Pitch accent distribution as a parameter of prosodic variation.*

1 Introduction

This paper deals with intonational languages which display what will we shall term rich pitch accent distribution, by which is meant that intonational pitch accents occur with high frequency, so that there is a pitch accent on almost every content word in an utterance. An intonational pitch accent is defined within Autosegmental-Metrical (AM) theory (Ladd 1996) as a linguistically significant movement of pitch associated with the stressed syllable of a word [1].

In general, variation in the distribution of pitch accents, and thus the possibility that some languages may have rich pitch accent distribution, has not been seen as a potential category of prosodic variation. Jun (2005) is the first typological survey to directly identify high frequency of pitch accent distribution as a property potentially relevant in intonational typology. In a survey of 21 languages of different prosodic types (including tone, lexical pitch accent and intonational stress-accent languages) which have been analysed in Autosegmental-Metrical (AM) frameworks, Jun (2005) appeals to prominence type and basic rhythmic/prosodic unit as the key categories of prosodic variation, both of which are seen as dependent on the function of prosody in the language, whether lexical or postlexical. However, Jun notes that this formulation of prosodic typology is not able to capture 'differences between stress languages that differ in the frequency and the type of postlexical pitch accent' (Jun 2005:447). She gives the example of Spanish and Greek which were included in her survey and which share the twin properties of having a pitch accent on almost every content word and a reduced pitch accent inventory in pre-nuclear (non-phrase-final) position: an accent 'on almost all content words, and ... the type of pitch accent is basically the same (L*+H for Greek)' (Jun 2005). Jun goes on to suggest that use of pitch to consistently mark word-level prominence in this way may have 'the perceptual equivalence of word segmentation... [which] is not captured in the [AM] model' (ibid.).

It is possible that systematic variation in pitch accent distribution may not previously have been seriously considered as a potential area of typological variation due to the interest paid to the role of pitch accent distribution as an indicator of focus and/or information status, particularly in Germanic languages, in which there is well-established interaction between the presence/absence of pitch accents and focus context (cf. Gussenhoven 1983, Selkirk 1984). In a cross-linguistic survey however, Cruttenden (2006) shows that there are languages in which accentuation does not directly reflect focus structure, in that items of old/given information are accented, which Cruttenden terms 're-accenting'.[2] Similar evidence from languages in which given information is not de-accented leads Ladd (1996: 174-187) to argue that the link between accent distribution and focus structure is mediated through prosodic structure, and thus that pitch accent distribution is, in all languages, ultimately a phonological phenomenon.

This paper makes three key claims. The first is that co-variation in the frequency and type of postlexical pitch accents is indeed systematic, being observed as correlated properties in Egyptian Arabic and in a range of genetically diverse languages; thus the anomalous category noted by Jun is in fact typologically quite common, and requires

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[1] In this paper the term 'stress' denotes word-level lexical stress, and 'accent' denotes a pitch movement associated with a stressed syllable.

[2] Languages of the 're-accenting' type in his survey include Spanish, French, Tunisian Arabic and Swedish, and, to a lesser degree, Italian and Albanian.

analysis. The second claim is that there is an additional correlated property in these languages, which is that frequent pitch accents tend also to be resistant to de-accenting, thus the function of pitch accents in these languages is not inherently focus-marking but rather prominence-lending at the word-level. These three properties are illustrated in detail from empirical evidence in Egyptian Arabic, and then by means of a literature survey of other rich pitch accent distribution languages which are shown to share the same constellation of properties. The final claim is that co-occurrence of these three correlated properties can be formalised within standard AM theory by appeal to the Prosodic Word (PWd) as the level of prosodic structure relevant for accent distribution.

The outline of the paper is as follows: §2: a case study of the frequency, form and function of pitch accents in Egyptian Arabic; §3: a literature-based survey of other languages with rich pitch accent distribution; §4: formal analysis, appealing to the notion of default tone; §5: conclusion.

2 Rich pitch accent distribution in Egyptian Arabic

2.1 The prosody of Egyptian Arabic

Egyptian Arabic (EA) is the dialect of Arabic spoken in Cairo, Egypt, and by educated middle class Egyptians throughout Egypt (often known as Cairene Arabic). The segmental and metrical phonology of EA are extremely well-described, and have been much discussed in the phonological literature (see Watson 2002 for a comprehensive summary and review of prior work).

Word-stress assignment in EA is non-contrastive and fully predictable from the syllabic structure of the word. The key generalisations are: attraction of stress to heavy syllables word-medially but not word-finally; attraction of stress to word-final superheavy syllables; and, displacement of stress from a heavy antepenult if it is followed by two light syllables ([maktaba] vs. [*maktaba]). Hayes (1995:67-71) analyses EA stress by means of consonant extrametricality, foot construction left-to-right in moraic trochees, and stress falling on the rightmost foot in the word.

(1)
```
(         x        )
(x  )(  x    . )
ʔ i n  k a s a r a
```
'to be/get broken' Hayes (1995:70)

As regards EA sentence-stress, the picture is much less clear. A number of studies include revealing comments to the effect 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). In focus contexts however, Mitchell (1993) notes that in EA the nucleus, in the sense of the main or focal prominence of the utterance (as defined in the British school of intonation, e.g. O'Connor & Arnold 1961), can be located in different places in the sentence to indicate the position of focus, without changing the word order. Thus according to Mitchell it is possible in (2) to locate the nucleus on [ʔitneen] 'two' or [gineeh] 'pounds' and obtain a contrastive reading ('two pounds (not three pounds)' or 'two pounds (not two shillings)' (Mitchell 1993:230):

(2)

ʔitniːn	giniːh	maṣri
two	pounds	Egyptian

'Two Egyptian pounds.'

In contrast, in an instrumental study Norlin (1989) reports purely gradient reflexes of focus, so that in an SVO sentence with narrow focus on just one part (subject, verb or object) all three constituents bear a pitch accent, but the pitch peak of the focussed phrase is higher than in a neutral statement, whilst the pitch peak of following phrases is lower. This matches the findings of a small study that used a game scenario to elicit short semi-spontaneous utterances in controlled focus contexts in EA, and in which no post-focal de-accenting was found (Hellmuth 2005). These instrumental studies suggest that even in focus contexts EA words tend to bear pitch accents.

There appears to be a mismatch therefore between the possibility of placing focus early in the sentence by prosodic means ('nuclear mobility') and an apparent lack of de-accenting after such a focus. In the case study below, we show that this problem is solved by recognising EA as a language which has rich pitch accent distribution, showing three correlated properties: high frequency of pitch accents (one on every word), pitch accents of consistent form (one pitch accent type in pre-nuclear position) and pitch accents with word-level prominence function (which emerges as a lack of de-accenting - the presence/absence of pitch accents in EA is unrelated to focus structure).

2.2 The frequency of distribution of pitch accents in Egyptian Arabic

Here we present empirical evidence that EA has rich pitch accent distribution, across a variety of contexts and speaking styles. The corpus of speech data reviewed here includes read sentences and narratives, as well as (semi-) spontaneous speech materials.

The read speech materials were a subset of a larger corpus of read speech sentences collected for other purposes. For each of the 8 sentences surveyed, 18 tokens were transcribed (3 repetitions each from 6 speakers, 3 male/3 female) yielding detailed transcription of 144 sentences, which contain 792 potentially accentable content words (defined as nouns, verbs, adjectives and adverbs). Five of these speakers (2 female/3 male) also recorded a narrative folk tale taken from a textbook for learners of EA (Abdel-Massih 1975). The story was read three times each by five speakers (2 female/3 male), and then they were asked to re-tell the story from memory. The second read repetition from each speaker and their re-told version were submitted to detailed auditory transcription, yielding 1055 potentially accentable content words in the read narratives, and 686 in the re-told narratives (speakers' retold versions of the story varied in length from 114-158 content words each). Finally, a spontaneous telephone conversation extracted the Linguistic Data Consortium Callhome Egyptian Arabic Speech Supplement corpus (Karins *et al.* 2002) was transcribed. The transcribed portion from a conversation between two female speakers contained 119 + 315 content words respectively.

The full set of materials included in the transcription corpus are listed in (3) below. The transcription, carried out by the author, sought to answer the following research question: what is the distribution of pitch accents (is every content word accented)? The inventory of pitch accents and boundary tones used during transcription as a working hypothesis is listed in (4).

(3) Materials included in the corpus survey.

corpus section:	speech style:	materials:	# of speakers:	# content words:
read sentences	read speech	8 syntactically varied sentences from text	6 speakers (x 3 repetitions)	792
read narratives	read speech	folk tale from text	5 speakers	1055
retold narratives	semi-spontaneous speech	folk tale re-told from memory	5 speakers	686
CallHome conversation	spontaneous speech	spontaneous telephone conversation	2 speakers	434
Total				3255

(4) LH* most common pre-nuclear pitch accent
H% L% indicating the right edge of an Intonational Phrase (IP)
L- H- indicating the right edge of a Major Phonological Phrase (MaP)

The results of the survey provide striking distributional evidence for the generalisation that in EA there is a pitch accent on every content word in the dataset; across all contexts and speech styles, over 95% of content words in EA bear a pitch accent (associated with the stressed syllable). A summary of the results is provided in (5).

(5) Counts/percentages of unaccented content words in the corpus (all speakers).

	# content words	# unaccented content words	% accented content words
read sentences	792	6	99.2%
read narratives	1055	31	96.8%
re-told narratives	686	29	95.7%
conversation	434	8	98.1%
Total	*3255*	*76*	*97.9%*

Whenever there was a borderline case (accented vs. unaccented) it was counted as unaccented, so these distributional counts represent the most conservative estimate, from the point of view of the hypothesis that EA does accent every content word. The following syntactic categories were classified as content words: nouns, verbs, adjectives and adverbs. There were comparatively fewer unaccented content words in the read sentences than in longer stretches of speech, whether read or spontaneous. Nonetheless the number of unaccented content words in narrative and conversational contexts is still extremely low. This contrasts with a distinction observed in Spanish between the distribution of pitch accents in speech collected under laboratory conditions (lab speech) and spontaneous speech (Face 2003). Face found approximately 70% accented content words in spontaneous speech in Spanish, compared to a distribution in Spanish lab speech which is similar to that observed here in EA. The results of the present survey suggest that highly populated pitch accent distribution is found in both lab and spontaneous speech in EA. The generalisation that every content word is accented holds across all speakers, as shown in (6) below: there was no speaker who left content words unaccented particularly more than others.

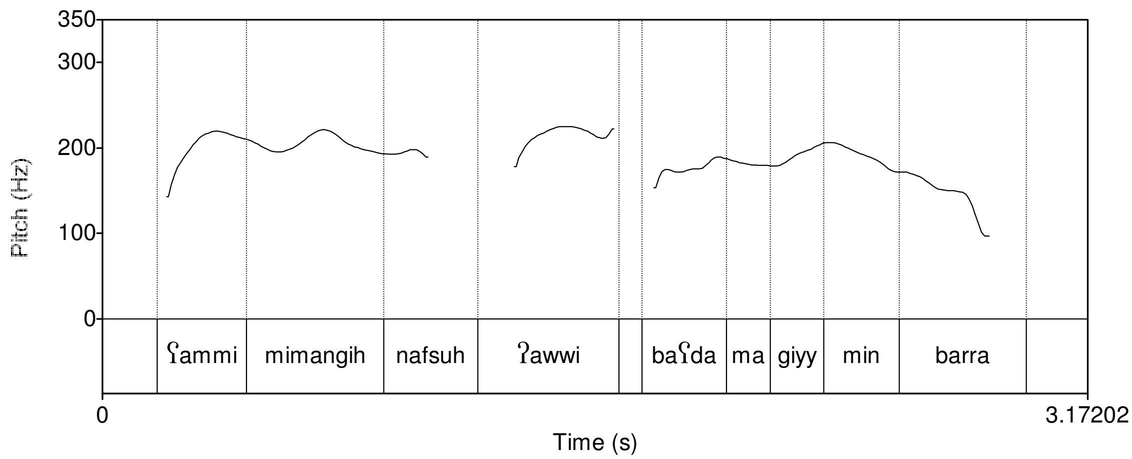
(6) Actual counts of unaccented content words and total percentage of accented content words across the whole corpus, by speaker.

	faa	*fna*	*fsf*	*meh*	*miz*	*mns*	*'A'*	*'B'*
read sentences	1/132	1/132	2/132	0/132	1/132	1/132	-	-
read narrative	-	6/211	7/211	1/211	8/211	10/211	-	-
re-told narrative	-	6/133	1/134	10/158	9/114	3/147	-	-
conversation	-	-	-	-	-	-	5/119	3/315
TOTAL (%)	99.3	97.3	98.0	97.9	96.2	97.2	95.7	99.1

The 2-4% of content words which were unaccented include: 'utterance-peripheral' items, such as 'reporting verbs' occurring in the read or retold narratives, [ʔaal-luh] 'he said to him'; words of high frequency which fulfil a discourse function rather than a lexical function in context, such as the discourse particle [yaʕni] 'well/I mean' (lit. 'it means'); 'serial' verbs and pre-head modifiers which occur in a structurally weak position, such as the verb [fakkar] 'he thought/decided' in the phrase [fakkar yinzil masr] 'he decided to go to Cairo..'; and a small number of content words which were unaccented in fast renditions of certain speakers.

Overall, however, the corpus survey confirms that EA has rich pitch accent distribution, across a variety of contexts and speech styles. Sample pitch tracks and transcriptions are provided below in Figures 1-3 (stressed syllables are underlined in the transcription).

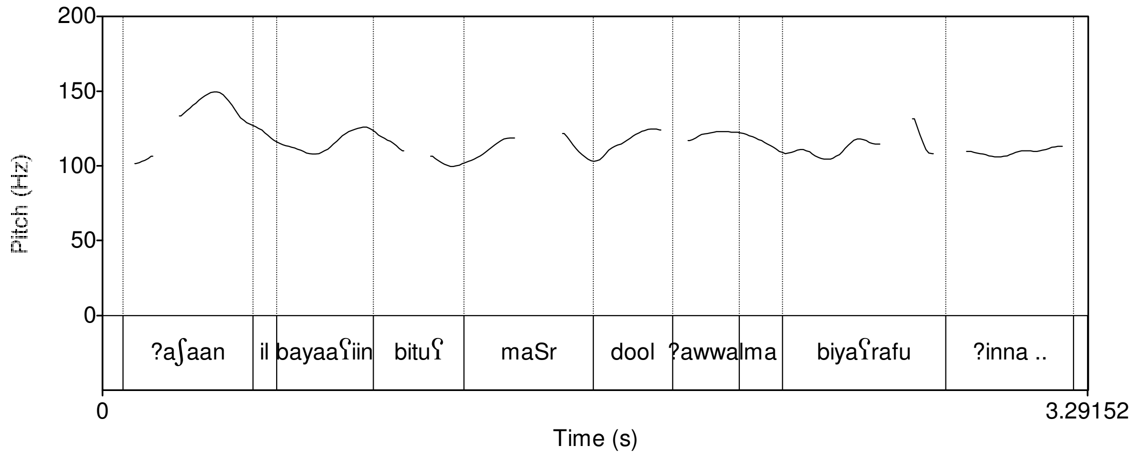
Figure 1 Sample read neutral declarative (*212121faa1* from the align corpus).



ʕamm-i	mimangih	nafs-uh	ʔawwi	baʕd	ma	gajj	min	barra
uncle-my	boastful	himself	very	after	that	he-came	from	overseas
LH*	LH*	LH*	LH* H-			LH*		!LH* L-L%

212121: 'My uncle has been full of himself since he came back from overseas.'

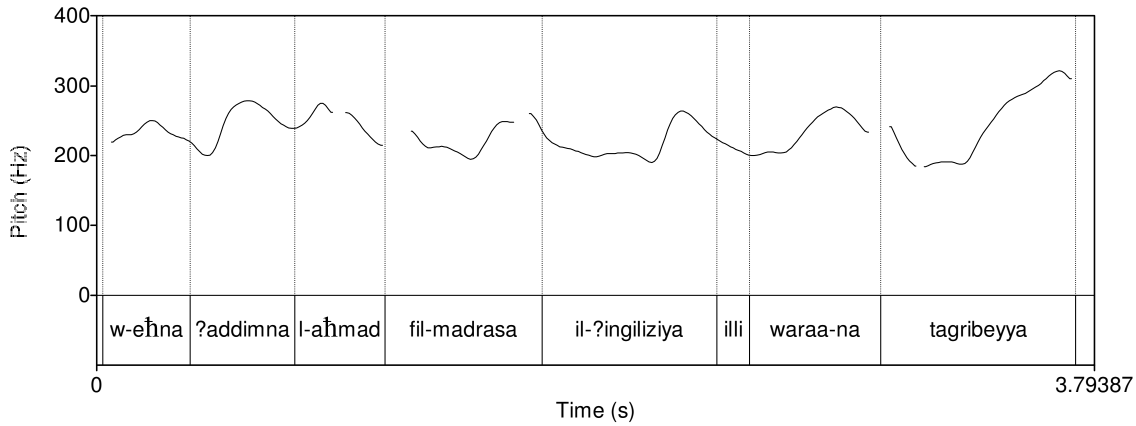
Figure 2 Sample extract from a retold narrative (*mns4*).



ʔaʃaːn	il	bayaʕiːn	bituʕ	mas̴r	doːl	ʔawwal	ma	biyaʕrafu	ʔinna..
because	the	sellers	belonging	Cairo	them	first	that	they-know	that..
LH*		LH*		LH*	LH*	LH*		LH*	

mns4: 'Because the traders in Cairo, as soon as they know that.....'

Figure 3 Sample extract from the spontaneous speech (LDC) corpus (*4862B*).



wi	eħna	ʔaddimna	li-	ʔaħmad	fi	-l-	madrasa	il-	ingliziyya ..
and	we	applied	for	Ahmed	in	the	school	the	English
	LH*	LH*		LH*			LH*		LH*
						...illi	waraːna	il-	tagribiyya
						that	behind-us	the	near
							LH*		LH* H-H%

4862B (330.53-334.27): 'And we have applied for (a place for) Ahmed at the English school right behind us.'

2.3 The form of pitch accents in Egyptian Arabic

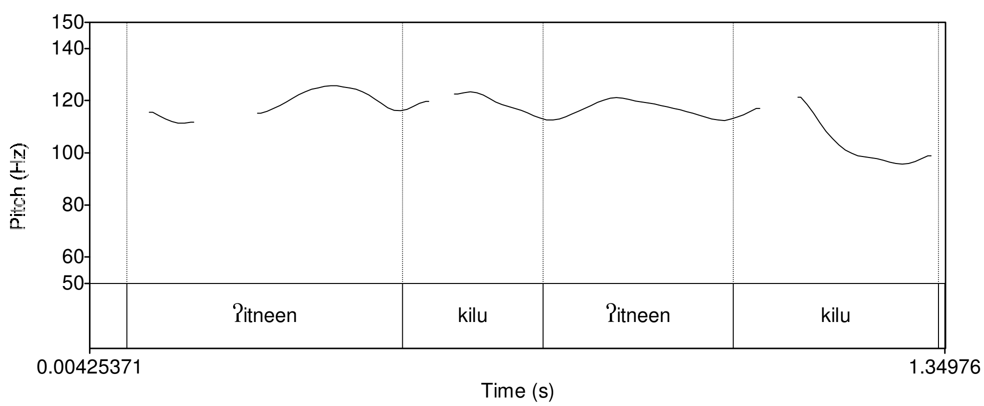
Having shown that pitch accents are frequent in EA (occurring on almost every content word), this section shows that the pitch movement associated with the stressed syllable of each word in EA is overwhelmingly of a single type. Thus EA will be shown to have the two properties indicated as correlated by Jun (2005).

A review of the shape of each pitch movement identified as a pitch accent in the corpus survey described in §2.2 reveals that the standard pitch movement observed is a rising movement, aligned within the stressed foot of the accented word. Pitch movements which do not appear to follow the normal pattern include pitch accents showing an unusual local pitch contour before or after the stressed syllable, which can be analysed as due to insertion of a phrase tone, and cases of an unusual pitch contour between two content words suggesting possible absence of the L turning point, which can be analysed as due to undershoot of the L pitch target in clash contexts.

The most likely contender for a fully fledged different pitch accent type in EA is the relatively rather larger group of cases in which sentence-final pitch accents appear to be falling rather than rising. There are two possible analyses of these. One analysis would classify sentence-final pitch accents as a qualitatively different pitch accent type, involving perhaps a HL sequence, and restricted to 'nuclear' Intonational Phrase (IP)-final position, as has been argued to best account for the facts of a number of European languages: Italian (Grice *et al.* 2005), European Portuguese (Frota 2000), Spanish (Face 2002)[3] and also for the Egyptian pronunciation of standard Arabic (Formal Egyptian Arabic, FEA, Rifaat 2005). An alternative analysis of sentence-final pitch accents in EA would see the final falling movement as the result of (very) early peak alignment in a standard LH* pitch accent, with early alignment of the H peak due to tonal crowding from IP-final boundary tones as well as proximity of the strong prosodic boundary (IP). Such effects on peak alignment have been observed for both Lebanese Arabic (Chahal 2001) and Spanish (Prieto *et al.* 1995), and the latter analysis was proposed for El Zarka (1997) for FEA.

The second option, of a single pitch accent type in EA, occurring in both nuclear and non-nuclear positions, is adopted here, and thus IP-final pitch accents are notated as LH*, even if there is an early peak and therefore essentially falling pitch throughout the word. The key evidence in favour of this analysis is that the sentence-final falling contour is observed exclusively before low sentence-final boundary tones; there are no instances in the corpus of a falling final pitch accent preceding high boundary tones. As an illustration, Figure 4 below shows a sequence of two phrases from a retold narrative, which together form a single IP (the example is from a bargaining dialogue in the narrative). The word [kilu] 'kilo' is repeated: in the first (non-final) instance the word bears a LH* pitch accent with usual alignment; in the second (phrase-final) instance the peak is shifted leftwards, so that there is falling pitch through most of the word.

Figure 4 Example of falling pitch/early peak in a final pitch accent (*miz4*).



ʔitni:n	kilu	ʔitni:n	kilu
two	kilos	two	kilos
LH*	LH*	LH*	LH* L-L%

mns4: 'Two kilos! Two kilos!'.

[3] Other authors have proposed a single pitch accent in Spanish, with the early peak in nuclear position ascribed to boundary effects (e.g. Nibert 2000).

In EA then, the overwhelming majority of pitch accents in the corpus are rising pitch movements in which the rise is associated with the stressed syllable of the word, and all are analysed here as tokens of a single phonological object: LH*.

2.4 The function of pitch accents in Egyptian Arabic: not focus-marking

The final part of this case study demonstrates that EA is a language in which pitch accents resist de-accenting, the final property claimed here to be typical of a language with rich pitch accent distribution. Initial evidence comes from a small pilot study by Norlin (1989) which elicited parallel renditions of an SVO sentence, embedded in different frame paragraphs to elicit either broad focus over the whole sentence or narrow focus on just one part (the subject, the verb or the object). As noted briefly in §2.2 above, Norlin found that in focus contexts the pitch peak of the focussed phrase is higher than in the neutral statement and that the F0 contour then dips below that of the neutral statement until the end of the utterance[4], indicating that focus can be expressed in EA by expanding F0 excursion on the focussed item and compressing F0 on following items. Crucially, Norlin does not report full de-accentuation of any of the post-focal words.

In an experiment reported in Hellmuth (2006), SVO target sentences were similarly placed in frame paragraphs designed to manipulate focus relations within the sentence. In particular the aim was to generate a context in which the pitch properties of words falling after a contrastive focus and which are themselves given (repeated from earlier in the discourse) could be examined, since this is a canonical context for de-accenting in Germanic languages (cf. Selkirk 2000). Thus in each target SVO sentence both the contrastive focus status (±F) of the subject (trigger) and the information focus status (±f) of the direct object (target) were varied, resulting in four possible 'contrastive focus~information focus' combinations [trigger~target]: [+F+f], [+F-f], [-F+f], [-F-f]. The pitch properties of words falling after a contrastive focus and which are themselves given (i.e. target words in +F-f condition) were systematically checked in the whole dataset of 144 tokens, and the presence of a local F0 maximum within the word set as the determining factor for whether or not such target words were ever 'de-accented'; absence of an F0 maximum would in every case be interpreted as an instance of de-accenting. However, there were no such instances: in all 144 target words a local F0 maximum was observed on or near the stressed syllable of the target word.

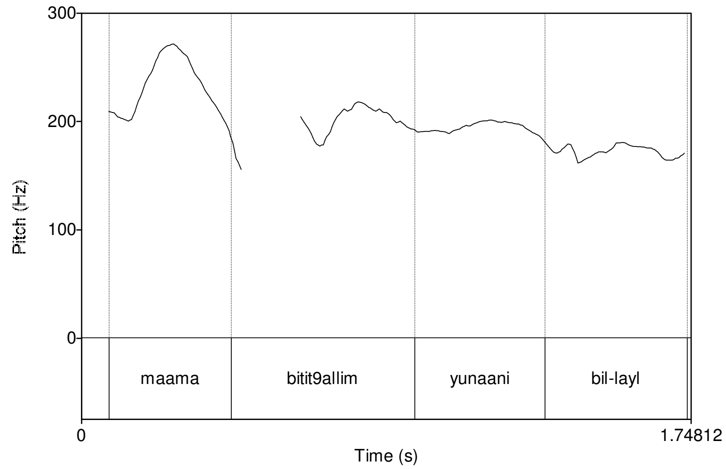
Typical pitch tracks are provided in Figure 5 below. In Figure (5c) it is visually clear that there is a pitch movement on the target word [yunaani] ('Greek'), in a [+F-f] token (123faa1). It is also clear that F0 excursion varies in the different words, suggesting that gradient manipulation of pitch range is likely to be relevant to focus expression in EA, and gradient effects of contrastive focus were indeed found, in the form of expansion of pitch range on items under contrastive focus and compression of pitch range in items occurring after a contrastive focus. matching the observations of Norlin (1989). Interestingly, however, compression of F0 excursion in EA does not reflect information status at all, but only of post-contrastive focus position.

Thus there is no categorical de-accenting in EA, regardless of the information focus status of a word itself or the contrastive focus status of preceding items in the utterance.

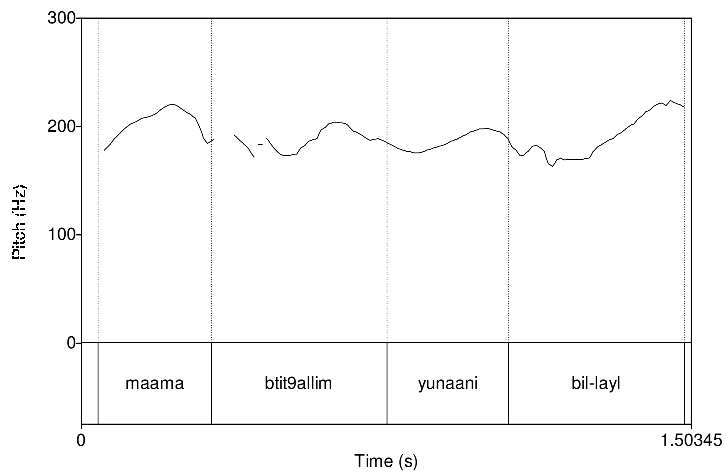
[4] In sentence-final focus conditions Norlin found the same contour in the pre-focus part of the utterance as observed in neutral statements, suggesting that the focus effects were directional, affecting the focussed item and any linearly subsequent items only, rather than also affecting pre-focus items.

Figure 5 Sample pitch tracks of:

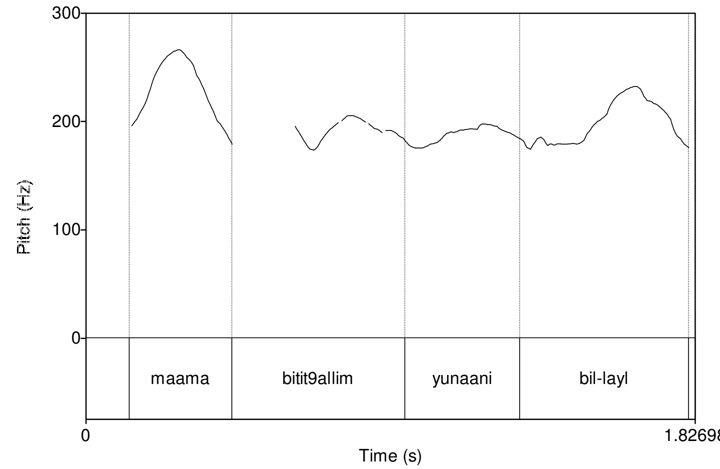
a) +F+f condition (*121faa1*).



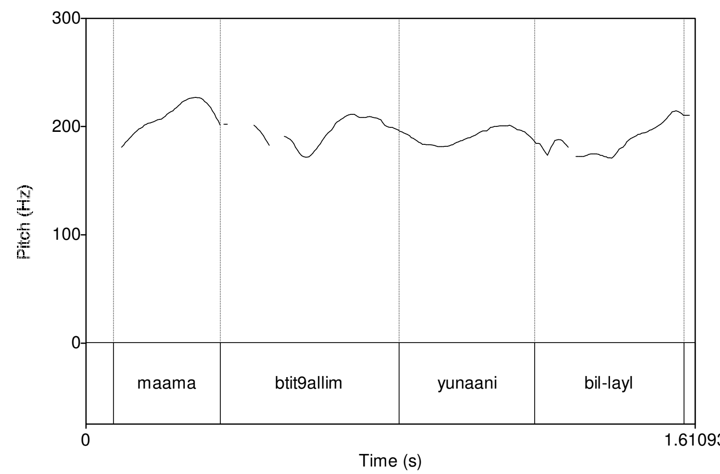
b) -F+f condition (*122faa1*).



c) +F-f condition (*123faa1*).



d) -F-f condition (*123faa1*).



2.5 Summary

In EA, then, every content word bears a pitch accent, of a single type, and that accent is observed in all conditions regardless of focus context. In the next section, these three properties (pitch accent frequency, form and function) are shown to be characteristic not just of EA but of a range of genetically unrelated languages.

3 Rich pitch accent distribution: a cross-linguistic survey

In §2 EA was shown to have the following properties: a pitch accent on (almost) every content word, a (strictly) limited pre-nuclear pitch accent inventory and pitch accent distribution unrelated to focus (no de-accenting). Here we offer a literature-based review of a selection of languages which appear from descriptions to have rich pitch accent distribution, in order to determine to what extent the other two properties of pitch accents (form/function) are also shared. The survey is necessarily limited to those languages for which an intonational analysis exists, and as a result cannot provide representative genetic or areal coverage. The main languages surveyed are Spanish, Greek, Northern European Portuguese, Italian, Mawng, Hindi and Danish. Also considered in detail are Halha Mongolian, Tamil and Aleut which appear to share similar distribution of pitch movements, but in which the regular pitch movements are analysed as phrase tones rather than pitch accents. Brief reference is made to Tunisian Arabic, Central Alaskan Yupik, Bininj Gun-Wok and Iwaidja.

Let us start with the two languages highlighted by Jun (2005). For Greek the examples provided by Arvaniti & Baltazani (2005) are consistent with the claim that every content word bears a pitch accent, and the majority of pre-nuclear accents in Greek are a rise to a peak, analysed in GrToBI as L*+H. In Cruttenden's (2006) survey, however, Greek speakers were more prone to de-accent given items than, say, the speakers of Spanish, who consistently accented words even repeated from earlier in the discourse. As regards pitch accent frequency in Spanish, Face (2003) shows that in lab speech every content word is accented, but, as already noted in §2.2 above, in spontaneous speech the proportion of accent content words falls to about 70%; Ortega-Llebaria & Prieto (2007 in press) note that content words in parenthetical sentences are usually unaccented in Spanish. The most frequent pitch accent observed in pre-nuclear positions in Spanish is a rise to a peak, analysed variously by different authors[5]. Among other Romance languages, Italian has a pitch accent on almost every content word which is mostly of a single type, H* (Grice *et al.* 2005), and Italian is known to resist de-accenting of given items (Ladd 1996, Swerts *et al.* 2002, Cruttenden 2006). Northern European Portuguese is reported to have rich pitch accent distribution: Vigario & Frota (2003) report that in their NEP corpus 74% of stressed syllables bear a pitch accent; they also report additional tonal events which take the form of a rise, and which they tentatively analyse as either a PWd-initial rise or as a rise associated with a secondary-stressed syllable.

Turning to other language families, another dialect of Arabic, Tunisian Arabic, is reported to have rich pitch accent distribution (p.c. Nadia Bouchouia) and was found in Cruttenden's (2006) survey to display little or no de-accenting. Moving into Asia, the facts of Hindi intonation have been documented in some detail and are very similar to those of EA. Hindi has rising pitch movements on every content word (analysed as LH), expect in phrase-final position, where the pitch movement is falling (Harnsberger 1996). Harnsberger & Judge (1999) show that in focus contexts the pitch movements survive though are produced in a compressed pitch range, as observed in EA. In a small study of

[5] H* (Prieto *et al.* 1995, Prieto & Shih 1995); (L+H)* (Hualde 2002); L*+H (Face 2002).

intonation in Indian English (IE), among speakers whose L1 is either Gujarati or Tamil, Wiltshire & Harnsberger (2006) note that IE utterances tend to have a pitch accent on every content word, and speculate that this may be a transfer from the substratum language Hindi. In Australia, the non Pama-Njungan language Mawng has been observed to have rich pitch accent distribution, and each pitch movement appears to be of the same basic type (a rise to a peak) analysed as H* (Singer 2006), and survive in focus contexts (p.c. Ruth Singer). These facts are surface similar to those of the Gunwinyguan language Bininj Gun-Wok (BGW) which has however been analysed as having a pitch accent on every foot (Bishop & Fletcher 2005).[6] An interesting final case is Danish, in which there is a rising pitch movement on 91% of 'stress groups' (Grønnum 1998), and thus on every Prosodic Word (every stress-bearing word). The pitch movement type observed is so consistent that the author has elsewhere questioned whether it is appropriate to classify the rises as pitch accents, since there is no variation in the shape of the pitch movement, and speakers appear to have "no choice" over what type of pitch movement to use (Grønnum 1992:49). The pitch movements have nonetheless been analysed as H*L pitch accents, with late alignment of the H* and right alignment of the L, by Gussenhoven (2004). As regards de-accenting in Danish, Paggio (1996:72) notes that a focussed word can be prosodically prominent, though does not state whether post-focal words in the same clause are accented or not.

Three languages which also display word-level distribution of pitch movements, which tend to be of the same shape/type, are Halha Mongolian (Karlsson 2005), Aleut (Taff *et al.* 2001) and Tamil (Keane 2006). In each of these cases however the pitch movements have been analysed as word- or phrase-edge tones, rather than pitch accents. They are considered here however because of the possible parallel function of pitch as an aid to word segmentation. Halha Mongolian (HM) has rising pitch movements on every content word, expect in phrase-final position, where the pitch movement is falling (Karlsson 2005). The pitch movements are not deleted when repeated from earlier in the discourse, though are produced in compressed pitch range after a focussed word. HM has a very productive process of vowel harmony applying within the word, which functions as a robust cue to word-hood in the language, and because of this Karlsson argues that HM does not have lexical stress, and thus that the pitch movements observed are phrase tones marking an Accentual Phrase level (AP) prosodic domain. Aleut has falling pitch movements on every content word, analysed as HL tones marking an AP domain (Taff *et al.* 2001, Gussenhoven 2007 in press). Taff *et al*. note that a similar pattern is observed in Central Alaskan Yupik (CAY) but that the recurring pitch movement observed on each AP is rising (citing Woodbury 1993). Tamil has a pitch movement on every content word, except verbs, which are always in phrase-final position (Keane 2006). The pitch movement shape is consistent and is analysed as a H*LH sequence, occurring on 'every nominal constituent' (Keane 2003). There is reduction of non-initial vowels (Christdas 1988), a process which is a strong cue to word-hood, and is analysed by some authors as an indication of word-stress. There are however no dynamic cues to stress in this (or any other) position of the word, thus Keane suggests that the regular pitch movements in Tamil can be analysed either as pitch-only marking of initial word-stress or as phrase tones marking the left edge of an AP-level domain.

In summary then, there are a number of languages which display similar properties to EA. The two key properties which most consistently co-occur are that languages with

[6] The stress-foot in BGW is a left-headed unbounded foot, and feet are coextensive with morphemes, though not with words, as BGW is a polysynthetic language, thus a word may contain several pitch accents (as many pitch accents as feet/morphemes).

lots of pitch accents tend to have only one pitch accent type, suggesting that these are default pitch accents of some kind. The degree of resistance to de-accenting in these languages, in so far as it has been investigated, seems to vary slightly more. Cruttenden (2006) suggests that there is no simple on/off parameter regarding de-accenting, but instead more of a continuum across languages with some in which de-accenting appears to be obligatory (such as English) and other in which it appears to be prohibited (such as Spanish) and other languages placed along the continuum in between, showing only a preference for or against de-accenting. This matches the findings in the languages surveyed here; EA, Hindi and Spanish strongly resist de-accenting whereas other languages such as Greek display only a preference.

It is interesting to note that the small set of languages studied here is already very disparate and shows no obvious areal or genetic homogeneity, though there are probably areal/genetic sub-groups such as the Romance languages. Although it is beyond the scope of this paper to attempt to account for the diachronic origins of the property of rich pitch accent distribution, it seems unlikely that a single unifying pattern of language change can account for the development of this property across all of these sub-groups.

A plausible pattern of language change which may account for some of the cases, is a loss of lexical use of tone. Danish, for example, is well-known formerly to have had a distinctive lexical pitch accent system, akin to its Scandinavian neighbours, and it has been suggested that the lexical function formerly borne by pitch is now borne by stød (Riad 2000, cf. Gussenhoven 2004). Although they have lost their lexical function, the frequency of distribution of Danish pitch movements has been retained. Similarly, since Ancient Greek is known to have had a pitch accent system (Steriade 1988), it is plausible that although pitch lost its lexical function in the language, the frequency of distribution of pitch movements has been retained in Modern Greek. Indeed, during the period in which Greek still had a lexical pitch accent distinction, the language was spoken widely through Hellenistic North Africa (Horrocks 1997), suggesting a possible contact explanation as the source of rich pitch accent distribution in Egyptian and Tunisian Arabic. As noted above, recent research suggests that in contact situations rich pitch accent distribution is readily transferred into the L2 of speakers of an L1 language with rich pitch accent distribution (Wiltshire & Harnsberger 2006).

In the reverse direction, lexical tone in Punjabi is argued to have emerged from phonemic consonantal phonation differences in Hindi (a Punjabi word with High tone has a breathy consonant in the Hindi cognate, and likewise a Punjabi word with Mid tone has a voiceless consonant in Hindi, and a Punjabi word with Low tone has a voiceless consonant in Hindi; see Purcell *et al.* 1978). However Punjabi is a tone language with just one lexical tone per word (thus, a 'word tone' language, Sprigg 1975). Set alongside the claim of this paper, that word-level tone distribution is itself a property of Hindi, the difference between Hindi and Punjabi may be seen not so much as the development of tone itself but rather of a change in the division of labour between the segmental and tonal phonology in conveying lexical contrast.

In her discussion, Jun (2005:447) suggests a possible functional explanation for rich pitch accent distribution, namely as an aid to word segmentation: ‘where pitch accent occurs at a regular interval.. with a similar type of pitch accent, each of the accents would provide a cue for a word boundary’. In favour of this explanation is the fact that many languages with rich pitch accent distribution display relatively fewer other cues to word-hood. For example, the domain of syllabification in EA is the Phonological Phrase (Watson 2002:61), with the result that that syllables frequently straddle word boundaries.

The same is true of spoken Spanish, in which syllabification applies across word boundaries within phrases (Hualde 2005) and Mawng (p.c. Ruth Singer).[7] However, a difficulty for this explanation is that psycholinguistic evidence indicates the parsing- or segmentation-unit in EA to be the stressed syllable (Aquil 2006), which is the same unit known to be the segmentation unit in English (Cutler & Norris 1988). Since English does not share with EA the properties of having frequent pitch accents of consistent form, which are resistant to de-accenting, a purely functional explanation of rich pitch accent distribution does not appear to be sufficient.

On the basis of this literature-based survey then, it appears that rich pitch accent distribution is indeed an independent parameter of prosodic variation, which cannot be straightforwardly linked directly to any other single typological or functional factor. Thus the final claim of this paper is that rich pitch accent distribution is rooted in the phonological grammar of a language, and this proposal is formalised in §4 below.

4 Analysis

The essence of the analysis proposed here is that rich pitch accent distribution in EA (and arguably also in other similar languages) arises due to a phonological constraint requiring the head of every Prosodic Word (PWd) to be associated with a phonological tone, in the form of a pitch target. The requirement is formulated as a markedness constraint, within Optimality Theory (Prince & Smolensky 2004), as follows:

(7) PWD→T A mora that is head of a PWd is required to be associated to tone.

The analysis is framed within, and adopts the notions of, Autosegmental-Metrical Theory (AM, Ladd 1996). The crucial concept within AM that underlies the analysis proposed here is that the pitch contour in an intonational language can be analysed in terms of a sequence of high and low pitch targets (H and L), which are seen as phonological objects (tones) autosegmentally associated with positions in the metrical structure of the utterance. Thus a pitch accent such as EA's LH* is a sequence of phonological tones, one or more of which is associated with a prominent position in the metrical-/prosodic-structure of the utterance. The constraint in (7) simply states that the relevant level of prosodic structure in EA is the PWd. The analysis is formalised within Optimality Theory which, as an output-oriented theory, is suitable for modelling the properties of phonological tone in an AM conception of intonation as part of the 'unity of pitch phonology' (Ladd 1996:147ff.): the theory is able to characterise how the grammar might treat phonological objects similarly regardless of their origin (lexical or otherwise) or function (focus-related or word-prominence-lending).

The idea of a constraint governing the association of tones to 'tone bearing units' (TBUs) is of course not at all new, and nor is the empirical fact of a language which might require every such TBU to bear tone. Yip (2002:162ff.), for example, appeals to the constraint SPECIFYT ('A TBU must be associated with a tone.') to analyse L tone-spreading to underlyingly toneless syllables in Igbo. Note that under Yip's conception of TBU as 'the prosodic head of some level of prosodic constituency' (Yip 2002:141), then the constraint in (7) above is simply a particular case of general TBU→T constraint, specific to the level of the PWd. In the absence of adjacent lexical tones in EA the constraint is satisfied through insertion of tone (in the form of a default pitch accent).[8]

[7] In the related language Iwaidja, syllabification applies within the Intonational Phrase (Birch 2002)
[8] A possible instance of tone-spreading to satisfy PWd →T in EA is discussed below.

Selkirk (2007 in press) has called tones of this kind, inserted in order to satisfy a phonological constraint on output representation, 'epenthetic tones'. A potential advantage of the notion of epenthetic or default tone is that it could be said to predict that the inserted tone will be of a consistent form, resulting in the highly restricted pitch accent inventory that we have seen is found in languages with rich pitch accent distribution. In segmental phonology we are used to the idea that an epenthetic segment, inserted into the phonological representation to fill some gap, is usually a consistent default segment, such as a centralised vowel [ə] or an unmarked stop ([ʔ]). If all EA pitch accents are default pitch accents it is perhaps to be expected that they are all of one type.[9] Indeed, the notion of default tone could be said to embody all three of the core properties shown to hold of pitch accents in languages with rich pitch accent distribution: frequency of distribution, because the constraint requires a pitch accent on every PWd; consistent form, because the tone inserted does not carry lexical or morphosyntactic meaning, but is instead a default phonological object; and, word-level prominence-lending function, so that every word bears a pitch accent regardless of focus context.

In the remainder of this section we illustrate how the PWD→T constraint can be used to explain the distribution of pitch accents in EA. The key data to explain are cases where there is a conflict between the (proposed) phonological requirement to mark each PWd with tone and: i) faithfulness constraints restricting the occurrence of marked structure (not present in the input, or lexical, representation), and ii) constraints on the mapping between morphosyntax and phonology (at the word level).

The PWD→T constraint interacts with a faithfulness constraint against insertion of tones not present in input representation:

(8) DEP$_{TONE}$. Every tone in the output has a correspondent in the input.

In an example taken from the focus experiment (see §2.4), the sentence in (9) below was treated uniformly by all speakers in all productions, with a pitch accent on all four content words.

(9)	maːma	bititʕallim	yunaːni	bi-	-l-	layl	
	ǀ LH*	LH*	LH*			LH*	L-L% ǀ
	mum	learns	Greek	in-	-the-	night	

The preference for accentuation of PWds over fewer inserted tones indicates that the constraint PWD→T outranks the constraint militating against tone insertion, DEP$_{TONE}$, as illustrated in the tableau in (10)[10]. In candidate (a.) every PWd is accented, by insertion of four pitch accents, each of which is penalised in the form of a single categorical violation of DEP$_{TONE}$; in candidate (b.) no accent is inserted on [maama], so (b.) incurs fewer violations of DEP$_{TONE}$ but at the cost of violating PWD→T. The winning candidate is (a.) indicating that PWD→T outranks DEP$_{TONE}$.

[9] Note that for the time being I assume (non-trivially) that the PWd→T constraint is blind to the quality of tone inserted, and thus that the default tone as well be complex (e.g. L+H*) as simplex (e.g. H*).
[10] In the tableaux lexical categories in the input form are marked with a subscript: 'lex'. Vowels bearing a pitch accent in output forms are indicated with an acute accent mark on the accented vowel: eg 'á' or 'ú'. The edges of prosodic constituents are marked at [PWd], (Minor Phrase) and ǀMajor Phraseǀ levels.

(10) PWd→T >> DEP_{TONE}

	/maama$_{lex}$ bitit9allim$_{lex}$ yunaani$_{lex}$ bi-l-layl$_{lex}$ /	PWd→T	DEP_{TONE}
☞	a. |([máama] [bitit9állim])([yunáani] bi-l-[láyl])|		****
	b. |([maama] [bitit9állim])([yunáani] bi-l-[láyl])|	*!	***

It would be possible to insert fewer accents without violating PWd→T, the better to satisfy DEP_{TONE}, if fewer PWds were formed. On the assumption that purely phonological constraints such as the T↔P constraints can only 'see' phonological categories, PWd→T will not itself penalise unaccented words which are not mapped to a PWd constituent. Such forms would however violate LexWd:PWd, the interface constraint on the mapping between morphosyntactic structure and prosodic structure at the word level (Selkirk 1996):

(11) LexWd:PWd A lexical word maps to a PWd[11].

The preference for a candidate which satisfies LexWd:PWD over a candidate which better satisfies DEP_{TONE} indicates that LexWd:PWD outranks DEP_{TONE}:

(12) LexWd:PWD >> DEP_{TONE}

	/maama$_{lex}$ bitit9allim$_{lex}$ yunaani$_{lex}$ bi-l-layl$_{lex}$ /	LexWd:PWd	DEP_{TONE}
☞	a. |([máama] [bitit9állim])([yunáani] bi-l-[láyl])|		****
	d. |(maama [bitit9állim])([yunáani] bi-l-[láyl])|	*!	***

Thus the ranking established for EA is:

(13) PWD→T, LexWd:PWD >> DEP_{TONE}

	/maama$_{lex}$ bitit9allim$_{lex}$ yunaani$_{lex}$ bi-l-layl$_{lex}$ /	PWd→T	LexWd: PWd	DEP_{TONE}
☞	a. |([máama] [bitit9állim])([yunáani] bi-l-[láyl])|			****
	b. |([maama] [bitit9állim])([yunáani] bi-l-[láyl])|	*!		***
	d. |(maama [bitit9állim])([yunáani] bi-l-[láyl])|		*!	***

This is the key section of the phonological grammar which I propose accounts for rich pitch accent distribution in EA. The grammar is demonstrated in a more complex sentence in (14-15) below.

[11] This constraint is equivalent to MCat=PCat in McCarthy & Prince (1993), and conflates a pair of left/right edge sensitive constraints, Align(Lex,L; PWd,L) and Align(Lex,R; PWd,R).

(14) Rich pitch accent distribution in a complex sentence.

ħasˁalit	ʕala	minħa	min	is-	sifaːra...	
she-received	of-	grant	from-	-the-	embassy	
ǀ LH*		LH*			LH*	
... ʕala	ʃaan...	tiruːħ	tidris	fi	ʔamriːka	
in-	order	she-goes	she-studies	in-	America	
	LH*	LH*	LH*		LH*	L-L% ǀ

'She got a grant from the embassy to go and study in America.'

(15) PWd→T, LexWd:PWd >> Dep$_{TONE}$ in a complex sentence.

	/HaSalit$_{lex}$ 9ala-minHa$_{lex}$ min-is-sifaara$_{lex}$ 9ala-šaan$_{lex}$ tiruuH$_{lex}$ tidris$_{lex}$ fi-?amriika$_{lex}$/	PWd→T	LexWd: PWd	Dep$_{TONE}$
☞	a. ǀ([HáSalit] 9ala-[mínHa] min-is-[sifáara] 9ala-[šáan] [tirúuH] [tídris] fi-[?amríika])ǀ			*******
	b. ǀ([HáSalit] 9ala-[minHa] min-is-[sifáara] 9ala-[šáan] [tirúuH] [tídris] fi-[?amríika])ǀ	*!		******
	c. ǀ([HáSalit] 9ala-minHa min-is-[sifáara] 9ala-[šáan] [tirúuH] [tídris] fi-[?amríika])ǀ		*!	******

An important implication of analysis by means of an (output-oriented) markedness constraint is that insertion of a default tone is not the only way to satisfy the PWd→T constraint. Gussenhoven (2000, 2004: 149) appeals to a similar TBU→T constraint[12], requiring every TBU to be associated to tone, in order to explain cases not of tone insertion but of tone spreading. In Roermond Dutch certain L- phrase tones display both alignment to a phrase edge and secondary association to a (non-phrase-final) stressed syllable, resulting in a stretch of low level pitch between the last stressed syllable and end of the phrase. In Gussenhoven's analysis, TBU→T outranks NoSpread, a constraint requiring tones to associate to at most one TBU. The TBU→T constraint is satisfied by spreading of the phrase tone, in violation of NoSpread.

The possibility of both tone insertion and tone spreading as a means to satisfy PWd→T permits two possible analyses of EA phrase-final (nuclear) pitch accents in EA, which, as discussed in §2.3 above, frequently display a very different shape to that observed on all pre-nuclear PWds. Firstly, one could propose that in EA PWd→T outranks NoSpread allowing the final phrase-/boundary-tone of the utterance to associate to the final stressed syllable as well as align to the phrase boundary. This analysis would capture the facts that in phrases ending with high boundary tones there is no L target or pitch fall between the final stressed syllable and the phrase-final H-H% combination; in a 'phrase-tone spreading' analysis co-variance between the properties of the final pitch accent and the following boundary tones is expected. Such an analysis has been proposed to account for the distinctive (falling) shape of phrase-final pitch accents in Hindi (Harnsberger 1996). Alternatively, one could maintain the working hypothesis adopted in §2.3 above, that EA has a single pitch accent in its inventory (LH*), and explain the choice to insert the default pitch accent in final position rather than allow

[12] Gussenhoven's constraint is 'Tone←TBU' but I have reversed the direction of the arrow for ease of comparison.

spreading of phrase tones by the following ranking: NOSPREAD >> PWD→T. This analysis captures the additional fact that a L turning point is observed between the H peak of the penultimate pitch accent of the utterance and the H peak of the final stressed syllable[13] whereas this pitch valley goes unexplained in a 'phrase-tone spreading' analysis. I therefore suggest that the single pitch accent inventory analysis is stronger, and thus that the ranking in EA is NOSPREAD >> PWD→T. However, interaction between NOSPREAD and PWD→T predicts that the properties of nuclear accents in rich pitch accent distribution languages may vary but within a limited range only, a prediction which must remain at present the subject of future research.

We have proposed an analysis of the phonological mechanism underlying rich pitch accent distribution. However the predictive validity of the proposal can only be tested if pitch accent distribution is recognised as a potential parameter of variation, and included as an empirical research question in new studies of intonation. Hence the primary goal of this paper, which is to set out the evidence in favour of this parameter of variation as an important and potentially fruitful avenue of future research in intonational and prosodic typology.

5 Conclusion

Evidence from a detailed case study of one language (Egyptian Arabic), and from a literature survey of a range of genetically unrelated languages, shows that there are languages in which pitch accents share three inter-related properties: pitch accents are distributed frequently through the utterance, with an accent on (almost) every content word; these pitch accents tend to be of a single type (a rise, fall or peak); and the presence/absence of accents is not related to focus context, indicating that the function of the pitch accents is not meaning-related but prominence-lending at the word-level. An analysis of this constellation of properties appeals to the notion of default tone, formalised by means of a markedness constraint requiring the head of every PWd to bear tone: PWd→T. The interaction of this constraint with faithfulness and with interface constraints on the morphosyntax-phonology mapping at the word-level is illustrated in the case of EA. The paper thus expands substantially on the suggestion by Jun (2005) that high frequency pitch accents of consistent form may be of typological interest, but also demonstrates how this typological property can after all be analysed within standard AM theory, in terms of the association of phonological pitch events to prosodic structure.

In a recent paper Gussenhoven has suggested that Nubi, a language in which every lexical word obligatorily bears a H tone, cannot easily be classified as an intonation language, since 'a prototypical intonation language... has pitch accents with discoursal meanings' (Gussenhoven 2006). This paper suggests that, whilst in many of the intonation languages which have been studied to date pitch accents do indeed have discoursal function (such as in the Germanic languages), there is an alternative type of intonation language in which pitch accents have instead a word-level prominence lending role. Recognition of variation in pitch accent distribution as a valid typological category, and thus inclusion of this factor in new empirical studies of intonational variation, will enable us in future to determine which type of intonation language is in fact prototypical.

[13] See for example Figure 4 in section §2.3.

References

Abdel-Massih, E.T. (1975). *An introduction to Egyptian Arabic*. Ann Arbor, University of Michigan.

Aquil, R.M. (2006). *The segmentation/parsing unit in Cairene Arabic.* Georgetown University.

Arvaniti, A. & M. Baltazani (2005). Intonational analysis and prosodic annotation of Greek spoken corpora. In Jun,S.-A. (ed.) *Prosodic transcription and typology: a unified approach.* 84-117. Oxford, OUP.

Birch, B. (2002). The IP as the domain of syllabification. *Proceedings of Speech Prosody 2002*.

Bishop, J.B. & J. Fletcher (2005). Bininj Gun-Wok Intonation. In Jun,S.-A. (ed.) *Prosodic Typology.* 331-361. Oxford, Oxford University Press.

Chahal, D. (2001). *Modeling the intonation of Lebanese Arabic using the autosegmental-metrical framework: a comparison with English.* Unpublished PhD thesis, University of Melbourne.

Christdas, P. (1988). *The Phonology and Morphology of Tamil.* Unpublished PhD thesis, Cornell University.

Cruttenden, A. (2006). The de-accenting of old information: a cognitive universal. In Bernini,G. & M.L.Schwartz (eds.) *Pragmatic organization of discourse in the languages of Europe.* 311-355. Berlin, Mouton de Gruyter.

Cutler, A. & D. Norris (1988). The role of strong syllables in segmentation for lexical access. *Journal of Experimental Psychology: Human Perception and Performance*, **14.** 113-121.

El Zarka, D. (1997). *Prosodische Phonologie des Arabischen.* Unpublished PhD thesis, Karl-Franzens-Universität Graz.

Face, T. (2002). *Intonational marking of contrastive focus in Madrid Spanish.* Lincom Europa.

Face, T. (2003). Intonation in Spanish declaratives: differences between lab speech and spontaneous speech. *Catalan Journal of Linguistics*, **2.** 115-131.

Frota, S. (2000). *Prosody and focus in European Portuguese: phonological phrasing and intonation*. New York, Garland.

Grice, M., M. D'Imperio, M. Savino, & C. Avesani (2005). Strategies for intonation labelling across varieties of Italian. In Jun,S.-A. (ed.) *Prosodic typology: the phonology of intonation and phrasing.* 362-389. Oxford, OUP.

Grønnum, N. (1992). *The Groundworks of Danish Intonation: An Introduction*. Copenhagen, Museum Tusculanum Press, University of Copenhagen.

Grønnum, N. (1998). Intonation in Danish. In Hirst,D. & A.Di Cristo (eds.) *Intonation systems: a survey of twenty languages.* 131-151. Cambridge, Cambridge University Press.

Gussenhoven, C. (1983). *On the grammar and semantics of sentence accents.* Dordrecht, Foris.

Gussenhoven, C. (2000). The lexical tone contrast of Roermond Dutch in Optimality Theory. In Horne,M. (ed.) *Prosody, Theory and Experiment: studies presented to Gösta Bruce.* 129-167. Dordrecht, Kluwer.

Gussenhoven, C. (2004). *The phonology of tone and intonation.* Cambridge, CUP.

Gussenhoven, C. (2006). Between stress and tone in Nubi word prosody. *Phonology*, **23.** 192-223.

Gussenhoven, C. (2007). The Phonology of Intonation. In deLacy,P. (ed.) *The Cambridge Handbook of Phonology* Cambridge, Cambridge University Press.

Harnsberger, J. (1996). Towards an intonational phonology of Hindi. (Paper presented at the 5th Conference on Laboratory Phonology July 7th 1996).

Harnsberger, J. & J. Judge (1999). Pitch range and focus in Hindi. *JASA*, **99.** 2493-2500.

Hayes, B. (1995). *Metrical stress theory: principles and case studies.* Chicago, University of Chicagoe Press.

Heliel, M. (1977). *The rhythm of Egyptian collquial Arabic: an experimental study*. Unpublished PhD thesis, UCL.

Hellmuth, S. (2005). No De-accenting in (or of) Phrases: Evidence from Arabic for cross-linguistic and cross-dialectal prosodic variation. In Frota,S., M.Vigario, & M.J.Freitas (eds.) *Prosodies (with special reference to Iberian languages).* 99-121. Mouton de Gruyter.

Hellmuth, S. (2006). *Intonational pitch accent distribution in Egyptian Arabic.* Unpublished PhD thesis, SOAS.

Horrocks, G. (1997). *Greek: A History of the Language and Its Speakers*. London, Longman.

Hualde, J.I. (2002). Intonation in Spanish and the other Ibero-Romance languages: overview and status quaestionis. In Wiltshire,C. & J.Camps (eds.) *Romance Phonology and Variation.* 101-115. Amsterdam, John Benjamins.

Hualde, J.I. (2005). *The Sounds of Spanish.* Cambridge, Cambridge University Press.

Jun, S.-A. (2005). Prosodic typology. In Jun,S.-A. (ed.) *Prosodic transcription and typology: a unified approach.* 430-458. Oxford, OUP.

Karins, K., M. Liberman, C. McLemore, & E. Rowson (2002). CallHome Egyptian Arabic Speech Supplement LDC2002S37. Philadelphia, Linguistic Data Consortium.

Karlsson, A.M. (2005). Rhythm and intonation in Halh Mongolian. *Travaux de l'Institut de Linguistique de Lund*, **46.**

Keane, E. (2003). Tamil intonation: a preliminary investigation. (Poster presented at TIE Workshop, April 2003, Oxford.).

Keane, E. (2006). Prominence in Tamil. *Journal of the International Phonetic Association*, **36.** 1-20.

Ladd, D.R. (1996). *Intonational phonology*. Cambridge, CUP.

McCarthy, J. & A. Prince (1993). Generalised Alignment. In Booij,G. & J.van Marle (eds.) *Yearbook of Morphology.* 79-153. Dordrecht, Kluwer.

Mitchell, T.F. (1993). *Pronouncing Arabic 2*. Oxford, Clarendon Press.

Nibert, H. (2000). *Phonetic and phonological evidence for intermediate phrasing in Spanish intonation.* University of Illinois at Urbana Champaign.

Norlin, K. (1989). A preliminary description of Cairo Arabic intonation of statements and questions. *Speech Transmission Quarterly Progress and Status Report*, **1.** 47-49.

O'Connor, J.D. & G.F. Arnold (1961). *The intonation of colloquial English.* London, Longman.

Ortega-Llebaria, M. & P. Prieto (2007). Disentangling stress from accent in Spanish: production patterns of the stress contrast in deaccented syllables. In Prieto,P., J.Mascaró, & M.-J.Solé (eds.) *Segmental and Prosodic Issues in Romance Phonology* Amsterdam/Philadelphia, John Benjamins.

Paggio, P. (1996). *Information Structure in Machine Translation.* University of Copenhagen and Centre for Language Technology.

Prieto, P. & C. Shih (1995). Effects of tonal clash on downstepped H* accents in Spanish. *Proceedings of EUROSPEECH'95*, **2.** 1307-1310.

Prieto, P., J. van Santen, & J. Hirschberg (1995). Tonal alignment patterns in Spanish. *JPh*, **23.** 429-451.

Prince, A. & P. Smolensky (2004). *Optimality Theory: constraint interaction in generative grammar.* Blackwell Publishing.

Purcell, E.T., G. Villegas, & S.P. Young (1978). A before and after for tonogenesis. *Phonetica: International Journal of Speech Science*, **35.** 284-293.

Riad, T. (2000). The origin of Danish stød. In Lahiri,A. (ed.) *Analogy, Levelling, Markedness: Principles of Change in Phonology and Morphology.* 261-300. Berlin, Mouton de Gruyter.

Rifaat, K. (2005). The structure of Arabic intonation: a preliminary investigation. In Alhawary,M.T. & E.Benmamoun (eds.) *Perspectives on Arabic Linguistics XVII-XVIII: Papers from the seventeenth and eighteenth annual symposia on Arabic linguistics.* 49-67. Amsterdam/Philadelphia, John Benjamins.

Selkirk, E.O. (1984). *Phonology and syntax: the relation between sound and structure*. Cambridge, Mass., MIT Press.

Selkirk, E.O. (1996). The prosodic structure of function words. In Morgan,J. & K.Demuth (eds.) *Signal to syntax: bootstrapping from speech to grammar in early acquisition.* 187-213. Lawrence Erlbaum.

Selkirk, E.O. (2000). The interaction of constraints on prosodic phrasing. In Horne,M. (ed.) *Prosody: theory and experiment.* 231-262. Dordrecht, Kluwer.

Selkirk, E.O. (2007). Default phrase stress, prosodic phrasing and the spellout edge: the case of verbs. *The Linguistic Review*.

Singer, R. (2006). Expression of Information Structure in Mawng: Intonation and Focus. *Proceedings of the Australian Linguistics Society Conference*.

Sprigg, R.K. (1975). Tonal units and tonal classification: Panjabi, Tibetan and Burmese. *Parole and Langue*, **7.** 1-21.

Steriade, D. (1988). Greek accent: a case for preserving structure. *LI*, **19.** 271-314.

Swerts, M., E. Krahmer, & C. Avesani (2002). Prosodic marking of information status in Dutch and Italian: a comparative analysis. *JPh*, **30.** 629-654.

Taff, A., L. Rozelle, T. Cho, P. Ladefoged, M. Dirks, & J. Wegelin (2001). Phonetic structures of Aleut. *JPh*, **29.** 231-271.

Vigario, M. & S. Frota (2003). The intonation of Standard and Northern European Portuguese: a comparative intonational phonology approach. *Journal of Portuguese Linguistics*, **2.** 115-137.

Watson, J.C.E. (2002). *The phonology and morphology of Arabic*. Oxford, OUP.

Wiltshire, C. & J. Harnsberger (2006). The influence of Gujarati and Tamil L1s on Indian English: a preliminary study. *World Englishes*, **25.** 91-1004.

Woodbury, A. (1993). Against intonational phrases in Central Alaskan Yupik Eskimo. (Presentation at the Linguistic Society of America Meeting, Los Angeles, January 1993).

Yip, M. (2002). *Tone*. Cambridge, CUP.