

Intonational Variation in Arabic

Transcription Workshop
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28-29th September 2009



introduction

aim:

- “to explore general issues in intonational transcription in the specific context of spoken Arabic dialects”
 - two case studies: use of transcription to develop/test hypotheses about number/type of phonological categories in a model

“transcription”

- the process of labelling data: using a set of labels which represent candidate phonological categories
 - ‘phonetic’, systematic attention to (some selected range of) detail
- a ‘model’: a set of labels which represent an analysis of the intonational phonology of a particular language
 - phonological, an analysis (not necessarily the only one possible)

introduction

scope of the next 90 minutes:

- demystify the transcription process
 - with a focus on establishing tonal categories
 - *how do you build “arguments used in tonal analyses”* Gussenhoven (2007:272ff):
 - phonetic considerations, distributional considerations, semantic criteria, analytical coherence

our stance:

- a mix of transcription-based & experimental evidence
 - quantitative~qualitative evidence interrelated
 - > a wishlist of properties needed in a transcription system for comparative work on Arabic

outline

1. Key issues in intonational transcription
2. Lebanese Arabic transcription
 - based on ToBI
3. Egyptian Arabic transcription
 - based on IViE
4. Conclusion
 - > starting point for discussion

The Lebanese Arabic Model

Developing an analysis using a
ToBI based transcription system

The AM Framework

Autosegmental Component

Contour Representation: sequence of H and L tones organised into local tonal events

- * prominence-lending events (pitch accents)
- * boundary-marking events (edge tones)

Metrical Component

Account of tune-text association via prosodic structure: grouping in a metrical hierarchy of

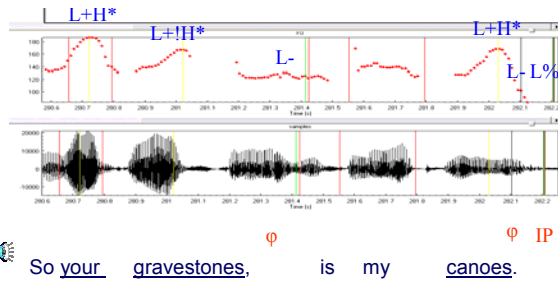
- * relative prominence relations
- * constituency levels

Phonetic Component

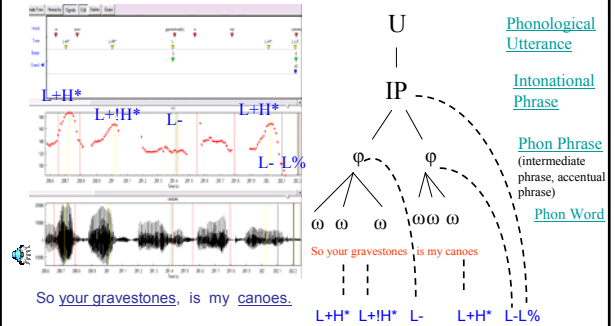
Tonal mapping of phonological categories into F0 values

e.g. Bruce (1977), Pierrehumbert (1980), Beckman and Pierrehumbert (1986), Pierrehumbert and Beckman (1988), Gussenhoven (2004), Ladd (1996)

Example from (Aus) English



Example from (Aus) English

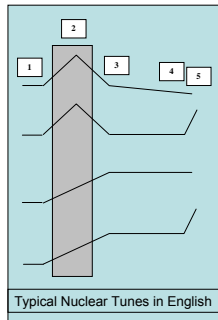


Tonal Organization in Different AM Models

The tonal domains of pitch accents: the status of pre-accentual pitch [1]

Tonal targets & tonal specification [2] [4] [5]

The status of post-nuclear tones [3]



ToBI (Tones & Break Indices)

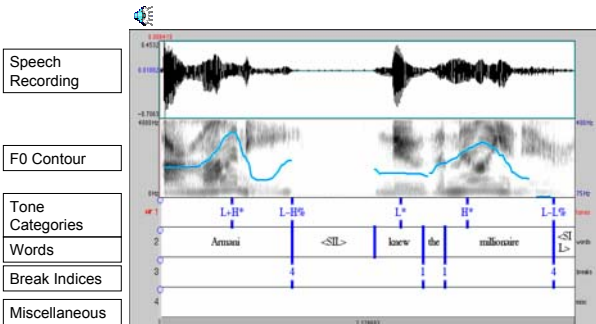
- Intonational theory of Pierrehumbert (1980) and Pierrehumbert and Beckman (1986) for Standard American English (AmE)

ToBI

- Annotation system for AmE
- Framework for transcribing intonation & prosody
- Framework used for
 - English, Japanese, Korean, German etc.

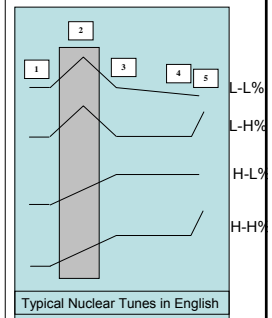
<http://www.homes.uni-bielefeld.de/gibbon/Docs/ToBI.htm>
<http://ocw.mit.edu/OcwWeb/Electrical-Engineering-and-Computer-Science/6.911/January-IAP-2006/CourseHome/index.htm>

ToBI Basics



Tonal Phonological Organisation in (AmE) ToBI

- Pitch accents
 - Alignment
 - Scaling
 - H*
 - L+H*
 - L*+H
 - L*
 - IH*
 - L+IH*
 - H+IH*
- Edge tones
 - Intermediate phrase accents: L-, H-
 - Intonational phrase boundary tones: L%, H%
- Phonetic realisation rules
 - H-L% (upstep)
 - L-L%, H-H%
 - sagging interpolation



ToBI: Phonological Transcription System

- **NOT** an International Phonetic Alphabet for prosody
- A **PHONOLOGICAL** transcription system based on an AM *intonational phonology* analysis of a particular variety/language
 - established phonological categories
 - identified non-distinctive phonetic variation
 - excluded predictable information (e.g. word stress placement)

Application to LA

How can a transcription system such as ToBI be adapted to suit an investigation of LA intonational phonology?

1. Possible ToBI labels as **phonetic** labels



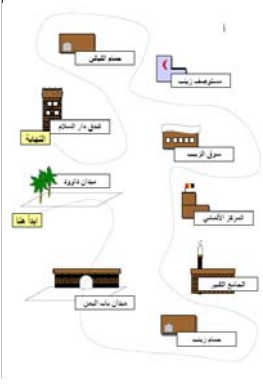
2. **Phonological** analysis

- phonetic criteria
- distributional criteria
- semantic criteria
- analytical coherence (Gussenhoven 2007)

a mix of transcription-based & experimental evidence

The LA Data: Map Task

Target Words	English Translation
?alEa	"fortress"
?el bideeye	"the start"
H?uul naEnaE	"mint fields"
janamaat	"gardens"
maEmal ?albaanw ?ajbaan	"a dairy product factory"
maEmal ?albaanw ?ajbaanel layaali	"the Layaali dairy product factory"
mazeereE	"farms"
mestawdaE ?ameH	"a wheat storehouse"
shajar sendyaan	"mahogany trees"
Siyyaadiin samak	"fishermen"
xaliijel leel	"the "night" gulf"
xaliijel maal	"the "money" gulf"



The LA Data: Experiments

Syllabic Composition	Used Target Words		
	X	Y	Z
CV.CV	la.ma	mu.na	li.ma

/lama Hamet muna min lima/
"Lama protected Muna from Lima"

X Hamet Y min Z Broad focus (e.g. "what happened today?")
X Hamet Y min Z Narrow focus on X or Y or Z (e.g. "who protected Y from Z?")

(II) Eal la met Eal lam lun la Eal laam

END(INTON):
keen leezeem t?uul niyyamet, bas ?aalet X
"she should have said she put to bed, but said X"

END(INTER):
keen leezeem t?uul X, bas maa ?idrit
"she should have said X, but she couldn't"

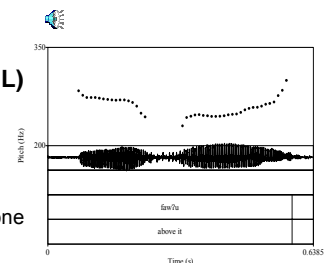
P-MID:
keen leezeem t?uul ?innu X Y
"she should have said that she X Y"

ToBI Tonal Possibilities as Phonetic Labels

- **Pitch accents**
 - Alignment
 - H*
 - H*+L
 - L+H*
 - L*+H
 - L*
 - Scaling
 - !H*
 - L+!H*
 - H+!H*
- **Edge tones**
 - Intermediate phrase accents: L-, H-, !H-
 - Intonational phrase boundary tones: L%, H%, !H%
- **Phonetic realisation rules**
 - H-L% (upstep)
 - L-L%, H-H%
 - sagging interpolation?

Transcription Considerations

- **Presence of a tone** (versus phonetic interpolation)
- **Value of a tone (H or L)**
- **Status of a tone**
 - Prominence
 - Starred
 - Leading or trailing tone
 - Edge tone
 - intonational
 - intermediate



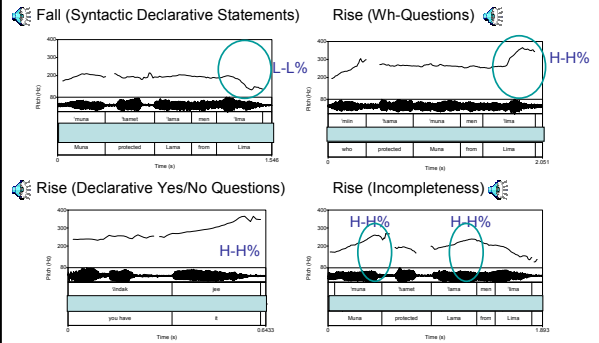
Phonetic Variation versus Phonological Categories

Phonetic Observations from LA Data

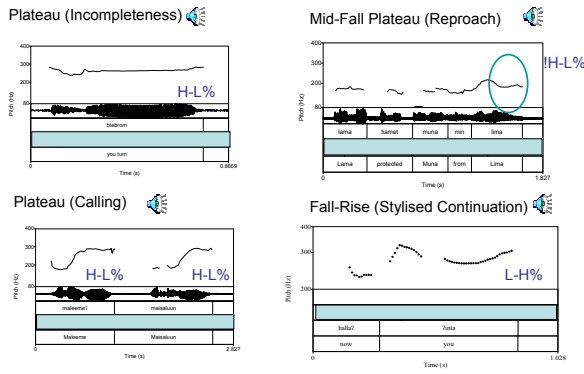
I. Phrasing related tones (boundary configurations)

- Fall [L-L%]
- Rise [H-H%]
- Plateau [H-L%]
- Fall-rise [L-H%]
- Mid fall-plateau [!H-L%]

I. Phrasing Related Tones

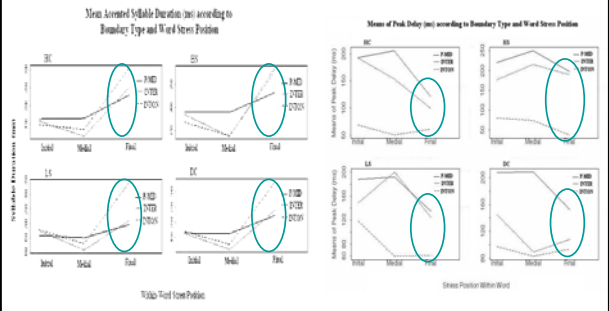


I. Phrasing Related Tones



Experimental Evidence for 2 Levels of Phrasing (iP and IP)

Phrase-final lengthening Peak alignment cues

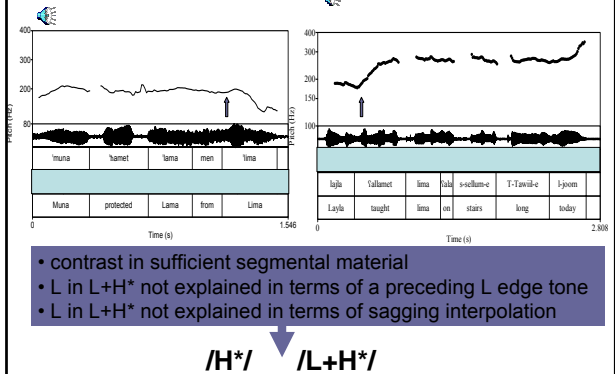


Phonetic Observations from LA Data

I. Prominence Related Tones

- Rising from mid versus rising from low
 - H* versus L+H*
- Rising from low [L+H*, L*+H, L*]
 - Phonetic alignment versus phonological association: L+H* versus L*+H
 - [L+H*] versus L* H-
- Scaling: Downstepped accents
 - !H*, L+!H*
 - H+!H*

Rising from mid versus rising from low: [H*] versus [L+H*]



Rising from mid versus rising from low: [H*] versus [L+H*]

Further issues for experimental verification

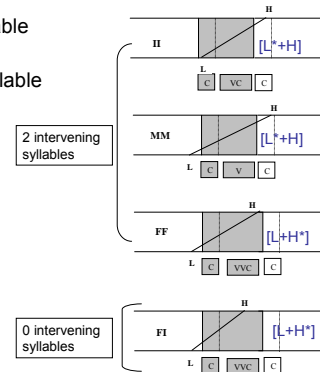
- Is the lack of L or its presence in these rising accents the consequence of pitch range span effects?
 - e.g. degree of prominence on accented word
 - e.g. large versus compressed pitch range

Rising from low: [L+H*] versus [L*+H]

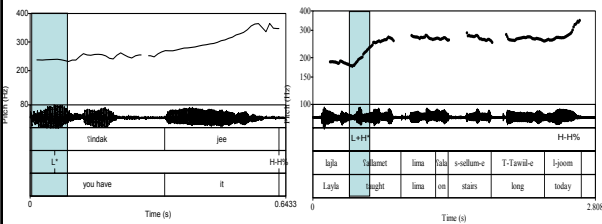
- H peak within accented syllable [L+H*]
- H peak outside accented syllable [L*+H]

Prosodic conditioning effects on peak alignment

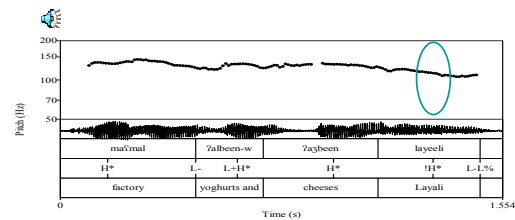
/L+H*/



Distinction between L+H* versus L* H-



A Note on Downstep: !H*, L+!H*, H+!H*



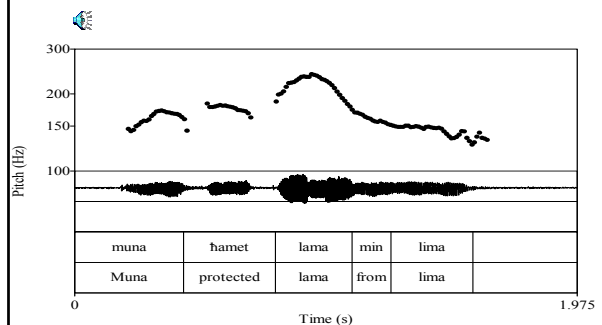
- not necessarily triggered by bitonals
- meaning of finality

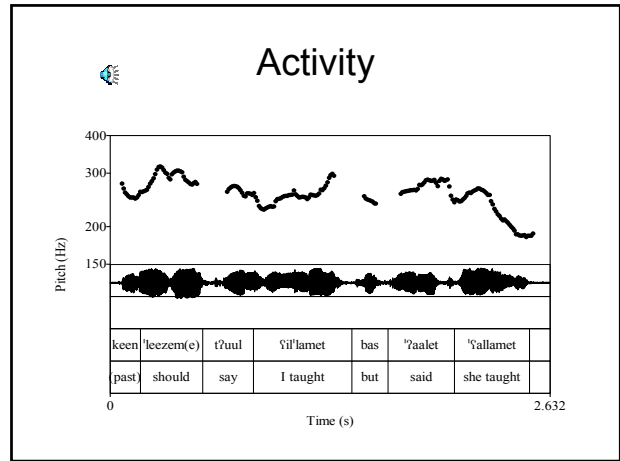
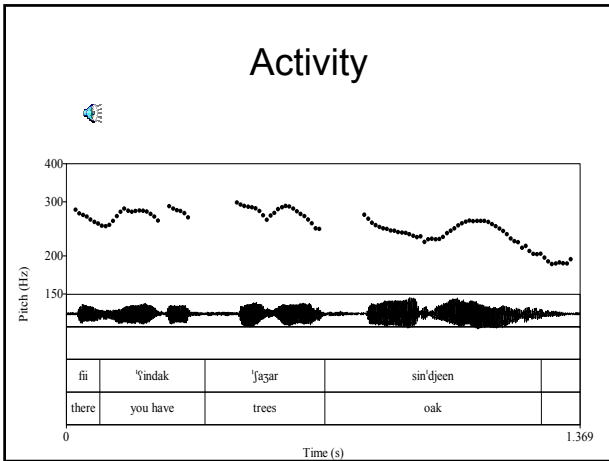
- ↓
- analysed as phonological categories

Proposed LA Tonal Inventory

- Pitch accents
 - H*
 - L+H*
 - L*
 - !H*
 - L+!H*
 - H+!H*
- Edge tones
 - Intermediate phrase accents: L-, H-, !H-
 - Intonational phrase boundary tones: L%, H%

Activity





Some Transcription Challenges

Examples from LA:

- L+H* and H* in phrase-initial position
- L*, H* and L+H* in phrase-final position preceding high rising or plateau configurations
- Presence and type of accents in compressed pitch ranges
- Degree of juncture versus tonal realisation at boundaries

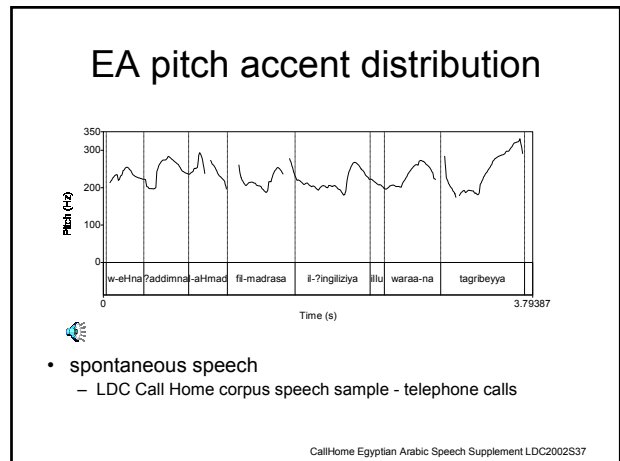
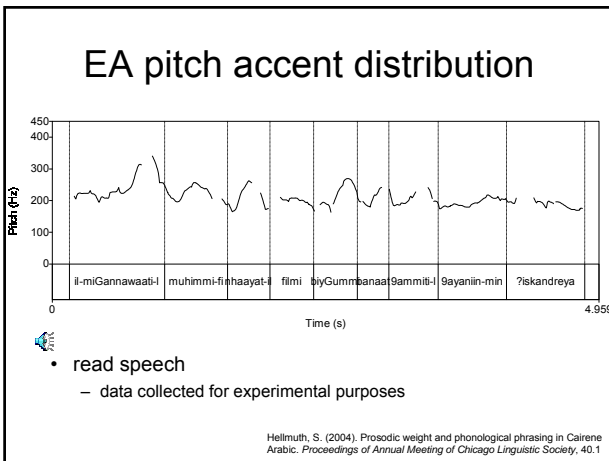
General (Brugos et al 2008):

- Regions of ambiguity (with more than one plausible transcription) → disproportionate amount of transcription time
- Making arbitrary decisions among competing labels → loss of information

Proposal: Alt tier (Brugos et al 2008)
Use of Break Indices

Egyptian Arabic

Testing an analysis using an
IViE-based transcription system

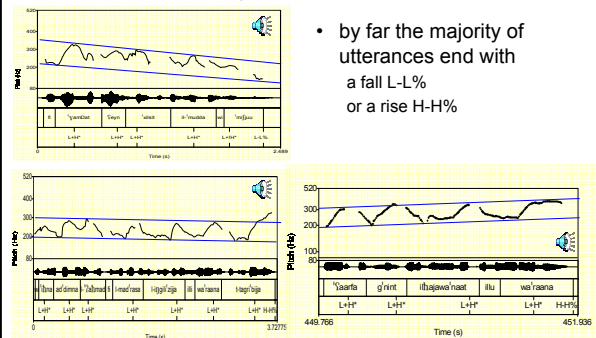


preliminary model of EA intonation

- pitch accents:
- L+H*
- edge tones:
- L- H- at 'MaP' edge
 - L% H% at IP edge
 - yields:
 - L-L%
 - H-H%
 - L-H%
 - H-L%
- implications:
- a phonological analysis
 - a 'broad' transcription
 - e.g. downstep treated as phonetic realisation
 - no "l" tones in inventory
 - restrictive > makes predictions:
 - meaning can't be expressed by paradigmatic means
 - e.g. using a different pitch accent
 - meaning will be expressed by syntagmatic means
 - changes in phrasing
 - global pitch range variation
 - ...

Chahal, Dana & Hellmuth, Sam (in press). Comparing the Intonational Phonology of Lebanese and Egyptian Arabic. *Prosodic Typology*, Volume 2, Oxford, Oxford University Press.

EA boundary tone combinations



- by far the majority of utterances end with a fall L-L% or a rise H-H%

Chahal, Dana & Hellmuth, Sam (in press). Comparing the Intonational Phonology of Lebanese and Egyptian Arabic. *Prosodic Typology*, Volume 2, Oxford, Oxford University Press.

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- pitch accents:
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- edge tones:
- L- H- at 'MaP' edge
 - L% H% at IP edge
 - yields:
 - L-L%
 - H-H%
 - L-H%
 - H-L%
- ongoing research questions:
- is there really a single pitch accent?
 - pre-nuclear accents
 - nuclear accents
 - phrasing
 - cues to phrasing
 - number of levels of phrasing
 - ...

Chahal, Dana & Hellmuth, Sam (in press). Comparing the Intonational Phonology of Lebanese and Egyptian Arabic. *Prosodic Typology*, Volume 2, Oxford, Oxford University Press.

pilot transcription study

- aim: to test the claim that non-final pitch accents all have the same local f0 contour shape
 - already shown for read speech
 - peak alignment varies with syllable type but not with focus status: ▶
- what happens in spontaneous speech?
 - quantitative methods not well-suited
 - variation in segmental materials and prosodic context
 - though not impossible (Hellmuth, Kügler & Singer 2007)
- can a qualitative approach work?
 - > transcription

the IViE transcription system

- IViE differs from ToBI in two key respects:
- theoretical basis of the tonal inventory:
 - ToBI ("Pierrehumbert-type"):
 - phrase tone, two levels of phrasing, boundaries must have a tone, right- and left-headed accents
 - IViE ("Gussenhoven-type"):
 - no phrase tone, one level of phrasing, boundaries can have a tone, left-headed accents
 - different number/types of labelling tiers
 - no juncture (break indices) tier
 - because a single level of phrasing is assumed
 - additional 'acoustic-phonetic structure' tier ('local f0' tier)
 - "shape and alignment of f0 patterns relative to the location of (accented) strong syllables"
 - invaluable in the development of a phonological analysis
 - are these f0 shapes all instances of a single category (or not)?

IViE annotation tiers

5	Comment Tier	Alternative transcriptions and notes
4	Phonological Tier	Formal linguistic representations of speakers' intonational choices
3	Target Tier	Phonetic transcriptions; syllable-based; allow transcribers to draw up a first set of hypotheses about accent alignment
2	Prominence Tier	Location of prominent syllables (stressed and accented)
1	Orthographic Tier	Transcriptions of the words spoken

Table from: Grabe, Esther. 2001. The IViE Labelling Guide. (Version 3.0). University of Cambridge. [p.3]

target tier labelling domain

"Implementation Domain" for English =
preaccented syllable + accented syllable +
following syllables up to next accented syllable

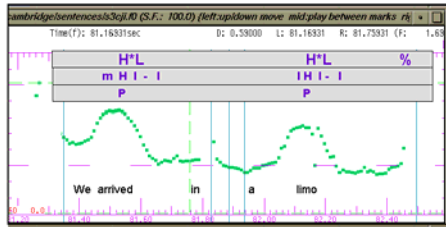
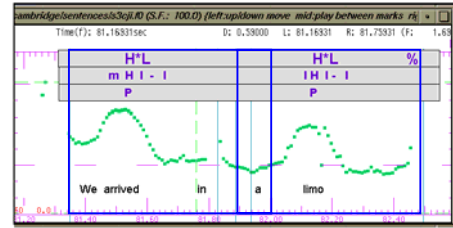


Image from: Grabe, Esther. 2001. The IVIE Labelling Guide. (Version 3.0). University of Cambridge. [p.6.]



how to fill in the target tier:

- determine the location of prominent syllables in the utterance > divide the utterance into **implementation domains**
- compare pitch levels on these landmarks (if present) in each ID:
 - preaccented syllable + accented syllable + postaccented syllable
 - final syllable in ID
- transcribe the height of these pitch levels relative to **each other**
- connect last pair of labels with '-' (= interpolation)

transcription study: methodology

corpus:

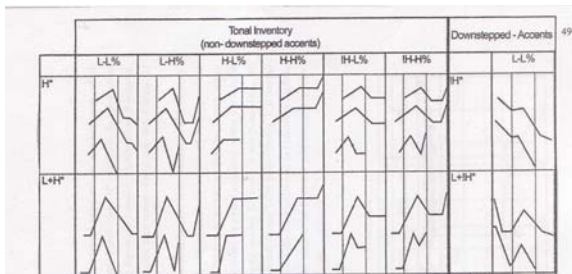
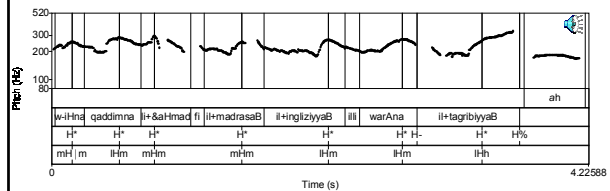
- 100 target words from a spontaneous speech telephone conversation (two female speakers, Call Home corpus)
 - selection criterion: little or no perturbation of the f0 contour

transcribed on three tiers:

- words** (broad phonetic transcription)
- tones** (phonological labels: pitch accents, boundary tones)
- local f0** (phonetic-acoustic structure tier)
 - position of pitch peak (or valley) within each target identified automatically using Praat pitch maxima/minima function
 - labelled 'H' or 'L' on **tones** tier
 - labelled 'H', 'M', or 'L' on **local f0** tier

variation from IViE norms

- shape of the f0 contour on **unaccented syllables occurring immediately before and after the peak/valley** annotated:
 - low, mid, high: 'l', 'm', 'h'
 - target based (one syllable either side)
 - not domain based
- position of the pitch peak/valley within the accented syllable noted
 - very early or very late in the accented syllable > insertion of a line 'j'



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

phrase stress / word stress	phrase / word stress	local	time	phrase / word stress	local	time	phrase / word stress	local	time		
initial	CV	qadir	mHm	325.1	gin (nouns)	mHm	359.1	baqa	mH-	378.4	
								kunib	mH-	344.1	
								castanB	mHm	340.0	
								nacam	mHm	389.6	
								baqa	mH-	446.5	
CVV	maxud	mHm	343.7	ceeni	mHm	368.0	ah	mHm	L-	378.7	
								Darunni	mHm	393.1	
								beelaB	mHm	417.3	
								waranaa	mHm	451.5	
CVV	w-Hina	mHm	330.7	hHmad	mHm	331.3	Takam	mH-	L-L%	429.7	
	HmadrasaB	mHm	352.0	baqa	mH-	341.4	sanya	mH-	L-L%	364.1	
	biyya *	mHm	369.5	baqra	mHm	360.5	masya	mHm	L-	367.5	
	aywa	mHm	402.9	ah	mHm	369.7	ir-azic	mHm	L-L%	388.5	
								aywa	mHm	393.9	
								ir-azic	mHm	403.1	
								baqa	mH-	423.7	
								baqa	L-L%	425.7	
final	CV	madrasaB	mHm	332.0	dHmadrasaB	mHm	336.2	gambina	mHm	H-H%	348.3
		dHmadrasaB	mHm	347.2							
CVV	baqera	mHm	360.3	waranaa	mHm	H-	333.2				
	hHmadrasaB	mHm	433.3	loqina	mHm	L-L%	460.9				
	hHmadrasaB	mHm	442.5	taani	mHm	H-H%	475.7				
CVV	qaddirna	mHm	331.0	ingilziyyaB	mHm	H-	478.1				
	dHmadrasaB	mHm	342.1	tabarraac	mHm	H-	332.7				
	ir-azic	mHm	352.9	qurayyib	mHm	H-H%	342.3				
final	CVVC	masSarif	mH-	341.1	ustu'atbaab	mHm	L-L%	353.6			
	HmadrasaB	mHm		naynala	mHm	H-	410.7				
	Hilaal	mHm		inween	mH-	L-L%	412.7				
	caSaana	mHm		inween	mHm	L-L%	435.4				
CVV				ibnu	mHm	H-L%	350.5				
CVVC				baqna	mH-	L-L%	383.7				

overall results

- all of the accents were transcribed with an 'H' on the accented syllable (and none with L)
 - that is, no pitch valleys were found, only pitch peaks
- no 'L*' type phonological labels are required for the description of pitch accents in EA
 1. alignment of H peaks within accented syllable
 2. shape of the preceding and following f0 contour

results 1: position of the H peak

- 80% of cases: peak observed to occur *within* the accented syllable
 - consistent alignment of the high peak within the accented syllable supports analysis of the H tone as the 'starred tone'
- position of H peak within accented syllable varies with:
 - position of the word within the phrase
 - e.g. just two 'H' cases, both were phrase-final words with final-stress: [inʤaʔal'laah], [tu're:]
 - position of the stressed syllable within the word
 - e.g. in phrase-medial words, the H peak was at the end of the syllable only in words bearing initial-stress. e.g. [ʔaja]
- no evidence in this (small) corpus for variation in peak position other than that caused by local prosodic factors

results 2: shape of the f0 contour

preceding pitch:

- mostly observed to be 'm' (82%)
 - no instances at all of preceding high pitch ('h')
- three types of context labelled 'l':
 - first accented word in the utterance, preceded only by an unaccented function word e.g. [wi hiʤa...]
 - large number of unstressed syllables between successive accents ('low plateau') e.g. [ingili'ziʤja]
 - when the word is followed by high pitch, such as a high phrase tone (H-) e.g. [wa'ra:na]

results 2: shape of the f0 contour

following pitch:

- mostly observed to be 'm' (66%)
 - following pitch more variable than preceding pitch (82% vs. 66%)
- occurrence of following 'h' or 'l' dependent on local prosodic factors
 - words followed by H% boundary tone show continuous rise throughout accented syllable ('h' after H peak) e.g. [tagri'biʤja]
 - words followed by a L- phrase tone or L% boundary tone show either mid 'm' or low 'l' following pitch
 - more likely to have a 'mHl' shaped accent (than 'mHm') if the next stressed syllable was relatively distant
- observed variation in local pitch contour before and after the accented syllable in EA can be described as a function of the surrounding tonal environs

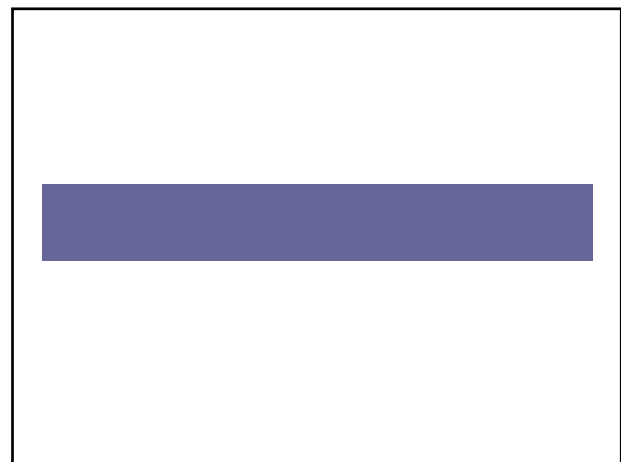
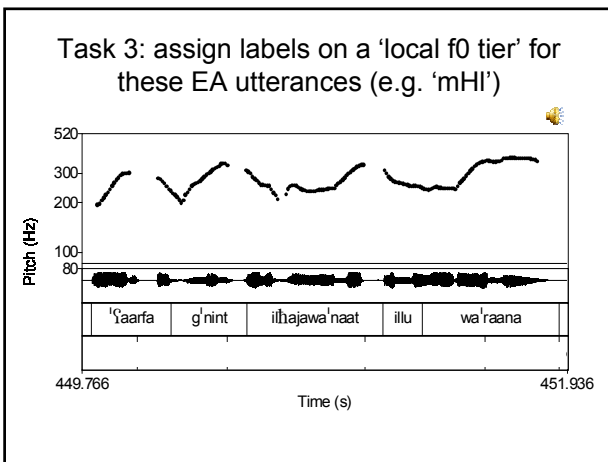
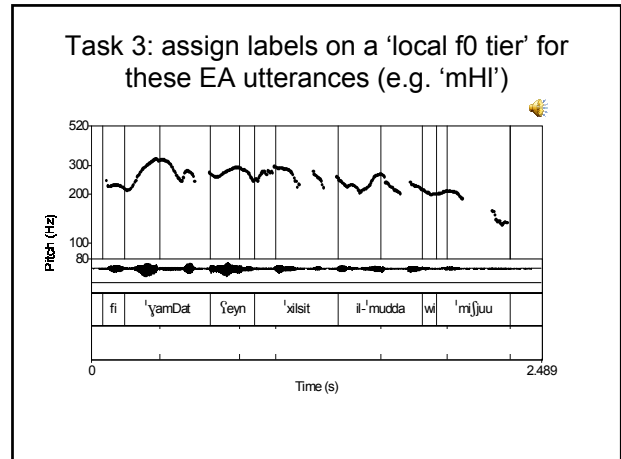
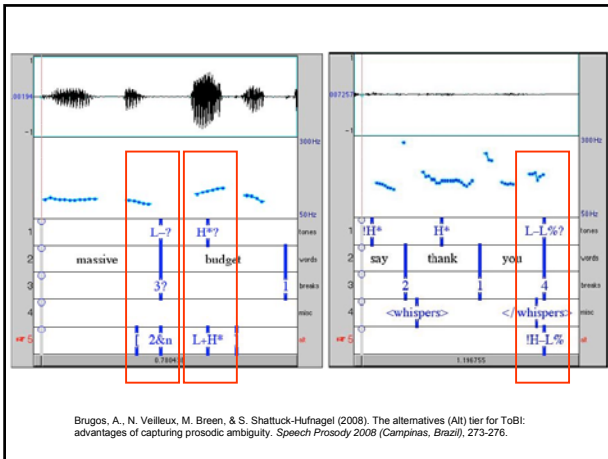
results: summary

- all variation in local f0 contour shape found to be predictable from the prosodic context
 - no evidence here for additional phonological categories of pre-nuclear pitch accent in EA
 - small study, requires expansion with multiple transcribers
- relative height of following contour more variable than preceding contour:
 - matches experimental findings
 - the preceding L tone is very stably aligned at the onset of the stressed syllable (Helmut 2007)
 - supports analysis of EA single pitch accent as L+H*
 - H peak with leading L target; that is, a rising accent

reflecting on transcription process

issues with IVIE:

- my implementation of 'local f0' tier is target-based (not domain based)
 - difficulties in deciding a priori what domain to label on phonetic tier in IVIE for Arabic
 - choice of left-headed domain is theoretical? ▶
- labelling on the local f0/phonetic tier is time-consuming
 - best used for subsets of data, in pursuit of specific hypotheses?
- a middle way:
 - use an "Alt tier" in a ToBI-style transcription (cf.Brugos et al 2008)
 - to identify patterns of intertranscriber disagreement
 - use a local F0/target tier for identified subset of data
 - to establish fine-grained detail of contour for disputed categories



conclusion → discussion

- there is a crucial role for intonational transcription
 - in the *development and testing* of a phonological analysis
 - in conjunction with experimental investigation
- widespread use and acceptance of AM systems (ToBI, IVIE etc) suggests an AM framework will yield most impact
 - the choice between Pierrehumbert vs. Gussenhoven type is theoretical (at least in part, and debate is still ongoing)
 - important to use a single system for comparative work
 - clearly distinguish between transcription systems for development of an analysis and final 'models'

conclusion → discussion

desiderata for a transcription system for comparative study of the intonation of spoken Arabic dialects:

- allow for potentially larger range of typological variation than observed in e.g. English
 - systematic variation in pitch accent distribution?
 - small vs. large pitch accent inventories?
 - others..?
- include a Break Indices tier
 - rather than decide a priori that every dialect has only one level of phrasing
- include a means of *developing* an analysis
 - alt tier in ToBI + use of IVIE local f0 tier for disputed categories?
- others..?