PWd as the domain of pitch accent distribution in LA. Conversely, the question of what forms the prosodic head of the IP in LA is still undetermined. It is currently unclear whether relative prominence relationships exist among a number of nuclear accents in iPs forming a single IP (see X.5.1 for further discussion of this point).

X.3.1.2 Constituency hierarchy

The constituency hierarchy proposed for LA is composed of three post-lexical prosodic constituents: the intonational phrase (IP), the intermediate phrase (iP), and the prosodic word (PWd).

As in other Arabic dialects, the PWd in LA is a constituent characterized as the domain in which lexical stress is assigned (see X.2 above). The PWd usually consists of a content word (a word stem and affixes) which may additionally be cliticized.

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[10] As pointed out by Jun (personal communication), while prosodic phonology theory generally assumes the existence of a head for each prosodic unit, not all analyses adopt this assumption. This is the case for i) English, where pitch accents do not seem to form the head of a particular domain and ii) non-stress languages which do not display heads for each prosodic unit.

Clitics typically include mono-syllabic function words such as the definite article /ʔel/ “the” and the conjunction /w/ “and”. Similarly to Modern Standard Arabic (MSA) and EA, the definite article in LA seems to encliticize to a preceding PWd even though it syntactically forms part of the following word (Al-Ani, 1992; Watson, 2002). Clitics in LA are not stressed and do not enter into stress assignment rules (Abdul-Karim, 1980). This observation further emphasizes that only one level of lexical stress occurs in the PWd in LA and that, consequently, only one pitch accent is expected to occur within this constituent.

The IP is another well attested prosodic constituent, which is usually coextensive with a syntactic sentence. It forms the highest level of tonally demarcated phrases in the language, being marked at its right edge by the boundary tones L% or H% (see X.4.1.3 for illustrations). The present LA model proposes that every IP is composed of at least one iP, an iP generally corresponding to a syntactic phrase (e.g. NPs, VPs or PPs). For example, in the test sentence /lama ħamet muna min lima/ “Lama protected Muna from Lima”, iP boundaries are commonly inserted after the NPs “Lama” and “Muna” and the PP /min lima/ “from Lima” (e.g. Fig. X.8)[11].

Evidence for the iP in LA is based on, i) the presence of tones delimiting the right edge of the phrase– phrase accents, ii) the domain span phenomena of pitch accent distribution and relative prominence relations and iii) boundary strength effects.

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[11] Since an exhaustive and non-recursive constituency hierarchy is assumed in the current model (e.g. Selkirk 1984; Nespor and Vogel 1986; Truckenbrodt 2007), the right edge of an IP will be coextensive with that of the final lower-level iP, giving rise to two post-nuclear edge tones.

In terms of phrasal tonal cues, in LA, iPs are tonally-marked at their right edges by one of three possible phrase accent types: L-, H- and !H- (see X.4.1.3 for illustrations). In long-tailed utterances, phrase accents not only display a local turning point at the edge of the iP, but also a non-local realization around the end of the nuclear accented word, analyzed here as secondary association with the final syllables of that word. In Fig. X.4b, for example, the flat stretch of pitch occurring between the rising (L+H*) nuclear accented word /ˈʕallamet/ ("taught") and the final H% rise at the end of the IP is analyzed as the manifestation of an H- phrase accent demarcating the end of the iP and displaying secondary association with the end of the nuclear accented word /ˈʕallamet/. The behavior of the LA phrase accent is thus similar to that displayed by phrase accents occurring in languages such as Hungarian, Romanian, Greek and English (Grice et al, 2000).

The iP in LA also illustrates the domain span phenomena of nuclear accent distribution and relative prominence relations. As discussed in X.3.1.1, every iP contains at least one accented word which serves as the nuclear head of the phrase, making the iP the domain in which nuclear accents are assigned in the language. Furthermore, if more than one pitch accent occurs within an iP, these display relative prominence relations such that the right-most pitch accent in the iP–the nuclear accent– is the most prominent.

The iP (as well as the PWd and IP constituents) receives further justification from relative boundary strength cues. Chahal (2001) found phrase-final lengthening effects such that for each of the investigated constituents, a boundary-final accented syllable displayed longer duration than its non-boundary-final counterpart (ANOVA results significant at $p<0.001$ for all four tested speakers). More importantly, the duration of an accented syllable is affected by the strength of the prosodic boundary in the vicinity of which it occurs: An accented syllable located at the end of IPs is significantly longer in duration than corresponding syllables found at iP boundaries, and the latter are in turn significantly longer than corresponding syllables found at PWd edges ($p<0.001$)[12].

In the same experiment, tonal alignment was found to constitute an additional correlate of prosodic boundaries in LA: Accented words occurring at the end of IPs displayed the earliest H peak alignment within the accented syllable, followed by those occurring at the end of iPs, followed by those occurring at the edge of PWd boundaries ($p<0.001$). The three boundaries are distinguished in this fashion regardless of whether the accented syllable is in boundary-final position or in a position further away from the right edge of the boundary ($p<0.01$ or better).

Finally, both the iP and IP seem to constitute the domain of pitch reset in LA (the general declination of high peaks observed within these phrases may be reset at the beginning of a new phrase) and can be followed by pauses. Impressionistically, the extent of the reset and pausing seems to be affected by the strength of the boundary (cf. degree of pitch reset observed in EA, see X.3.2.2 below). Future experimental verification of such boundary strength phenomena may provide further evidence for distinguishing the proposed constituency levels.

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[12] Note, however, that the experiment did not control for accents in pre-pausal versus non pre-pausal position or accents in non-utterance versus utterance final position, factors which have been shown to affect syllable duration in languages such as European Portuguese (Frota 2000).

The following diagram illustrates the post-lexical prosodic constituency hierarchy proposed for LA.

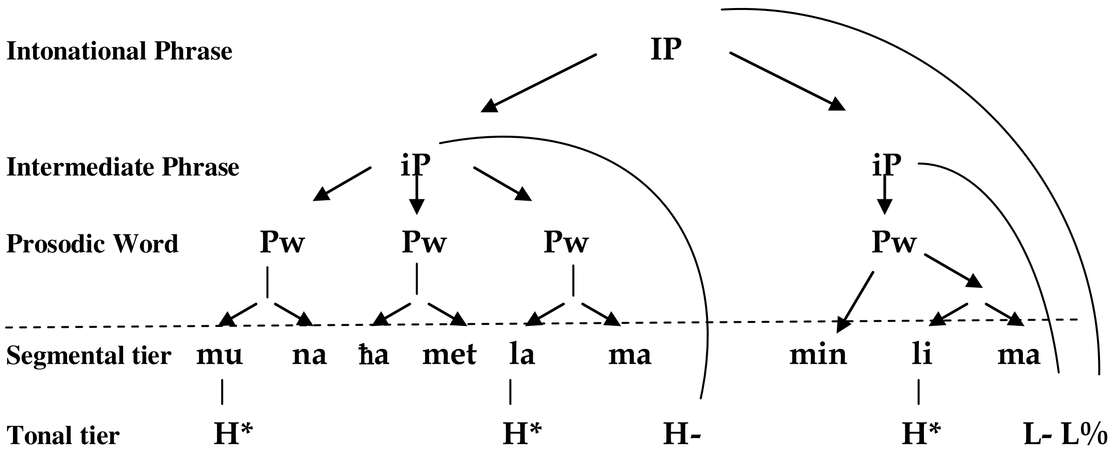

Fig. X.1 A metrical representation of the prosodic hierarchy in LA, illustrated for the utterance /ˈmuna ˈħamet ˈlama min ˈlima/ "Muna protected Lama from Lima". This utterance is produced as two iPs within a single IP. In the first iP /muna/ and /lama/ are pitch accented, in the second /lima/ is accented. The intonational structure of the utterance is: H* H* H- H* L-L%.

X.3.1.3 Two levels of phrasing?

As indicated above, the evidence for positing two levels of phrasing for LA (iPs and IPs) is based on tonal, relative prominence, and boundary strength phenomena. The tonal evidence in particular explains why two post-nuclear tones may be found in LA contours following the nuclear accented syllable: the two tones are the reflexes of a final iP phrase accent and an IP boundary tone. Two such post-nuclear tones can be seen in the fall-rise and high-rise occurring in the stylized continuation and YNQ tunes respectively (Fig. X.4 and Fig. X.7). The distinction between iPs and IPs also explains why such complex pitch configurations are not found medially in an IP: the phrase accent and boundary tone can only co-occur at the end of an IP; phrase-medially, only one of the mono-tonal phrase accents occurs.

One could argue for the elimination of the iP phrasing level by analyzing the phrase accent, i) as a trailing tone of a bitonal nuclear accent (e.g. H*+L or L*+H) as suggested for languages such as English (e.g. Ladd 1983) and European Portuguese (e.g. Frota 2000), or, ii) as part of a bitonal IP boundary tone as proposed for languages such as Bengali (Hayes and Lahiri 1991) and Dutch (Gussenhoven and van der Vliet 1999). However, the tonal alignment of LA phrase accents does not support either of these bitonal analyses. In the experiment reported on in X.3.1.2 above, for example, preliminary observations of the pitch following the accented words occurring at the right edge of iPs indicate that the pitch falls at the end of the iP (i.e. at the right edge of the accented word) whether the accented syllable is in word-initial, medial or final position. While experimental verification is required, this observed alignment reflects an edge-marking characteristic, not a prominence-related one such as that expected of trailing tones.

Similarly, whereas bitonal boundary tones are expected to align at the absolute right edge of the IP they are delimiting, relevant LA contours do not display this alignment characteristic: In long-tailed falling-rising contours in LA, the pitch following the nuclear accented syllable does not fall gradually until the very end of the IP (where the potential LH% bitonal boundary would be realized) but rather falls towards the right edge of the nuclear accented word, remains flat till the end of the iP, and then rises again for the final H% boundary tone (Fig. X.7 provides an illustration of this flat stretch in a one-word utterance). To explain this flat stretch, one could posit secondary association between the first of the bitonal boundary tones and the edge of the nuclear accented word (as is implicitly proposed by Grice et al. 2000). However, this alternative analysis has difficulty accounting for why these bitonal boundary tones are restricted in distribution, i.e. why they never occur phrase-medially (recalling that IP-medial units show less tonal complexity than IP right edges).

In summary, positing two levels of phrasing in LA explains tonal manifestations in the language which cannot be reanalyzed unproblematically as pitch configurations forming part of a bitonal nuclear accent or IP boundary tone. Independently of tonal evidence, this phrasing distinction is further justified by relative prominence and boundary strength cues. Nevertheless, other post-lexical phonological phenomena such as non-tonal sandhi (e.g. Nespor and Vogel 1986)[13] and investigations of break indices (which indicate the perception of degree of juncture) may also shed light on issues of phrasing in LA.

X.3.2 EA Prosodic Structure

X.3.2.1 Prominence Hierarchy

EA intonational phonology can be framed in terms of three levels of prominence, as has been done for LA above: lexical stress, pitch accents and nuclear accents. In EA, however, these three levels are not distinct, since the prominence marking of the lexical stress and pitch accent levels are conflated: as will be seen in greater detail in X.4.2 below, in EA, a pitch accent is generally observed on every Prosodic Word

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[13] While some segmental processes (such as aspiration of phrase-final syllables and glottal stop deletion in the definite article /ʔel/) have been impressionistically noted to occur at the edges of iPs, these factors need to be examined in more detail.

(PWd) (Hellmuth 2006, 2007b), and thus, almost invariably, a lexically stressed content word will be realized with a pitch accent. Function words may optionally be promoted to PWd status if bimoraic, in which case they will be accented (Hellmuth 2007b).

As regards nuclear accent, in EA the main prominence in broad focus utterances is not easy to characterize phonetically since, as discussed in X.4.2 below, the last accent in an IP in EA is generally realized in a compressed pitch range due to final lowering, and yet the word in question may still be picked out as most prominent. In focus contexts, the nuclear accent is more readily recognizable, as it is usually realized in an expanded pitch span. However non-final nuclear accents are routinely followed by post-nuclear accents in EA, albeit realized in a compressed pitch span (see X.5.2 for further discussion of both of these phenomena).

X.3.2.2 Constituency hierarchy

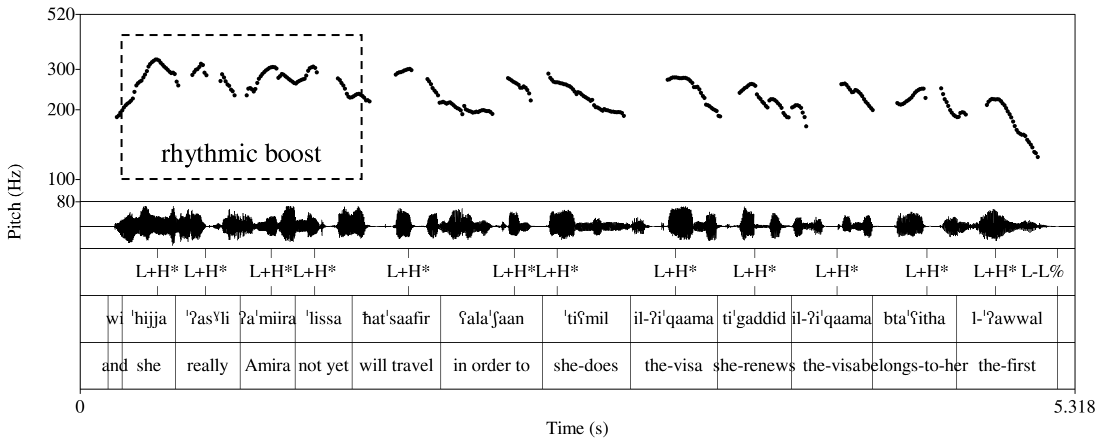
We can also describe prosodic phrasing in EA in terms of three levels: IP (Intonational Phrase), MaP (Major Phonological Phrase, equivalent to the iP proposed for LA) and PWd (Prosodic Word). The findings of Hellmuth (2004, 2007b) suggest that these constituents can be defined with reference to elements of morphosyntactic structure, but that phrasing is subject to prosodic constraints on the minimal size of constituents. As in LA, in EA a morphosyntactic word maps to a PWd, a syntactic maximal projection (XP) maps to a MaP, and a syntactic root clause (CP/IP) maps to an IP (Hellmuth 2007b). The IP in EA is marked at its right-edge with a boundary tone (either L% or H%). The MaP may be marked at its right-edge with a phrase tone, either L- or H-, but a phrase tone is not obligatory (see below). The PWd is the domain of distribution of pitch accents in EA: the head foot of every PWd is tonally marked with a rising pitch accent (Hellmuth 2007a), whose phonological representation is discussed in X.4.2.2 below.

Both IP and MaP are the domain of downstep of the peaks of successive pitch accents, resulting in tonal cues such as reset and upstep, which reflect the reset of downstep domains at the edges of prosodic constituents (cf. Truckenbrodt 2002, 2004, 2007), and which are the most consistent indicator of prosodic constituency in EA (Hellmuth to appear b). The degree of local pitch reset at a juncture indicates the strength of the boundary; a sequence of two MaPs within a single IP will display partial reset of pitch at the start of the second MaP, rather than reset to the full pitch height observed at the start of the IP.

Evidence in favor of proposing MaP as an intermediate constituent level between IP and PWd in EA comes from a segmental sandhi effect which marks out IP level junctures. Hellmuth (2004) analyzed a corpus of SVO read speech sentences which occurred in variants with and without an inserted parenthetical expression between the subject and object. EA has a rule of epenthesis which applies systematically to break up sequences of three consecutive consonants, by insertion of an epenthetic vowel between C2 and C3: e.g. /bint gami:la/ → [binti gami:la] "beautiful girl" (Watson 2002). Epenthesis contexts were placed in the SVO stimuli across all potential boundary positions. Failure of epenthesis was observed consistently across boundaries at the right-edge of a parenthetical expression, and thus taken as a cue to an IP level juncture, since it has been observed that parenthetical expressions frequently induce a full IP boundary at their right edge (Nespor & Vogel 1986, Frota 2000). Only a few sentences without an inserted parenthetical expression were realized with an internal boundary after the subject, but in these cases the juncture was marked by tonal cues only and epenthesis always applied across the boundary, and they were analyzed as MaP boundaries. This suggests that epenthesis applies across MaP boundaries within the intonational phrase (IP) in EA (cf. Aquil 2006), providing evidence for a level of phrasing between the IP and PWd in EA.

Crucially however, Hellmuth (2004) found IP-internal MaP level boundaries in only a small subset of the data (mostly in tokens elicited at a slower speech rate). In most cases the SVO sentences were realized as a single prosodic phrase (analyzed as a single MaP, strictly layered within a single IP), with no boundary between the subject and verb phrase (as might be expected from syntactic XP constituency). To account for the long MaP phrases observed in EA, Hellmuth (2004) proposed an additional level of phrasing, the Minor Phonological Phrase (MiP), positioned between the MaP and PWd in the prosodic hierarchy. MiP was proposed as a rhythmic unit (cf. the Accentual Phrase in other languages) with no mapping to any level of morphosyntactic constituency. The MiP is tonally marked in that the pitch accent at the right edge of an MiP shows local final lowering, being followed by a local pitch reset at the start of the new MiP (to the pitch level of the start of the previous MiP, rather than to the pitch level of the start of the previous MaP). This effect resembles the rhythmic boost pitch peak enlargement observed at the beginning of two-PWd MiPs in Japanese (Kubozono 1993), and is frequently observed in the spontaneous speech corpus (as in Fig. **X.2** below) suggesting that this is not a phenomenon confined to laboratory speech. In the analysis of Hellmuth (2004, 2007b), in EA a well-formed MaP contains at least two MiPs, and a MiP contains at least two PWds, yielding a MaP of at least four PWds[14]. Although this analysis was developed for read speech data (Hellmuth 2004), it can also account for the facts of semi-spontaneous speech (narratives re-told from memory, analyzed in Hellmuth 2007b).

The empirical observation then is that long prosodic phrases are often found in EA, even in naturally occurring speech, as in the example in Fig. X.2 below. In the current analysis this example is analyzed as a single IP, co-extensive with a single MaP[15]. Phrases can of course also be much shorter, for example, if they simply contain fewer PWds, and phrase breaks are also observed which are inserted for pragmatic and/or information structure reasons, as for example in Fig. X.22 and Fig. X.23, which are discussed in the context of the prosodic reflexes of focus in EA in X.5.2 below.



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[14] Cf. recent work by Tomas Riad (p.c.) suggesting that languages which make use of a larger number of levels of prosodic phrasing typically show larger prosodic phrases. See below for an alternative reanalysis in terms of compounding of PWds however.

[15] The utterance includes a self-repair in which the speaker reformulates [ˈtiʕmil il-ʔiˈqa:ma] as [tiˈgaddid il-ʔiˈqa:ma], but realizes the repair in the same register domain as the original formulation.

Fig. X.2 Long phrase in EA, with rhythmic boost effect, in the utterance: [wi ˈhijja ˈasˠli ʔaˈmi:ra ˈlissa ħatˈsa:fir ʕalaˈʃa:n ˈtiʕmil il-ʔiˈqa:ma tiˈgaddid il-ʔiˈqa:ma bitaˈʕitha l-ˈʔawwal] "and she really Amira hasn't traveled yet because she is getting a visa, renewing her first visa" (4862A 389.84-392.03).

Since phrases in EA tend to be long, tonal phrasing cues in EA were investigated in Hellmuth (to appear b) in SVO sentences in which the subject is of sufficient prosodic weight to always form a MaP (containing 3 or 4 PWds). The cues to phrasing in EA were investigated in detail by means of qualitative auditory transcription and quantitative investigation of the f0 scaling of successive peaks and the duration of boundary-adjacent words. The most consistent cues to MaP level phrasing proved to be those which reflect phonetic implementation of the downstep register domains of successive prosodic constituents, including local pitch reset, upstep or suspension of downstep. These effects are consistent both within and across speakers, though individual speakers show clusters of preferences, using, say, reset following a boundary rather than upstep at the boundary edge itself (cf. inter-speaker variation observed in Truckenbrodt 2007 for German). Phrase tones (L-/H-) and domain-final lengthening are regularly observed but neither prove to be obligatory markers of MaP edges in EA, since a clear reset of register domain can occur independently of either. Pauses were observed but are not a reliable cue, nor used by all speakers.

As regards non-tonal sandhi phenomena, Watson (2002) lists for each segmental phonological rule of EA the prosodic domain within it applies (e.g. coronal sonorant assimilation applies across PWd boundaries within the MaP, Watson 2002:237ff.). However Watson points out that the domain of application of such rules is subject to speaker variation, and no systematic study of EA phrasing generalizations based on sandhi cues of this type has been made, apart from epenthesis as discussed above.

X.3.2.3 Two levels of phrasing?

As outlined above, it is possible to analyze the prosodic phrasing patterns of EA speech in terms of three levels of phrasing as in LA (PWd + MaP/iP + IP), but two non-trivial differences in the analysis are required for EA: i) the conflation of the marking of prominence of two of the levels, PWd and MaP (both are marked with pitch accents) and ii) an additional level of prosodic structure (the MiP) is proposed (in Hellmuth 2004). Hellmuth (to appear b) suggests reanalysis of the MiP constituent in terms of PWd-compounding, with the assumption that recursive structure is tolerated and that prosodic constraints on MaP size read maximal PWd constituents (cf. Ito & Mester 2009). The theoretical problem of the lack of distinct prominence marking of different levels of the prosodic hierarchy remains however, such that either the theory must allow for languages in which not all constituent levels display tonal marking of culminative prominence (see footnote 10), or we must consider an even simpler analysis of EA prosodic structure in which there is only one level of prosodic constituency below the IP[16]. In parallel with LA, however, without an intermediate MaP/iP level of phrasing it would be difficult to account for the fact that complex boundary tones, though rare, are only found at IP edges in EA; these would have to be analyzed as bitonal accents, and their restricted distribution would go unexplained. We therefore retain both MaP and IP in the present analysis of EA.

X.3.3 Summary

In LA, three prominence levels (lexical stress, pitch accent, nuclear accent) and three prosodic constituents (PWd, iP and IP) are posited. Lexical stress is proposed as head

[16] We are grateful to an anonymous reviewer for suggesting this alternative; see also Hellmuth (2010b).

of the PWd level, and nuclear accent as head of the iP level. Evidence for each level of constituency and for the distinction between the iPs and IPs is based on right-edge tonal manifestations, relative prominence relations and boundary strength phenomena. The facts of EA are also amenable to analysis in terms of three levels of phrasing (PWd, MaP and IP) but three distinct levels of prominence are not found, since the lexical stress and pitch accent levels of prominence are routinely conflated. In addition, the MaP and IP constituents are often co-extensive. Hellmuth (to appear b) proposes a three-level analysis (PWd, MaP, IP), incorporating compounding at the PWd level to explain constraints on the minimum size of MaPs .

This summary suggests clear empirical differences between LA and EA, particularly in the distribution of word- and phrase-level prominences, but investigation of prosodic juncture and prominence in directly parallel data is much needed, in these and other Arabic varieties.

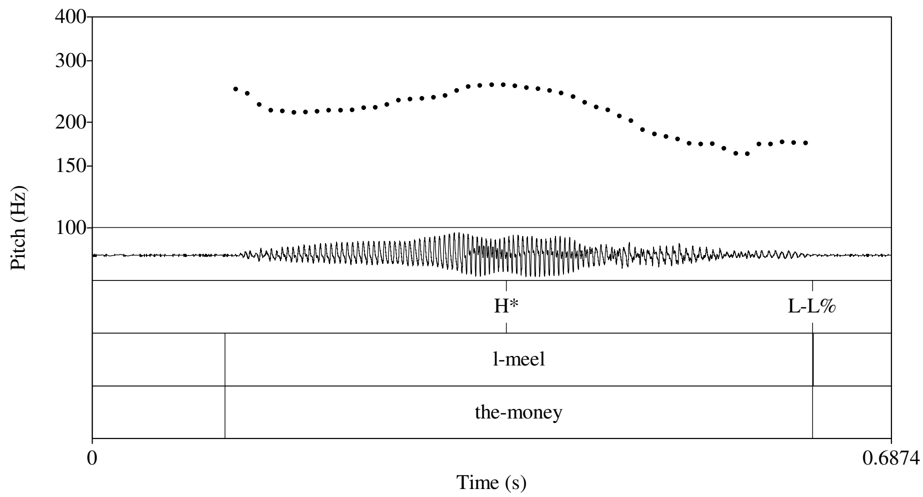
X.4 Intonational phonology

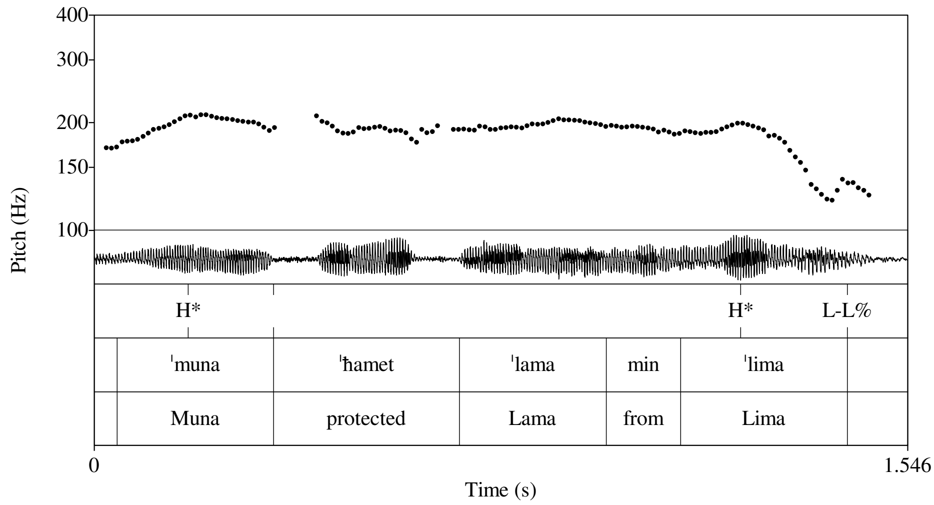
X.4.1 The intonational phonology of LA

Analysis of the collected LA corpus identifies a number of basic tunes associated with declarative and interrogative sentences in the language. The current model accounts for this data in terms of three tonal events: pitch accents, phrase accents and boundary tones. As discussed above, pitch accents represent prominence-lending tonal events that associate to lexically stressed syllables, while phrase accents and boundary tones represent tonal events which mark the right edge of the iP and IP boundaries respectively.

X.4.1.1 Main LA sentence types

The most common declarative tune in LA is a falling contour. It generally shows an initial rise on an accented syllable and then falls towards the phrase edge (analyzed here as L-L%). In the experimental data, when the IP is composed of a single pitch accent (the nuclear accent), the contour takes the shape of a "pointed hat" (t'Hart et al., 1990; e.g. Fig. X.3a). When it contains two or more pitch accents, it usually displays a "flat hat" pattern (ibid; e.g. Fig. X.3b). In longer sentences occurring in the more natural map-task corpus, the H peaks show a downtrend effect within an utterance as schematized in Fig. X.3c (see X.4.1.2 0 belowfor more information on these declination effects). As in most languages, the overall falling pitch contour in LA generally indicates a statement.





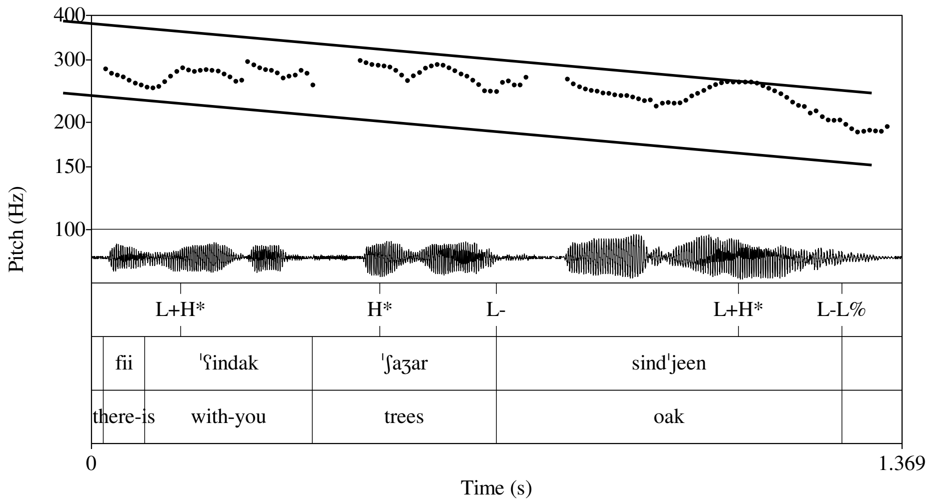
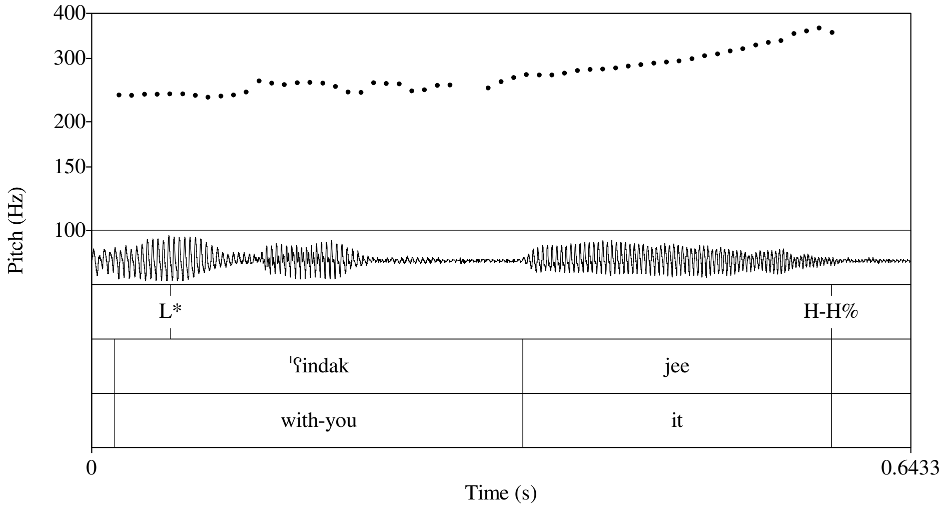


Fig. X.3 Illustrations of declarative tunes in LA: a) A pointed hat contour occurring on the utterance /l-meel/ "The money", b) a flat hat contour occurring on the utterance /ˈmuna ˈħamet ˈlama men ˈlima/ "Muna protected Lama from Lima" and c) a falling contour occurring on the utterance /fii ˈʕindak ˈʃaʒar sindˈjeen/ "you have oak trees", illustrating a general downtrend pattern. (Note: the register line is a schematization).

Syntactically declarative sentences in LA can also be associated with overall rising pitch contours. These rising contours function primarily as yes/no questions (YNQs) lacking an overt syntactic question marker, referred to here as declarative YNQs. Declarative YNQ tunes in LA are typically composed of a high rising edge configuration (analyzed here as H-H%) preceded by low (Fig. X.4a) or rising (Fig. X.4b) pitch occurring on the nuclear accented syllable (the latter form being more marked).



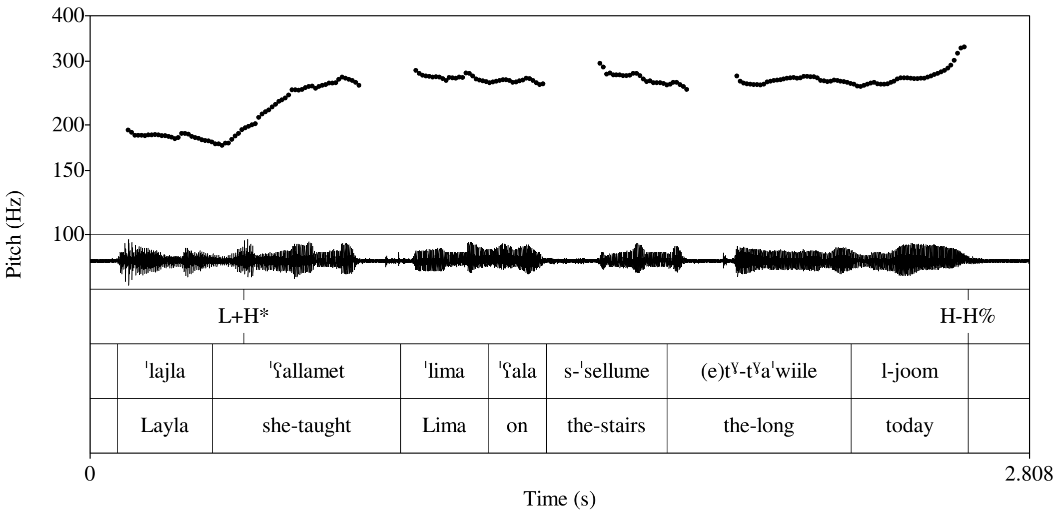


Fig. X.4 An illustration of LA YNQ tunes with a) a low nuclear accent on /ˈʕindak/ "you have" in the utterance /ˈʕindak ˈjee/ "Do you have it?", and b) a rising nuclear accent on /ˈʕallamet/ "teach" in the utterance /ˈlajla ˈʕallamet ˈlima ˈʕala ˈs-sellume tˠ-tˠaˈwiile l-joom/ "Did Layla teach Lima on the stairwell today?".

In addition to YNQ tunes, another type of rising contour is observed in LA which indicates incompleteness. This is the continuation-rise tune which shows an initial rise on a nuclear accented syllable that continues till the end of the IP. The tune is illustrated in Fig. X.5 below on the syntactically declarative sentence /muna ħamet lama min lima/ "Muna protected Lama from Lima". The sentence is divided into three IPs, the first two of which display an overall rising contour and indicate incomplete propositions.

Notably, both declarative YNQs and continuation-rise tunes occur on syntactically declarative sentences and show an overall rising contour of similar pitch accent and edge tone types (L+H* H-H%). As suggested for EA below, a possible phonetic factor which may explain the distinct pragmatic function of the two contours could be the relative pitch height of the final rising edge: investigations of declination patterns in EA (e.g. Ibrahim et al 2001) indicate that the upper F0 trendline in declarative YNQs shows a steeper rise than in other types of rising contours (see X.4.2.1 below).

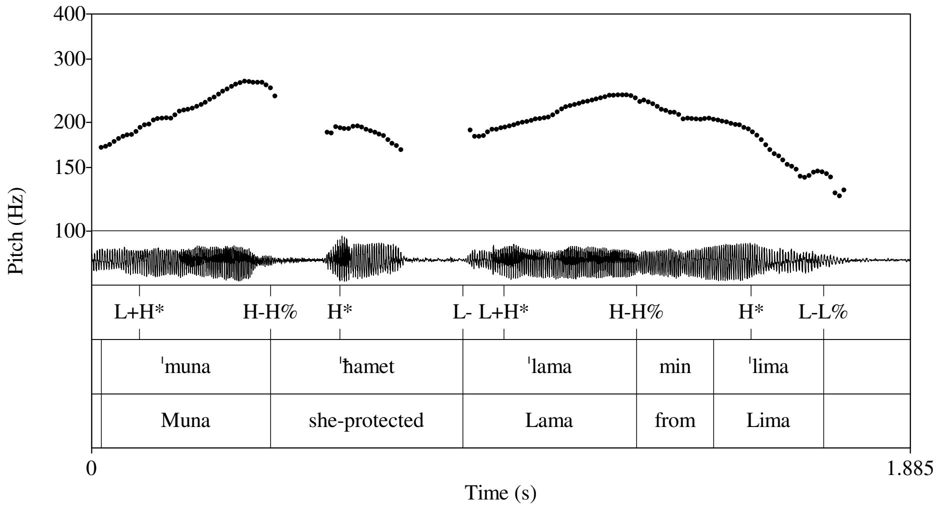


Fig. X.5 Rising tunes illustrating incompleteness in the utterance /ˈmuna ˈħamet ˈlama min ˈlima/ “Muna protected Lama from Lima”.

The pragmatic function of incompleteness can also be indicated in LA through continuation-plateau tunes. These contours occurring on declarative sentences exhibit a plateau (analyzed as H-L%) extending from a high or rising nuclear accent to the edge of the IP (Fig. X.6a). The plateau is sustained at the same pitch level as that of the preceding accent. When they occur utterance-medially and are followed by a final declarative IP, these tunes indicate continuation. When used on a proper noun, these plateau contours can also commonly form calling tunes (Fig. X.6b).

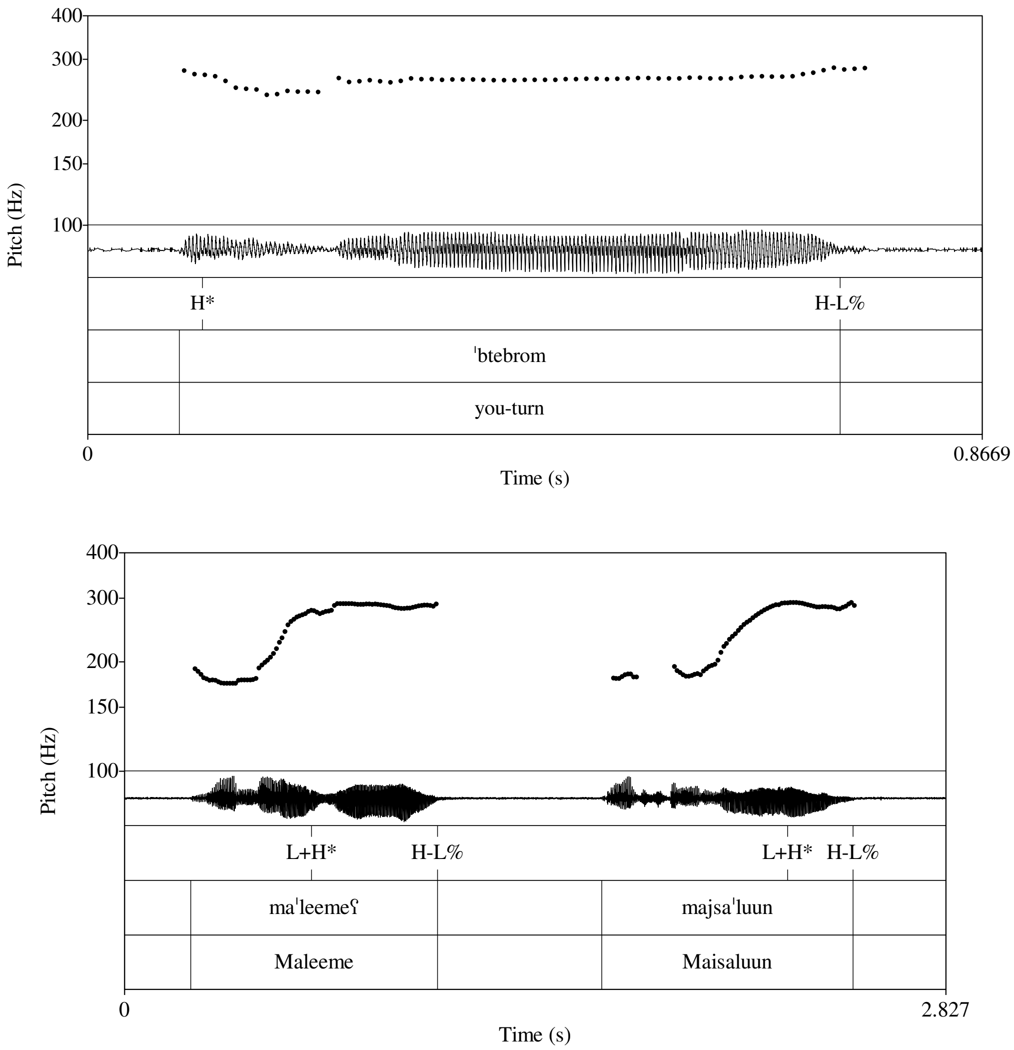


Fig. X.6 Typical plateau contours a) indicating incompleteness and produced on the word /ˈbtebrom/ "you turn", and b) illustrating calling tunes produced on the proper nouns /maˈleemeʕ/ and /majsaˈluun/.

A more semantically marked type of incompleteness in LA is found in the stylized falling-rising continuation tunes (Fig. X.7). Unlike the continuation-rise tunes discussed above which exhibit an overall rising pattern, these stylized tunes show an initial rise on the nuclear accented word, followed by a fall and a final rise at the right edge of the IP (analyzed as L-H%). These contours are less frequent than continuation-rises and continuation-plateau tunes and may even represent borrowings from English (Chahal 2001).

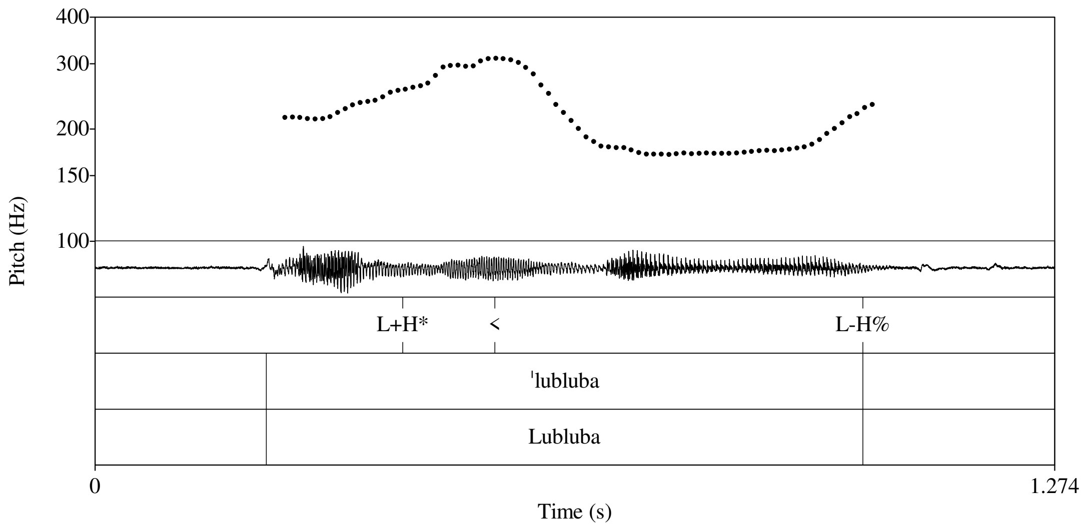


Fig. X.7 A stylized continuation tune produced on the proper noun /ˈlubluba/. The ‘<’ symbol represents peak delay.

The final type of observed tune occurring on syntactically declarative sentences is the stylized plateau tune. This tune is structurally similar to the continuation-plateau contours discussed above, the only difference being that the elbow of the plateau is realized as a step down from the level of a preceding high accent to a tonal target occurring in the middle of the speaker’s range. The stretch to the phrase edge is sustained at this level and is analyzed as a !H-L% boundary (Fig. X.8). The meaning conveyed by these contours, although characteristic, is difficult to pin down. It indicates a sense of polite and mild reproach, suggesting that the hearer should already be aware of the presented information.

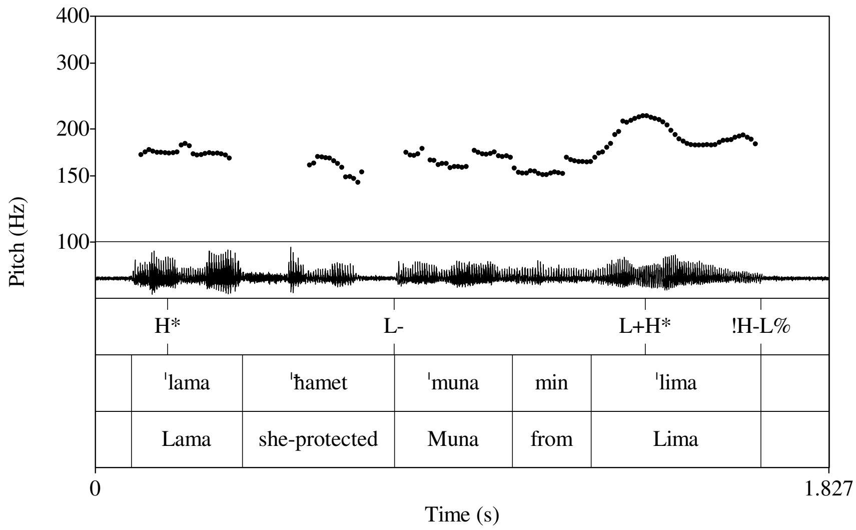


Fig. X.8 A downstepped plateau tune produced on the phrase /min ˈlima/ "from Lima" as occurring in the utterance /ˈlama ˈħamet ˈmuna min ˈlima/ "Lama protected Muna from Lima".

While the above discussed tunes occur on syntactically declarative sentences, the only syntactically interrogative sentence type obtained in the LA corpus is represented by a number of wh-questions. The pitch contour occurring on these sentence types is similar to that observed on YNQs, in that it exhibits overall rising pitch, starting from predominantly rising nuclear accents on the wh-word and rising further at the edge of the intonational phrase as illustrated in Fig. X.9. It should be noted, however, that these wh-questions sound particularly marked to the first author, possibly because they were used as elicitation questions in experimental tasks. More naturally occurring wh-questions are required to make accurate claims about this particular tune type.

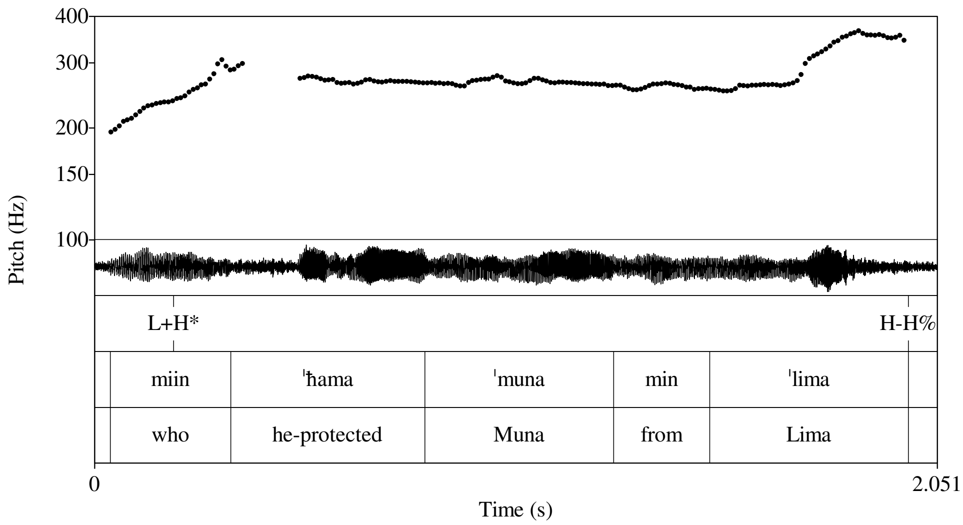


Fig. X.9 A wh-question and combining with a rising nuclear accent on /ˈmiin/ "who" in the utterance /ˈmiin ˈħama ˈmuna min ˈlima/ "Who protected Muna from Lima?"

X.4.2.1 Pitch accents

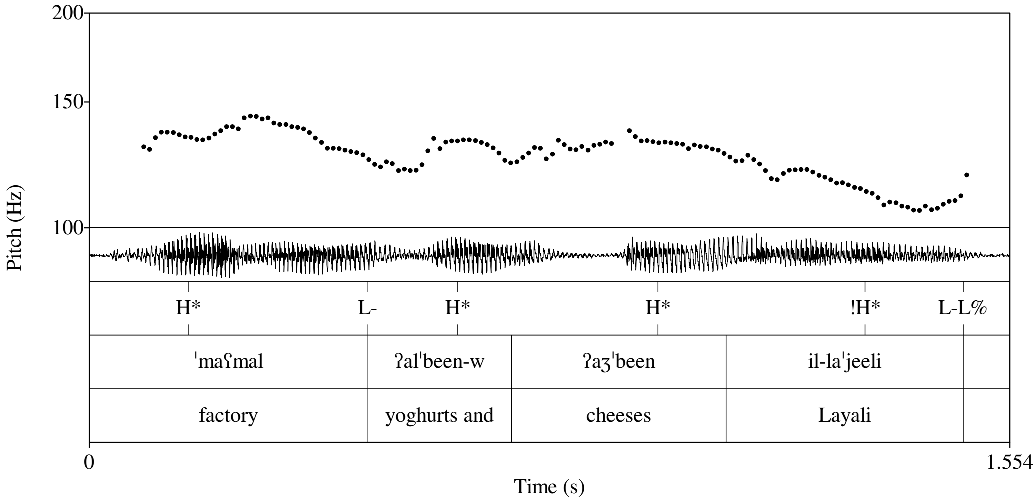
The model proposed in Chahal (2001) posits six pitch accent types in the tonal inventory of LA. These occur both in nuclear and prenuclear position and under broad and narrow focus conditions. Thus, no distinction is maintained between nuclear and prenuclear accent inventories, nor is a particular type of pitch accent found to be responsible for indicating a specific focus condition.

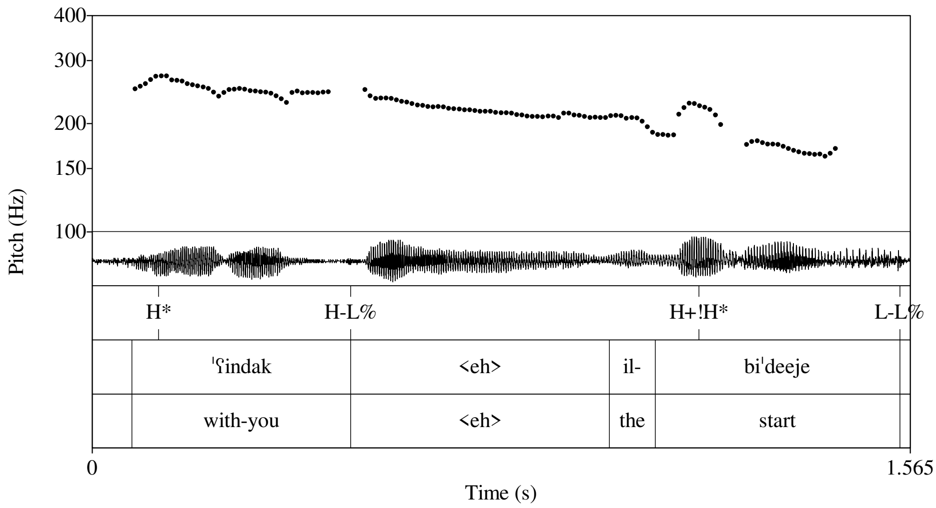
The model distinguishes between two types of rising pitch accents observed in the LA corpus. The first begins as a rise from the middle of a speaker's pitch range while the second begins as a rise from a low part of the speaker's pitch range. These are analyzed as two distinct phonological categories—H* (Fig. X.3b) and L+H* (Fig. X.4c) respectively. The evidence given for this distinction is that the lead tone of the L+H* accent cannot be explained in terms of a preceding L- or an initial %L boundary tone since the accent can occur phrase-medially. Even when a preceding L edge tone is observed, the transition to the following H accent peak does not rise gradually but rather stays at a low level until the onset of the accented syllable when it rises sharply (e.g. Fig. X.8). This suggests the existence of an L tonal target associated with an accented syllable and not a tonally insignificant phonetic transition.

Chahal (2001) also proposes that, conversely, H* cannot consistently be analyzed as an undershot realization of an L+H* accent in contexts lacking sufficient segmental material, although this claim has not been investigated using controlled data. Experimental investigation is also needed to confirm whether the apparent rise from a low point in the speaker's pitch range is not a consequence of a more expanded overall pitch range and/or the by-product of the number of intervening syllables between two H peaks, as argued for English by Ladd and Schepman (2003).

In a large number of instances, the H peaks of the above described rising accents may display a feature whereby they are realized as a step down from the level of a preceding high pitch accent. Using the conventional '!' symbol to indicate this downstep pattern, these accents are represented as !H* and L+!H* (Fig. X.10a and Fig. X.3c respectively). An additional accent showing downstep in the corpus is one where the pitch on the accented syllable steps down from immediately preceding high pitch, represented as H+!H* (Fig. X.10b).

While !H* and L+!H* occur frequently in the data, H+!H* is a less common accent type which occurs with falling boundaries only and which gives the accent-bearing word a particular degree of emphasis. The lead tone of the H+!H* accent cannot be explained in terms of a preceding high boundary. For example, in Fig. X.10c below, even though the H+!H* accent on the word /l-biˈdeeje/ is preceded by a !H- boundary, the pitch does not merely interpolate to the level of the downstepped accent but remains high on the unstressed syllable /bi/ until the start of the accented syllable /ˈdee/, where it steps sharply down to the !H* level. This indicates that an H tone was targeted before !H*, thus the analysis of the accent as H+!H*[17].





[17] Note that the LA model, as discussed so far, assumes monotonic and linear interpolation between tone types in the experimental data. It remains to be shown whether sagging interpolation applies in LA, especially in more naturally occurring speech.

Fig. X.10 Contours illustrating a) a !H* accent on the word /laˈjeeli/ “nights” in the sentence /ˈmaʕmal ʔalˈbeen-w ʔaʒˈbeen-el laˈjeeli/ “The Layali dairy factory”, and b) a H+!H* accent on the word /l-biˈdeeje/ “start” in the sentence /ˈʕindak l-biˈdeeje/.

While the precise nature of downstep in LA still requires extensive investigation, the above described downstepped accents are proposed to form phonological categories for the following reasons: Firstly, as in Greek (Arvaniti et al 2005) and unlike Pierrehumbert’s (1980) analysis of English, the scaling of these accents does not emerge as a purely phonetic effect predicted by the presence of a preceding bitonal accent. This is especially evident in the case of the above illustrated H+!H* which occurs as the initial accent in its IP. Secondly, these downstepped accents seem to be associated with certain semantic meanings: In the corpus, downstepped accents occur most frequently on the second noun of genitive construct state phrases[18], ascribing it a degree of emphatic finality. This is illustrated in Fig. X.10a, where the noun /lajeeli/ “Layali” carries a degree of finality in the construct phrase /ʔalˈbeen-w ʔaʒˈbeen-el laˈjeeli/ “the Layali dairy (products)”.

Finally, while all of the accents described so far are composed of an H peak which is associated with the lexically stressed syllable, the corpus also identifies low troughs associated with stressed syllables. These are analyzed as L* pitch accents and are

[18] Construct state phrases usually contain two nouns in a genitive relationship. They are comparable to English compounds or genitive phrases e.g. “The dairy-product factory” or “The factory of dairy products”.

relatively sparse in the data. They most commonly occur as nuclear accents in declarative YNQ tunes (e.g. Fig. X.4a).

Notably, the LA model does not propose an L*+H bitonal counterpart to L*. This also means that no phonological distinction is made in LA between L+H* versus L*+H, i.e. between rising accents based on the phonetic alignment of the H peak within or outside the bounds of the accented syllable. While prenuclear rising accents in LA display variable early and late peak alignment (amenable to an L+H* versus L*+H analysis), Chahal's (2001) experimental examination of the alignment characteristics of these peaks confirms that they are phonetically conditioned by three prosodic contexts: accented syllable duration, stress clash and prosodic boundary effect[19].

X.4.1.3 Phrase accents and boundary tones

Three types of phrase accents (L-, H- and !H-) and two boundary tones (L% and H%) are posited for LA. In line with exhaustive and non-recursive models of constituent structure, at the right edges of IPs the boundary tones combine with phrase accents yielding the following six boundary configuration types: L-L%, L-H%, H-L%, H-H%, !H-L% and !H-H%. These contrast in terms of the level at which they occur within a speaker's pitch range and display varying phonetic realizations depending on the number of unstressed syllables occurring between the nuclear accented syllable and the edge of the IP.

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[19] For more detailed information on prosodic contextual effects and justification for representing rising accents as L+H*, see Chahal (2001: chapter 5).

L-L% usually represents a fall to the lowest part of the speaker's pitch range. It is typical of neutral declarative statements. In long-tailed intonational phrases, L-L% is realized as a fall after the nuclear accent, which then continues in a low stretch until it reaches the end of the intonational phrase. At this point the L% boundary tone may display a lower scaled F0 value than that of the low stretch (which may be indicative of possible final lowering effects). L-H% represents a fall to a low level in the speaker's range followed by a rise to mid-pitch, corresponding to the boundary tone. It is typical of stylized continuation contours (e.g. Fig. X.7).

H-L%, H-H%, !H-L% and !H-H% represent boundary configurations in which the phonetic realization of the boundary tones displays upstep, a local pitch range modification raising the scaling of boundary tones after H- and !H-: The L% tone is raised to be scaled at the same level as the preceding phrase accent while the H% is raised to be scaled at an even higher level than that of the phrase accent. Accordingly, H-L% is realized as a level or plateau configuration typically found in continuation-plateau and calling tunes (e.g. Fig. X.6) while the H-H% commonly forms the high-rising edges typically observed in YNQ and wh-question tunes (e.g. Fig. X.4 and Fig. X.9).

!H-L% and !H-H% represent the downstepped versions of the H-L% plateau and H-H% rising boundary configurations. !H-L% occurs as the edge configuration of stylized plateau tunes (e.g. Fig. X.8) while the !H-H% is a relatively uncommon boundary configuration (e.g. Fig. X.11).

Similarly to downstepped pitch accents, !H- is argued to be a phonologically distinctive phrase accent since its scaling is not predictable from triggering environments such as preceding bitonals and since its presence in !H-L% versus H-L% configurations seem to create minimal pair contours: the stylized plateau tune (indicating mild reproach) versus the unmarked continuation-plateau tune. A consequence of this analysis, however, is an obvious gap in the system: since both accents and phrase accents show downstep effects, this leaves boundary tones as the only types of tonal events in LA which do not.

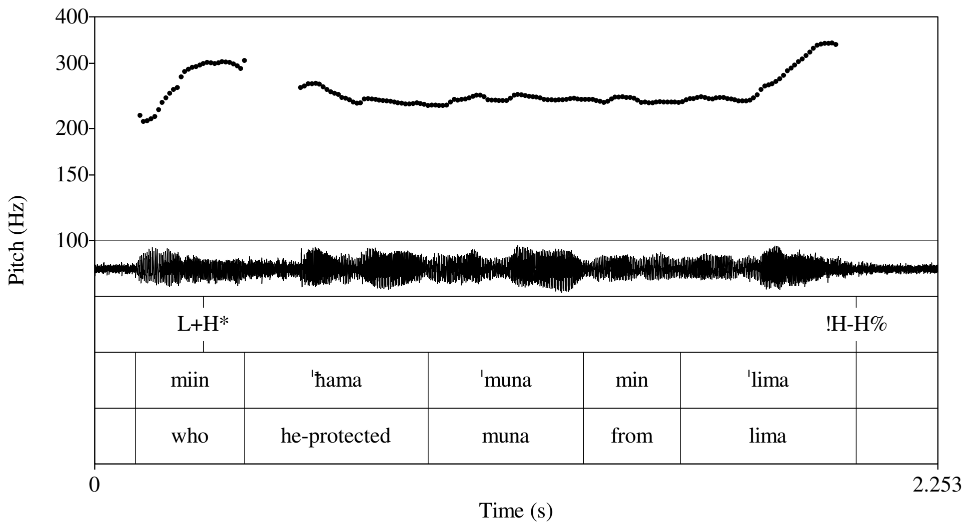


Fig. X.11 Illustration of an !H-H% boundary configuration occurring on the sentence /ˈmiin ˈħama ˈmuna min ˈlima/ “Who protected Muna from Lima?” with narrow focus on “who”.

X.4.2 The intonational phonology of EA

X.4.2.1 Main EA sentence types

This section describes the main intonational tunes observed in the EA corpus, and the sentence types with which they can be associated. The examples are taken from spontaneous conversation (from the LDC Call Home corpus, Karins et al. 2002) which allows us to establish from the interactional sequence how the utterance was interpreted[20].

A typical EA declarative intonation contour shows an overall falling pattern, with a pitch accent on each content word, and typically ending with falling pitch, analyzed here as a L-L% phrase-/boundary-tone sequence. The pitch height of both H and L turning points falls steadily throughout the utterance, as observed also by Norlin (1989) and Rifaat (1991). We analyze this pattern as downstep within local register domains which reflect prosodic constituency, following Truckenbrodt (2002, 2004, 2007). In most declarative utterances the peak of the final pitch accent is realized much lower than would normally be expected from the preceding sequence. This effect is also found in English, and termed final lowering (Liberman & Pierrehumbert 1984), and is also a feature of Egyptian Formal Arabic (EFA, the EA pronunciation of MSA; Rastegar-El Zarka 1997, Rifaat 2005). Accents showing final lowering are transcribed here with '!' to denote realization in a different local pitch range; the effect is analyzed as being distinct from the ordinary application of downstep within the local register domain and appears to be under the control of speakers, since it can be suspended.

Examples of both downstep and final lowering can be seen in Fig. X.12 below; the speaker uses an idiom to provide an assessment of the situation under discussion (speaker B's response is provided in Fig. X.22). Approximate register lines, superimposed on the pitch contour, serve to illustrate the falling height of both high

[20] This approach is inspired by 'next-turn-proof' procedures (Hutchby and Wooffitt 1998:15).

(the top register line) and low (the bottom register line) turning points in subsequent pitch accents through the utterance. The pitch peak of the final accent is realized somewhat lower than predicted by the slope of the top register line (final lowering).

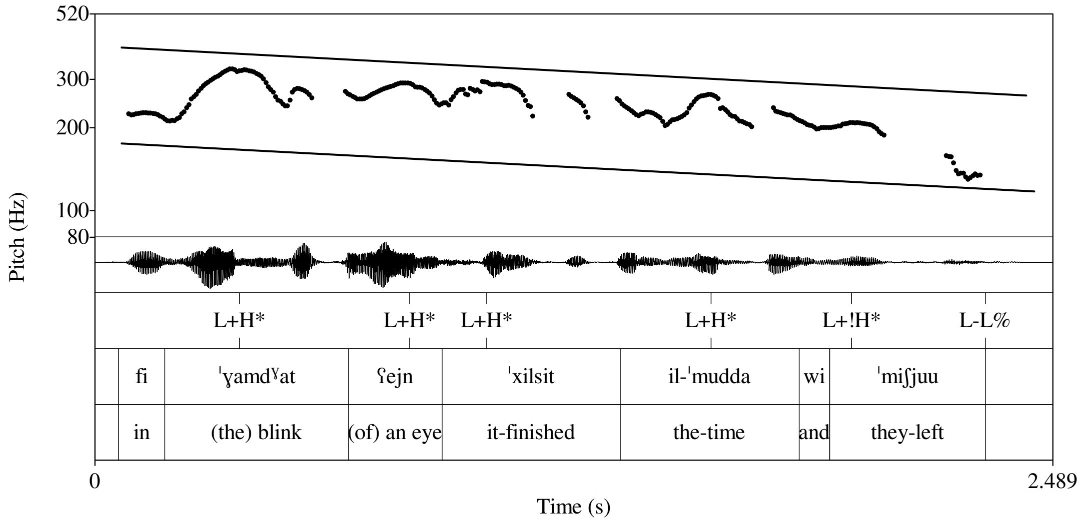


Fig. X.12 Spontaneous speech declarative showing declination and final lowering: [fi ˈɣamdˠat ʔejn ˈxilsit il-ˈmudda wi ˈmiʃju:] "in the blink of an eye they were gone" (4862A 364.61-367.05). Register lines are schematic only.

Syntactically declarative sentences can also be realized with rising pitch at the end of the utterance, transcribed here as a H-H% phrase-/boundary-tone sequence. In his EFA corpus Rifaat (2005) observes that rising pitch at the end of a phrase (a final LH pitch accent, in his notation) is used consistently to indicate incompleteness. In colloquial EA utterances which bear what we may term a final continuation rise, tend to show standard falling declination across earlier pitch accents in the phrase, however. This is shown in the utterance in Fig. X.13 below, produced by speaker B as the opening statement in a narrative sequence; speaker A responds with [ʔa:h] "yes", allowing speaker B to hold the floor and continue her turn. Sequences of incomplete phrases (realized with a final rise) followed by at least one complete phrase (realized with a final fall) seem to be a hallmark of EA speech (cf. Rifaat 2005).

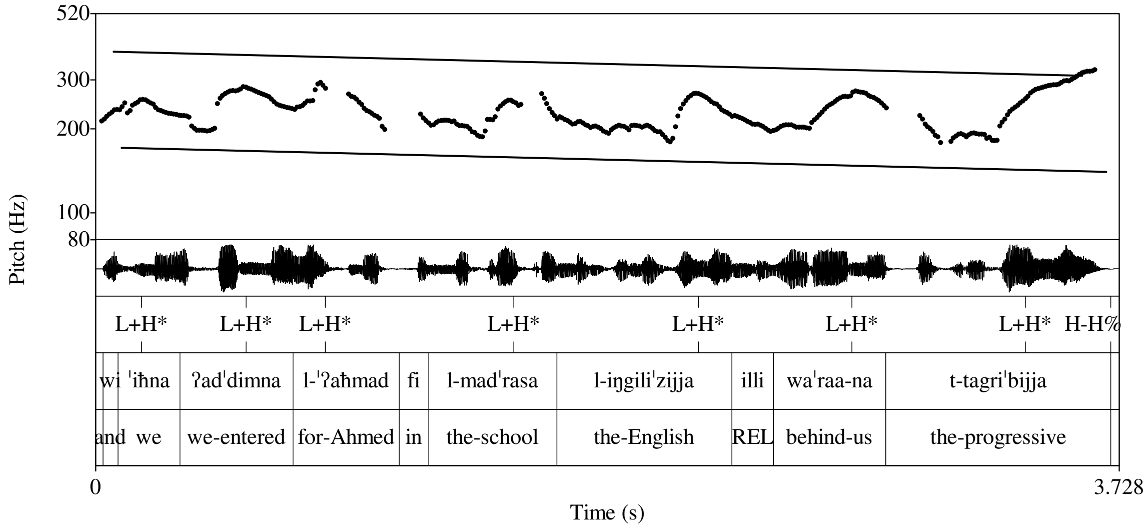
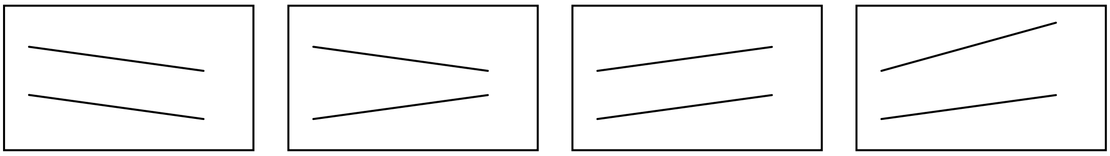


Fig. X.13 Spontaneous speech declarative showing a continuation rise: [wi ˈʔiħna ʔadˈdimna l-ˈʔaħmad fi l-madˈrasa l-ʔiŋgiliˈzijja illi waˈra:na t-tagriˈbijja] "and we have entered Ahmed for the English school that's right behind us" (4682B 330.53-334.27). Register lines are schematic only.

An H-H% sequence cannot always be assumed to be an indicator of incompleteness, however, since in EA a yes-no question (YNQ) is most felicitously expressed by a syntactic declarative bearing final rising pitch (Gary & Gamal-Eldin 1981); that is, as a declarative YNQ, as discussed earlier for LA. The distinction between an incomplete declarative with a final continuation rise and a declarative YNQ is realized prosodically in EA by means of a difference in the global declination trendlines of the two utterance types. In a read speech experimental study, Ibrahim et al. (2001) calculated linear trendlines from F0 measurements taken in declaratives and in three types of questions: WHQs (containing an overt wh-word), YNQs starting with a question word, and declarative YNQs. The upper/lower trendlines are calculated on all points lying above/below a global trendline itself calculated from all F0 values in each utterance (cf. Haan et al. 1997). Declarative sentences showed declination, as we might expect, with both upper and lower trendlines falling throughout the sentence. Although all three question types showed a rising *lower* trendline, only YNQs and declarative YNQs showed a rising *upper* trendline, and the slope of the upper trendline was steeper in declarative YNQs than in YNQs. In contrast, WHQs had a falling upper trendline resulting in narrowing pitch range through the sentence. These generalizations are illustrated in schematized form in Fig. X.14 below.



declarative sentence	WHQ	YNQ	declarative question

Fig. X.14 Schematization of upper and lower F0 trendlines in EA (based on Ibrahim et al. 2001).

The declarative YNQ pattern is illustrated from spontaneous speech in Fig. X.15 below, produced by speaker B. The utterance is syntactically declarative, but realized with a H-H% boundary; speaker A treats it as a yes-no question, responding with [ʔa:h] “yes”. There are no instances of syntactically-overt YNQs in the spontaneous data, but there are a small number of WHQs, which also match the trendline findings of Ibrahim et al (2001). In Fig. X.16, speaker A produces a question formed syntactically with an in-situ wh-interrogative [ʔeeh] “what” which speaker B treats as a WHQ, responding with [itˈkasafit] ‘she was silent’.

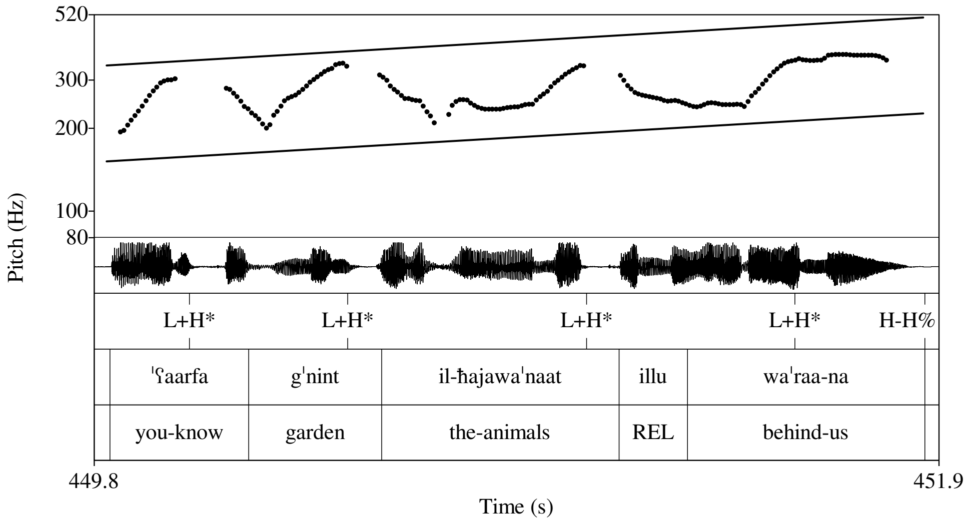


Fig. X.15 Spontaneous speech declarative question showing rising pitch register and a rising final boundary: [ˈʕa:rfa gˈnint il-ħajawaˈna:t illu waˈra:na] "Do you know the zoo behind us (i.e. behind our house)?" (4682B 449.77-451.95). Register lines are schematic.

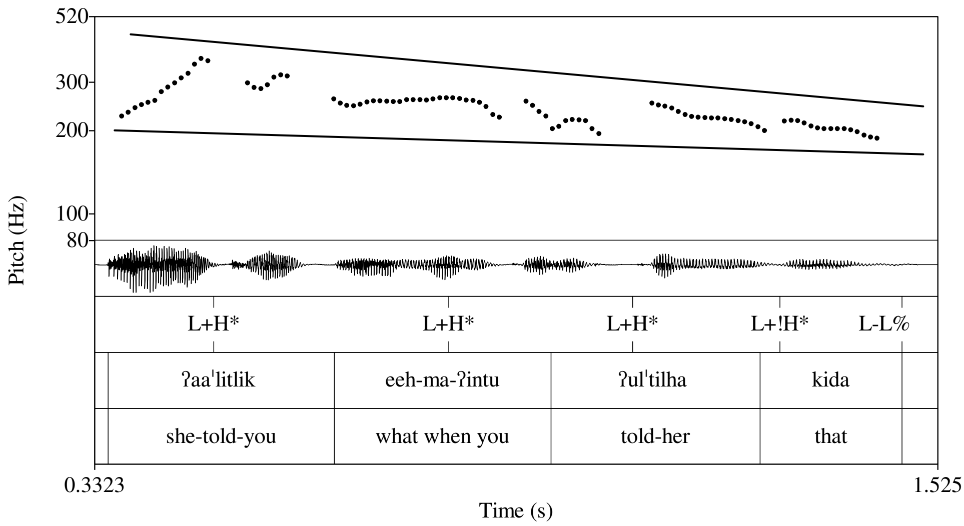


Fig. X.16 Wh-question showing narrowing pitch span: [ʔa:ˈlitlik ˈʔeeh-(lam)ma-ʔintu ʔulˈtilha ˈkida] "What did she say when you said that to her?" (5328A 415.02-416.77). Register lines are schematic.

The above survey of declaratives and interrogatives cannot claim to exhaust the full range of intonational expression in EA, but the patterns described do represent the most common intonational contours observed in naturally occurring speech. The distinctions among these key intonational tunes are realized in EA partly by means of differences in the sequence of tonal events (e.g. L-L% vs. H-H%) and partly by means of variation in pitch range settings across whole utterances.

X.42.2 Pitch accents

All of the intonational tunes described above share an unusual yet salient feature, that a pitch accent is observed on every content word in an utterance. This matches comments in earlier literature, that EA has “a tendency to accent all words” (Mitchell 1993:230) and that “in the unmarked case the lexical stress of each word will in continuous speech be stressed” (Heliel 1977:125). The occurrence of an accent on every content word is noted as a feature of EFA by both Rifaat (1991) and Rastegar-El Zarka (1997), and has been shown to hold of colloquial EA in Hellmuth (2006b), across a range of speech styles, including spontaneous conversations. The properties of accented and unaccented function words indicate that it is every phonological word (PWd), rather than every content word, that is accented in EA (Hellmuth 2007b).

EA thus joins Spanish and Greek in a group of languages displaying rich accent distribution, a feature which Jun (2005) suggested might usefully be added to surveys of prosodic typology, and which is shown in the present volume to be a distinguishing feature of some but not all varieties of Portuguese (Frota this volume). This chapter demonstrates that Arabic varieties appear also to vary with regard to this property, since LA does not display the same rich accent distribution patterns observed in EA. Face (2003) suggests that in Spanish pitch accents are observed on every word only in laboratory speech (elicited or read speech). In EA however, pitch accents are observed on every content word even in fully spontaneous conversation, as illustrated in all of the EA examples in this chapter. The distribution of accents is also unchanged in focus contexts, as discussed in X.5.2 below.

The pitch accents observed so frequently in EA are also all of a similar shape, and are analyzed here as instances of a single phonological object (discussed in detail below): L+H* (Hellmuth 2006b). The co-occurrence of rich accent distribution and a reduced pitch accent inventory was also noted as a feature of Spanish and Greek by Jun (2005) who suggests that this cluster of properties may indicate that the function of pitch accents in such languages is as an aid to word segmentation. Hellmuth (2007b) argues that pitch accents in EA do indeed mark prominence at the PWd level, and develops an analysis in which languages may vary typologically in which level of the prosodic hierarchy (PWd, MaP or even IP etc.) is prosodically marked with a pitch accent.

The typical shape of the EA pitch accent, in pre-nuclear (non-phrase-final) position, is a rise, which could in theory be analyzed as H* or as L+H*. Since instances of a rise with a clear leading L target are observed in a very much wider range of contexts than instances of a peak with no leading L, and since such peaks tend to occur in contexts in which a leading L might undergo truncation (e.g. phrase-initially or due to clash), Hellmuth (2006b) proposes an L+H* analysis of the EA pre-nuclear pitch accent.

A read speech experimental study of target alignment in different syllable types (CV, CVV and CVC) (Hellmuth 2007a), showed that, all else being equal, in EA the leading L tone target aligns consistently at the onset of the accented syllable, and the H tone aligns within the second mora of the stressed foot (e.g. towards the end of a long vowel, inside a coda consonant, or within the intervocalic consonant in feet comprised of two light syllables). Mitchell's (1993) pedagogical pronunciation guide to EA describes the EA intonational contour as a sequence of "see-saw jumps". He notes that "pitch dips markedly.. [on] pre-accentual syllables.. from which a 'jump' takes place to the height of the.. accented syllable" (Mitchell 1993:222-3), treating the pre-accentual local pitch contour (the leading L tone) as part of each rising accent. Hellmuth (2006b:250-252) sets out additional arguments in favor of a L+H* analysis of the EA pitch accent.[21]

To document peak alignment properties in EA spontaneous speech, Hellmuth (2008) used a phonetic transcription tier adapted from IViE notation (Grabe et al. 1998), and classified the results by position of stress in the accented word and position in prosodic structure, for comparison with the experimental findings of Chahal 2001 (as in X.3.1.2). The position of the H peak within the accented syllable was found to vary, but the variation could in all cases be attributed to factors in the surrounding prosodic context, such as stressed syllable type, position of the stressed syllable within the word, and position of the target word relative to upcoming prosodic boundaries (see Hellmuth 2008 for full details). Pre-accentual pitch was found to rise from low in the speaker's pitch range in only two contexts: i) in utterance-initial content words preceded by unaccented function words (e.g. [wi hiyya…] 'and she…') and ii) when there are a number of unstressed syllables between accents, resulting in a short low plateau (cf. El Zarka & Hellmuth 2009) between two successive peaks (compare [iŋ.gi.li.ˈzij.ja] 'English' in Fig. X.14, which contains three unstressed syllables before

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[21] The pitch accent represented here as L+H* is distributionally equivalent to the 'plain' H* of ToBI, argued by some authors to be the default pitch accent in English (Brugos et al 2008).

the stressed syllable). Post-accentual pitch was found to be much more variable, but was also dependent on local prosodic context. For example, words followed by a high H- phrase tone show a continuous rise throughout the accented syllable, in contrast to words followed by a L- phrase tone. In some instances pitch falls immediately after the stressed syllable to an elbow coinciding with the right edge of the word, rather than falling gradually across all intervening unstressed syllables until the next pitch accent, and these are analyzed as instances of a L- marked phrase boundary inserted following the accented word, as discussed in X.4.2.3 and X.5.2 (cf. also X.3.2.3).

The clearest position where it might be argued that a distinct pitch accent is regularly observed in EA is in phrase-final (nuclear) position, since IP-final pitch accents usually show falling pitch through the accented syllable rather than rising pitch, with the H peak is aligned early in the accented syllable. These could be analyzed as a distinct H*+L nuclear pitch accent (cf. Frota 2000 for European Portuguese, and Rifaat 2005 for the EA pronunciation of MSA). In the present analysis however, these falling accents are analyzed as positional variants of the default L+H* accent, realized with an early peak due to the effects of an upcoming prosodic boundary, as demonstrated in Lebanese Arabic (Chahal 2001) and Spanish (Prieto et al. 1995). Evidence in favor of this analysis comes from the shape of the post-accentual contour following a phrase-final pitch accent (where visible and not subject to final lowering) which always continues in the direction of upcoming phrase tones; that is, there is a continuous rise in pitch between the last pitch accent and H-H% edge tones in both incomplete declaratives and declarative questions, as in X.3.2.1 above). Experimental study of the alignment properties of EA nuclear accents is rendered difficult by the fact that most such accents are subject to final lowering (and thus realized in compressed pitch range) and by the fact that it is not possible to induce a long-tailed nuclear accent in EA, since every word bears an accent, and most words are accented within the last three syllables of the word. Nonetheless a carefully crafted experimental study might yield fresh evidence regarding the phonological status of EA nuclear accents.

At present then, for all of the reasons outlined above, the pitch accent inventory of EA is here proposed to consist of one pitch accent only: L+H*. This is a phonological analysis, based on evidence from the detail of the phonetic contour and its sensitivity to prosodic context, but also heavily influenced by distributional evidence (cf. Gussenhoven 2007). A more fine-grained, narrow transcription of EA (e.g. for speech technology purposes) might assign distinct labels to some of the tonal events that we claim here for the sake of analytical coherence to be positionally-conditioned allophonic variants of a single phonological object. Implicit in the present analysis however is the claim that paradigmatic choice of pitch accent type does not convey a meaning difference in EA: local variation in the scaling or alignment of pitch accents is analyzed as due to prosodic context. It follows that the prosodic reflexes of meaning contrasts (such as focus) will necessarily be analyzed as syntagmatic changes to the prosodic context, as discussed in X.5.2 below.

X.4.2.3 Phrase accents and boundary tones

The most common phrase and boundary tone combinations in EA observed in the corpus were L-L% and H-H%, as illustrated in the main intonational tunes described in X.3.2.1. Although they are rare, there are a small number of H-L% and L-H%

boundary combinations which suggests that phrase and boundary tones may freely combine in EA:

(1)	L-L%	declarative, WHQ
	H-H%	continuation rise, declarative YNQ
	H-L%	mid-level boundary (expresses open-ended, rare)
	L-H%	fall-rise boundary (signifies reproach/irony, rare)

A H-L% boundary, which sounds like a mid-level final tone, appears in a few instances in read and re-told narratives (mostly in indirect speech), and also occasionally in spontaneous speech. In the example illustrated in Fig. X.17, speaker B uses a H-L% boundary in an utterance which corrects an incorrect presupposition expressed by speaker A (that Gary would already have left by September).

The L-H% fall-rise boundary tone combination is also rare and was only observed in the spontaneous speech (LDC) corpus. With the preceding rising pitch accent (L+H*) the H-L% boundary tone combination results in a *rise-fall-rise* at the end of the utterance. In the example in Fig. X.18, the H-L% ending occurs in an utterance in which speaker A is suggesting that a father should take his share of childcare responsibilities; the statement is interpreted ironically by speaker B, who laughs along and repeats the joke by reformulating it. This usage is similar to that observed in LA for L-H%, and deemed a potential borrowing from English (see X.4.1.1).

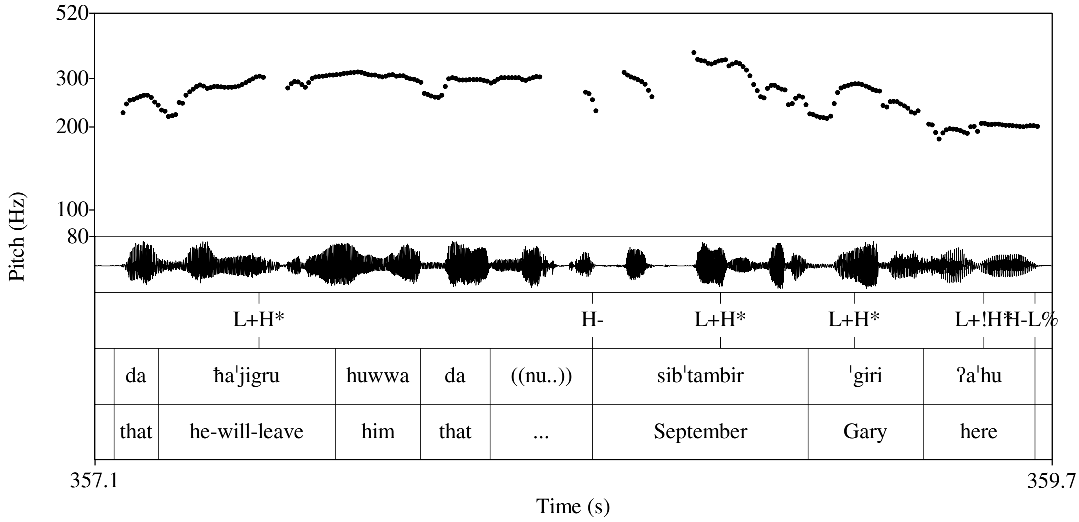

Fig. X.17 Example of H-L% open-ended boundary tone combination: [da ħaˈjigru huwwa da… sibˈtambir ˈgiri ʔaˈhu] "that one he will leave.. Gary will be here in September" (4862B 357.15-359.71).

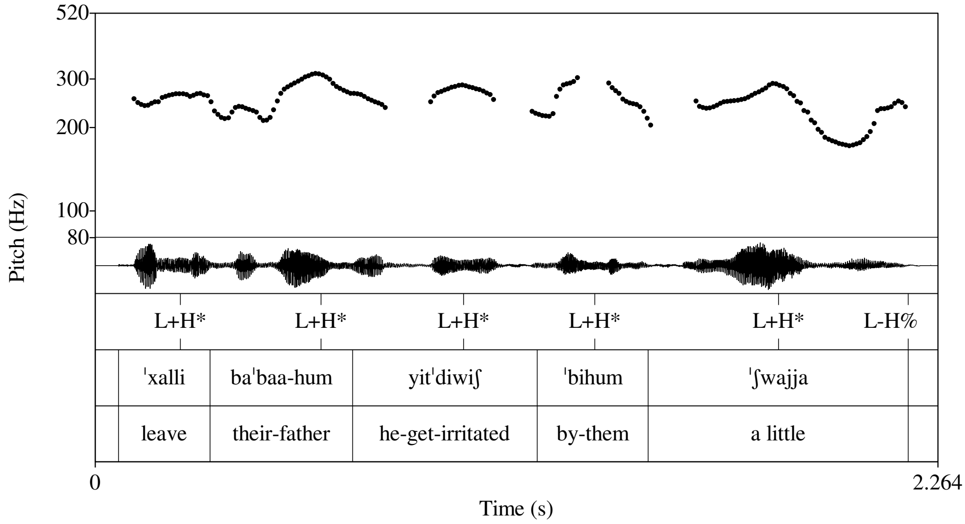

Fig. X.18 Example of L-H% ironic boundary tone combination: [ˈxalli baˈba:hum jitˈdiwiʃ ˈbihum ˈʃwajja] "let their dad put up with them for a while" (4862A 389.84-392.03).

Given the rarity of the H-L% combination, and the possibility that it is a borrowing from English, one could argue that the native EA boundary inventory comprises only three (simplex) boundary tones: high H%, low L% and mid M% (or, zero 0%)[22]. However, since the present analysis maintains use of the intermediate MaP level of phrasing, and since these apparently marginal L-H% boundaries are nonetheless observed in fully spontaneous speech in EA, we continue to employ both phrase accents and boundary tones in the current analysis.

X.4.3 Summary

The above sections set out our empirical findings regarding the intonational patterns observed in LA and EA, together with proposals for their analysis within the AM framework.

The main intonational tunes observed in LA and EA are broadly similar, as is their distribution across utterance types: Apart from WHQs (which are falling in EA but rising in LA), final falling contours are frequently observed in declaratives and final rising contours in incomplete declaratives and in declarative YNQs[23]. The difference in utterance type seems to be conveyed not only through the sequence of tonal events (e.g. choice of boundary tones), but also in part through the global phonetic properties of the utterance (as is the case with EA WHQs versus declaratives and possibly with LA YNQs versus continuation-rise tunes)[24]. While the sequence of tonal events is readily transcribed within AM, no agreed method is yet available for transcription of global phonetic properties (but see Post & Delais-Roussarie 2006).

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[22] This would support the single phrasing level analysis of EA tentatively discussed in 3.2.3 above.

[23] Calling contours were not discussed for EA as they did not appear in the corpus of data examined.

[24] We thank an anonymous reviewer for drawing our attention to this distinction in our data.

A stark difference between LA and EA is in their pitch accent inventories. LA has an inventory of six accents: H* and L+H*, with their downstepped counterparts !H* and L+!H*, together with H!+H* and L*. In contrast EA is analyzed by means of a single phonological category: L+H*, with local variation in the contour argued to be conditioned by prosodic context (adjacency to boundaries or other tones). A further salient difference between LA and EA is in the distribution of pitch accents, which are observed on every PWd in EA, but not obligatorily so in LA.

Turning to edge tones, the intonational patterns of LA and EA are analyzed similarly with L- and H- phrase accents and L% and H% boundary tones. A !H- phrase accent is additionally posited for LA. In both varieties phrase accents and boundary tones seem to be able to combine freely, though contour combinations such as L-H% and H-L% are less frequent. A comparison of our descriptions suggests that these shared phonological representations also display certain surface phonetic similarities such as upstep, especially apparent in the H-L% boundary[25] (cf. 0% in Grabe et al 1998).

An apparent difference of theoretical stance between the two analyses lies in downstep, which in LA is treated as phonological (resulting in the appearance of downstepped variants in the tonal inventory), but in EA as the phonetic

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[25] Upstep of the H% tone in the H-H% boundary configuration is clear in LA, but in EA is less apparent since it is difficult to find long-tailed utterances with a long stretch of unaccented syllables after the last pitch accent (since every content word is accented), in which the level of H- can be compared to that of H%.

implementation of register domains reflecting prosodic constituency[26]. Without further research it is not possible to determine whether this difference in the treatment of downstep represents an actual empirical difference between EA and LA, or rather a difference of approach only. An argument in favor of the hypothesis that this difference is empirical can be based on the clear distinctions between the two varieties in pitch accent distribution and inventory size. The prominence marking function of pitch accents is strikingly different in the two varieties, with pitch accents marking PWd-level prominence in EA but phrase-level prominence in LA. We might thus expect a different division of labor in the expression of meaning also, resulting in a larger pitch accent inventory (in the form of downstepped variants) in the variety which is free to use paradigmatic contrasts at the word-level (i.e. LA).

X.5 Focus

X.5.1 Prosodic reflexes of focus in LA

To examine the reflexes of focus in LA, Chahal (2001) designed an experiment based on a test sentence of the form "X ħamet Y min Z", ("X protected Y from Z") where X, Y and Z represent disyllabic target proper nouns bearing initial lexical stress (/ˈmuna/, /ˈlama/ and /ˈlima/). Four questions were used as prompts: one elicited broad focus ("What happened today") and three placed narrow focus on each of the test words ("WHO protected Y from Z?", "X protected WHOM from Z"? and "X protected Y from WHOM?").

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[26] In EA a phrase-final L+H* pitch accent may optionally show additional downstep (analyzed as final lowering and transcribed '!') but this is not obligatory.

The examination of the intonational patterns of the two focus conditions reveals that LA speakers do not seem to rely on a particular accent type to distinguish between broad and narrow focus, since both can bear either H* or L+H* nuclear accents. In broad focus data, speakers primarily produce a flat hat contour, with a rising accent usually occurring on the first and final target words of the utterance (Fig. X.3b). The final target word carries the main prominence of the broad focus utterance, its nuclear accent status phonetically signaled through increased intensity, duration and more peripheral vowel formant characteristics[27]. In the narrow focus data, the most common contour is a pointed hat, where the narrow focused word similarly receives an H* or an L+H* nuclear accent[28].

Instead of accent type, LA speakers seem to indicate narrow focus primarily through deaccenting. This is most obvious when narrow focus is in non-final utterance position where the narrow focused target word receives a nuclear accent and subsequent target words are deaccented (confirming the analysis of nuclear accent assignment in LA as right-headed). Fig. X.19, for example, illustrates an utterance which displays narrow focus on the initial target word /ˈmuna/. The post-focal target words display no particular F0 tonal event and are thus analyzed as deaccented.

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[27] F0 is not consistently increased due to the flat hat patterns.

[28] The major exception to the pointed hat contour is illustrated in some utterances receiving narrow focus on the final target words, where the narrow focused item receives an H* or L+H* within a similar range as that of a preceding accent, rendering the contour similar in shape to the flat hat patterns observed in broad focus utterances. This observation has also been noted for English (e.g. Ladd 1996).

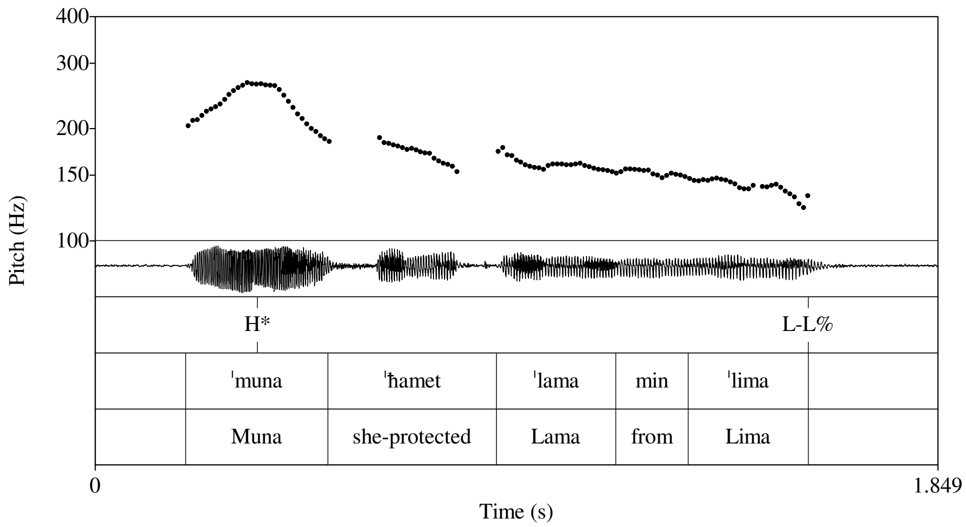

Fig. X.19 A typical realization of an utterance bearing narrow focus on an initial target word.

LA speakers also seem to indicate narrow focus through the insertion of a phrase break with concomitant gradient pitch range manipulation. This strategy is especially obvious in utterances having narrow focus on the initial target word. In Fig. X.20, for example, the utterance-initial narrow-focus word /muna/ is clearly separated into its own IP, as evidenced by the !H-L% tonal configuration and extensive phrase-final lengthening. The insertion of an IP break is accompanied by gradient pitch range manipulation: Following the narrow focused item, the remainder of the utterance is realized in an extremely compressed pitch range featuring as a monotonous stretch of low pitch till the end of the utterance (analyzed as a sequence of an L* nuclear accent falling on /ˈħamet/ "protected" followed by an L-L% boundary).

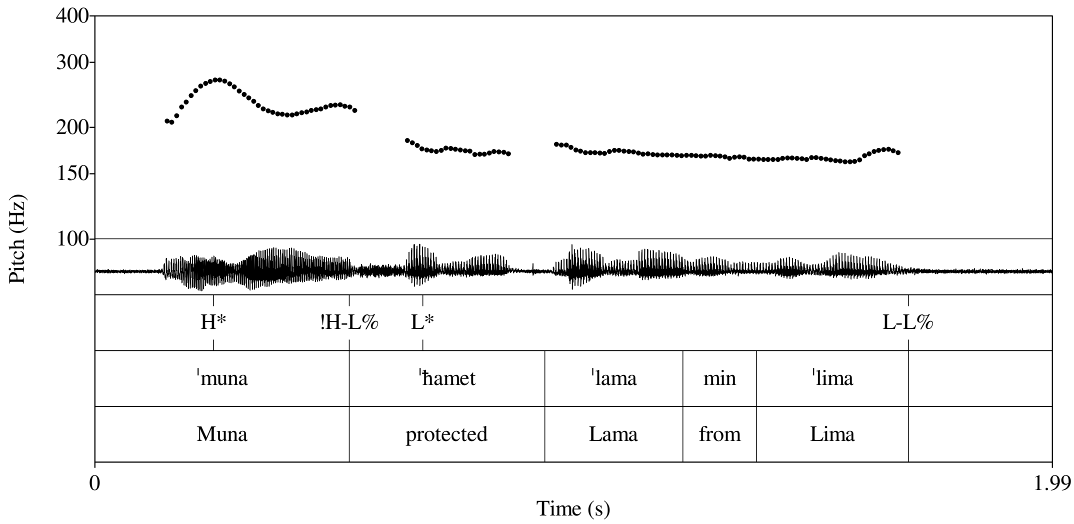

Fig. X.20 An example of phrasing and gradient pitch range manipulation in /ˈmuna ˈħamet ˈlama min ˈlima/ “Muna protected Lama from Lima”, with narrow focus on the utterance-initial target word.

The pitch range of the narrow focused word and that of the non-focal material is thus manipulated such that the former is produced with a relatively large F0 peak whereas post-focal targets are produced in an extremely compressed pitch range. This gradient pitch manipulation is controlled not only for post-focal but also for pre-focal material. While pre-focal target words may be similarly accented, their pitch excursions are significantly compressed compared to that of the narrow focused target (e.g. Fig. X.8).

Chahal (2001) investigated the above gradient realizations quantitatively by comparing the F0, RMS and duration values of accented syllables occurring in narrow versus broad focus. T-test results showed that narrow focused nuclear accented syllables show higher mean values of F0 and RMS than their broad focus counterparts ($p<0.001$). Conversely, comparable non-focal target words in narrow focused utterances showed *lower* mean values of F0 and RMS than their broad focus counterparts ($p<0.001$). This inverse pattern suggests that in narrow focus, the difference between nuclear accented narrow focused words, on the one hand, and non-focal words on the other, is attained not purely by realizing more extreme nuclear accents, but also by producing reduced realizations of non-focal material through lower F0 and RMS values.

The above described phrasing and gradient pitch manipulation effects raise a significant question regarding relative prominence relationships amongst words in an IP: In IPs containing more than one iP, and therefore more than one nuclear accent (e.g. Fig. X.20), how are prominence relations defined? In broad focus utterances, it seems that the final target word- the final nuclear accent- is invariably the most prominent. However, in narrow focus, the prominence relationships amongst nuclear accented words seem to be overridden by the location of the narrow focused item and its F0 relationship with non-focal target words. This may be indicative of another level of prominence which heads the IP constituent. Future research is needed to investigate this claim.

X.5.2 Prosodic reflexes of focus in EA

A key feature of EA intonation, in the present analysis, is the occurrence of a single pitch accent type (L+H*) on every PWd. The option of varying the type or distribution of pitch accents to express focus is thus not available[29]. EA utterances are by no means devoid of expression however, on the contrary, speakers use a range of other prosodic strategies to express focus and other pragmatic functions.

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[29] See Hellmuth (2010a) for discussion of syntactic devices for marking information structure in EA, and for formal definitions of the focus types mentioned here.

The lack of focus-related deaccenting in EA has been shown in a number of studies. Norlin (1989) observed that, after a focus, pitch accents in EA were not deleted but instead produced in compressed pitch range. Hellmuth (2002) reproduced Chahal's (2001) lab speech study (as in X.5.1 above) but found no variation in accentuation or phrasing in any of the focus conditions, and Hellmuth (2005) used a game scenario to elicit focus in semi-spontaneous speech, with the same result. In a larger study Hellmuth (2006a) elicited read speech SVO sentences in frame paragraphs (following Norlin 1989) to manipulate the information status of a target word (given vs. new) as well as its context (following vs. not following a contrastive focus), and confirmed that neither factor resulted in deaccenting of target words. A sample SVO sentence from that study is reproduced in Fig. X.21 below, elicited with contrastive narrow focus on [ˈmaːma] 'Mum' and with the target word [juˈnaːni] 'Greek' textually given (repeated from earlier in the paragraph). The target word bears a clear pitch movement (albeit compressed), even though it occurs after a contrastive focus and is itself given.

Individual tokens from semi-spontaneous speech (a retold narrative containing focus contexts) show the same pattern: even in a fluent narrative, a lexical item following a contrastive focus which is itself given is not de-accented (Hellmuth 2009).

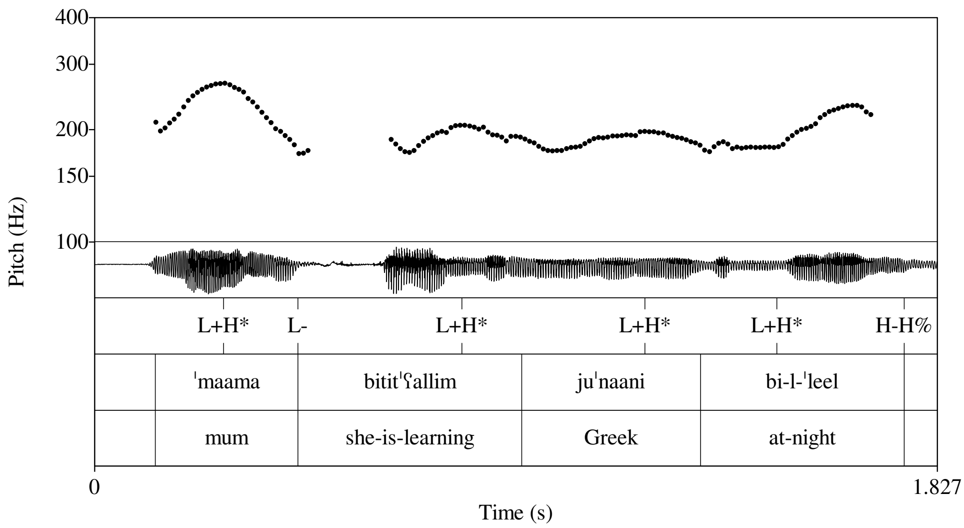

Fig. X.21 A read speech SVO sentence elicited with narrow contrastive focus on the subject [ˈmaːma], and such that the object [juˈnaːni] was old information, in: [ˈmaːma bititˈʔallim juˈnaːni bi-l-ˈleːl] "Mum is learning Greek in the evenings" (from Hellmuth 2006b).

Although complete deaccenting of a lexical item is resisted in EA, F0 excursion clearly varies in the target words discussed above. Quantitative analysis in Hellmuth (2006a, 2009) showed a clear effect of contrastive focus: a focused word is realized in an expanded pitch range (as compared to non-focused counterparts) whereas a word *following* a contrastive focus is realized in a compressed pitch range (compared to non-post-focus counterparts). This matches the findings of Chahal (2001) for LA for F0 (see X.5.1 above), however in EA focus-induced pitch range manipulation is not accompanied by variation in duration (Hellmuth 2006a) or intensity (Hellmuth to appear a), nor by any effects on the alignment of the pitch accent peak (Hellmuth 2006a, b).

In many cases, as in Fig. X.21 above, pitch range expansion on a focused item is accompanied by insertion of a following prosodic boundary marked by a phrase tone. This combination is also found in spontaneous speech, as in the utterance illustrated in

Fig. X.22 below which is produced by speaker B in response to speaker A's use of an idiom (see Fig. X.12 above) to summarize and assess the situation under discussion; speaker B repeats the word [ˈmiʃju:] 'they left' from speaker A's assessment, and follows it with a mild oath suggesting strong agreement. The repeated assessment is produced with expanded F0 excursion, and is followed by an inserted phrase boundary, marked by lengthening and a L- phrase tone; all following accents are produced in a highly compressed pitch range [30].

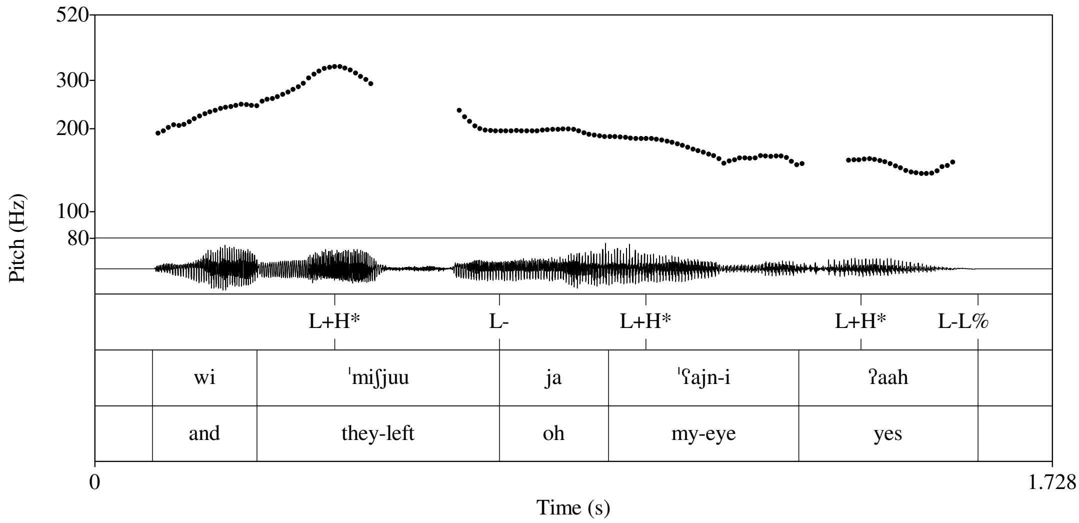

Fig. X.22 An example of MaP phrase boundary insertion for pragmatic function after the initial clause in: [wi ˈmiʃjuː ja ˈʕajn-i ʔaːh] "and they left, dear me [lit. oh my eye], yes" (4862B: 367.17-368.69).

Finally, another focus strategy observed in EA is insertion of an extra pitch accent on the focused word, seen in the EA pronunciation of MSA (El Zarka & Hellmuth 2009). An example from naturally occurring EA speech is given in Fig. X.23: speaker B is

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[30] MaP boundaries are not obligatorily marked with a phrase tone and/or lengthening by all speakers in EA (see X.3.2.3), thus analysis of the use of phrase boundary insertion as a reflex of focus must take account of the particular phrase-marking strategies used by an individual speaker. See El Zarka (to appear) for an alternative analysis of prosodic marking of focus in EA.

listing the advantages of living in a first floor apartment. The word [ˈʔaw.wal] ‘first’ has a pitch accent on each syllable; both accented syllables are lengthened and a following phrase boundary is inserted. Increased duration was not found to be a systematic reflex of contrastive focus in lab speech studies; the observation here that a focused word may be realized with increased duration may be due to a difference between lab and spontaneous speech or may be a specific accompaniment to the realization of two pitch accents on a single PWd.

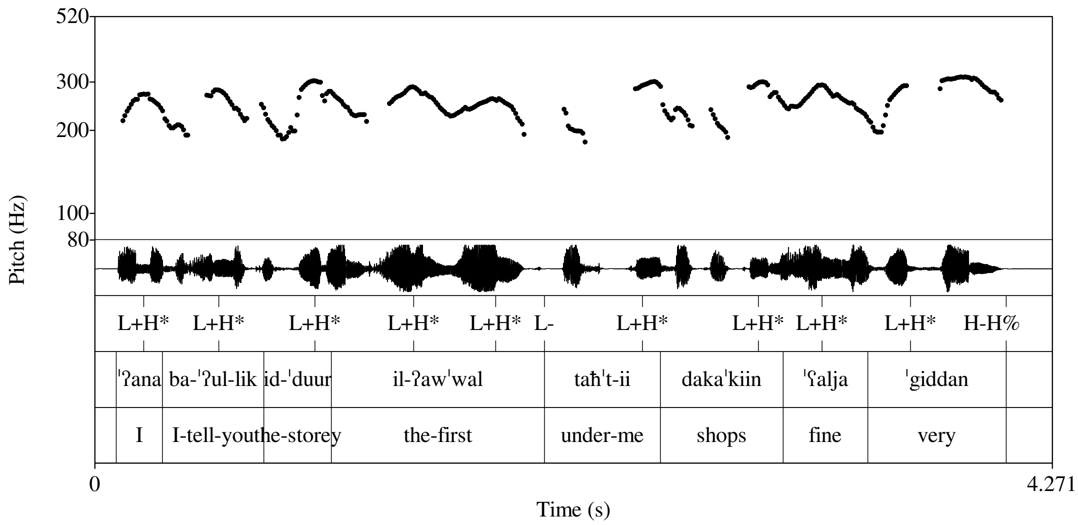

Fig. X.23 An example of secondary accents for pragmatic function on the word /ʔawwal/ in: [ˈʔana baˈʔullik id-du:r il-ˈʔawwal.. taħˈti: dakaˈki:n ˈʕalja ˈgiddan] “I tell you the *first*… below me (i.e. below my first floor apartment) there are really great shops” (4862B: 483.25-487.40).

In summary, pitch range manipulation is used in EA to express contrastive focus, with expansion of the pitch range on the focused item and compression of the pitch range on following items (cf. LA). There is also some evidence that a prosodic boundary may be inserted after a focused item. This is consistent with the expectation (cf. X.4.2 above) that focus in EA will be expressed by means of changes in syntagmatic relations among and within prosodic constituents, in the form of boundary insertion and/or pitch range manipulation (perhaps as a type of prosodic subordination among PWds, cf. Ladd 2008). The range of data and contexts analyzed thus far in EA is nonetheless limited, and further investigation of the prosodic expression of information structure in EA is much needed.

X.5.3 Summary

In LA, narrow (contrastive) focus is expressed by means of expansion of acoustic cues to prominence on the focused item (including F0, RMS, F1/F2 and duration) and compression of cues on items preceding and following it. This contrasts with broad focus utterances in which the relationship between the various prominence levels is kept to a necessary but minimal threshold of difference: the F0 level of individual accents is not necessarily distinct for all speakers (as some use flat hat patterns), but their prominence level is signaled through other non-tonal means such as duration and amplitude. In addition to these arguably gradient cues to focus prominence, in LA, under narrow focus, a non-phrase-final nuclear accent conditions either deaccentuation of all following items within the same iP or insertion of an iP boundary directly after the focus.

In EA, a contrastive focus is also marked by expansion of f0 excursion on the focused item and compression of f0 excursion on following items, though evidence to date suggests that this is not accompanied by variation in other dynamic cues. Optional focus marking strategies include insertion of a prosodic boundary, lengthening of the (phrase-final) focused word, and realization of two accents on a focused word.

An intriguing picture thus emerges in that both LA and EA employ gradient cues to acoustic prominence, yet categorical de-accentuation is available as a prosodic focus-marking strategy only in LA. Cross-linguistic variation in the availability of deaccenting is an established phenomenon (Cruttenden 2006[31], Ladd 2008), and the data described here suggest that LA and EA are at different positions in the continuum of prosodic variation with respect to de-accentuation.

X.6 Discussion and conclusion

This section highlights key similarities and differences in the intonational phonology of LA and EA. A summary of the tonal inventories proposed here for the two varieties is provided in Table X.2 below.

Table X.2. The inventory of pitch accents and edge tones proposed for LA and EA.

	LA			*EA*	
Pitch accents	H*	L+H*	L*	L+H*	
	!H*	L+!H*	H+!H*		
Phrase tones	L-	H-	!H-	L-	H-
Boundary tones	L%	H%		L%	H%

Starting with edge-marking, both LA and EA have two intonationally-relevant levels of phrasing above the word (though the analysis is more complex in EA) and share a broadly parallel edge tone inventory. Boundary tone combinations are used in similar contexts in the two varieties, so that falling L-L% boundaries are frequently observed on declarative statements (cf. Vaissière, 1983) and rising H-H% boundaries are frequently observed in declarative YNQs and to indicate incompleteness.

[31] Cruttenden's (2006) cross-linguistic production study includes data from Tunisian Arabic which resists deaccenting in a similar fashion to EA.

The differences between LA and EA are more striking when we consider prominence-lending tonal events. Both LA and EA use rising pitch accents analyzed as L+H*; in EA, L+H* is claimed to be the only pitch accent type in the tonal inventory, whereas in LA, it is proposed to contrast phonologically with five other accent types (H*, L*, !H*, L+!H* and H+!H*). This disparity in the size of the two pitch accent inventories represents a key typological difference between EA and LA, even allowing for the fact that the two models are not based on parallel corpora (in size or style), or indeed for the fact that one could arguably enlarge the EA inventory (by proposing a phrase-final falling pitch accent) and/or reduce the LA inventory (for example, by treating downstep externally to the phonological system).

A case in point is the phonological distinction between H* and L+H* which has been a point of contention for English. Ladd and Schepman (2003) argue that the absence of an L tone in English H* is due to contextual factors such as pitch range variation and/or the number of syllables intervening between two H peaks, and this approach is adopted to account for undershoot of the leading L tone in EA, in a sequence of L+H* accents (Hellmuth 2006a:78-79). Although the L tone in rising accents in LA is well motivated, behaving as a clear tonal target (see X.3.1.2), the extent of the onglide into H* accents could be argued to be subject to contextual factors such as lack of segmental material in LA also.

Despite this caveat, the models presented here for EA and LA indicate that a critical question for future research in comparative Arabic intonation is to establish the size of pitch accent inventory and the number of phonological contrasts available in positions of metrical prominence. Our present comparison suggests that the size of the pitch accent inventory can vary cross-dialectally in Arabic.

Turning to accent placement, LA and EA share the same basic phonotactic constraint that pitch accents are realized on metrically stressed syllables at the PWd level. However, the two dialects differ significantly in the distribution of pitch accents and in the effects of focus on accent distribution. Whilst in LA every content word in an utterance may bear a pitch accent (such as in the examples in Fig. X.3c and Fig. X.5), it is not true that every content word must be accented, even in read speech, as can be seen for example in Fig. X.3b and Fig. X.4b. In contrast, in EA every content word will usually bear a pitch accent, even in spontaneous speech and in focus contexts. This contrast in accent distribution is another key typological difference between EA and LA, and thus an important finding of the present comparison is that the distribution of pitch accents may also vary cross-dialectally in Arabic.

Finally, there is also a difference between LA and EA in the effect of focus on the intonational structure of the two dialects. In LA, nuclear accent placement is obligatorily right-headed; in narrow focus contexts an intermediate phrase boundary is placed after the focused item and subsequent target words within the same intermediate phrase are deaccented. In contrast, in EA, content words following a focus are not subject to categorical deaccentuation. Nonetheless, both dialects make use of gradient manipulation of pitch range to signal focus (with accompanying variation in dynamic cues to prominence in LA). An important goal of future research will be to clarify by means of perception tests whether the gradient pitch range manipulation effects observed in both varieties in production result in distinct phonological systems, with categorical deaccentuation in one variety but not in the other. Our production-based comparison of EA and LA suggests however that the degree of deaccenting can vary cross-dialectally in Arabic, just as it varies cross-linguistically between Germanic and Romance languages (Ladd 2008, Swerts et al 2002).

In conclusion, despite a broad family resemblance between EA and LA in their prosodic phonology, the comparison presented here highlights a number of areas in which the prosodic systems of different Arabic varieties may differ in non-trivial ways. We hope that this paper has served to identify potentially fruitful areas of divergence in the intonational phonology of different Arabic varieties, which future studies will be able to explore by means of directly parallel comparison.

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