THE UNIVERSITY of York

Intonational Variation in Arabic

Transcription Workshop

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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

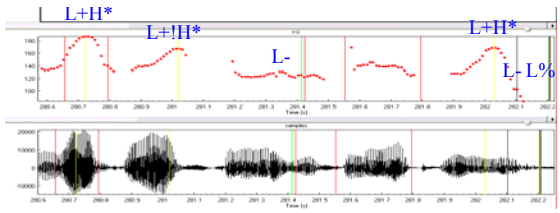
* relative prominence relations
* constituency levels

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



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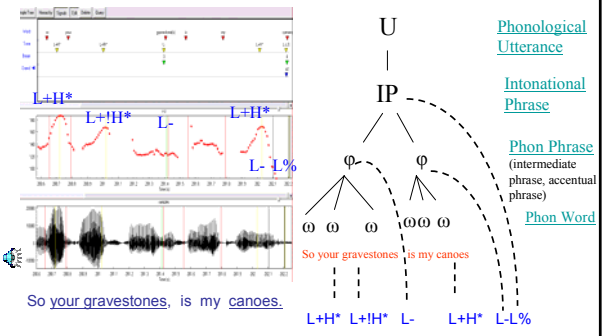
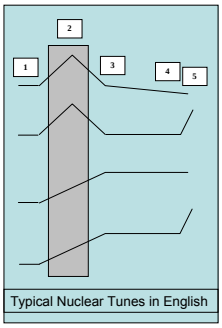


Tonal Organization in Different AM Models

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]

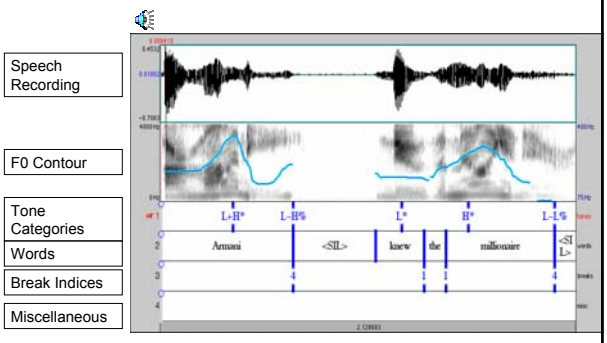


ToBI (Tones & Break Indices)

- 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://wwwhomes.uni-bielefeld.de/gibbon/Docs/ToBI.htm
http://ocw.mit.edu/OcwWeb/Electrical-Engineering-and-Computer-Science/6-911January--IAP--2006/CourseHome/index.htm

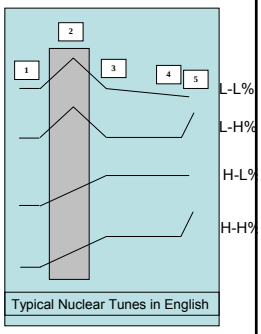
ToBI Basics



Tonal Phonological Organisation in (AmE) ToBI

- Pitch accents

Alignment Scaling
  - H* - !H*
  - L+H* - L+!H*
  - L*+H - H+!H*
  - L*
- 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



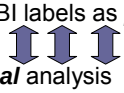
ToBI: Phonological Transcription System

- **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

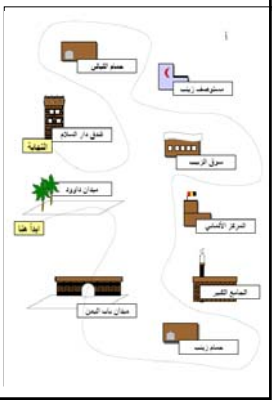


2. ***Phonological*** analysis
   - phonetic criteria
   - distributional criteria
   - semantic criteria
   - analytical coherence (Gussenhoven 2007)

a mix of transcription-based & experimental evidence

The LA Data: Map Task

Target Words	English Translation
?al Ea	"fortress"
?el bi**dee**ye	"the start"
H?uul naEnaE	"mint fields"
jana**inaat**	"gardens"
maEmal ?al**baan**w ?aj**baan**	"a dairy product factory"
maEmal ?al**baan**w ?aj**baa**nel la**yaa**li	"the Layaali dairy product factory"
ma**zee**reE	"farms"
mes**taw**daE **?a**meH	"a wheat storehouse"
shajar send**yaan**	"mahogany trees"
Siyyaa**diin sa**mak	"fishermen"
xa**liij**el **leel**	"the "night" gulf"
xa**liij**el **maal**	"the "money" gulf"



The LA Data: Experiments

(I)

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

/**la**ma **Ha**met **mu**na min **li**ma/
"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 leezem t?uul niyyamet, bas ?aalet **X**
"she should have said she put to bed, but said X"

END[INTER]:
keen leezem t?uul **X**, bas maa ?idrit
"she should have said X, but she couldn't"

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

ToBI Tonal Possibilities as Phonetic Labels

- **Pitch accents**

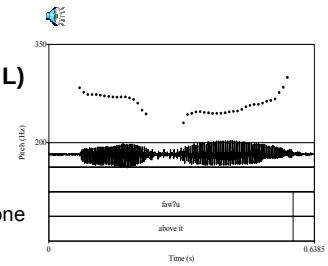
Alignment
- H*
- H*+L
- L+H*
- L*+H
- L*

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

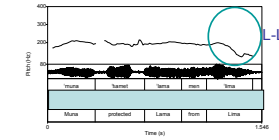
Phonetic Observations from LA Data

I. Phrasing related tones (boundary configurations)

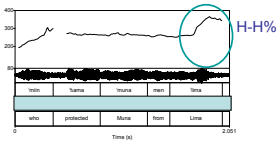
- Fall [L-L%]
- Rise [H-H%]
- Plateau [H-L%]
- Fall-rise [L-H%]
- Mid fall-plateau [!H-L%]

I. Phrasing Related Tones

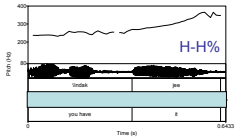
Fall (Syntactic Declarative Statements)



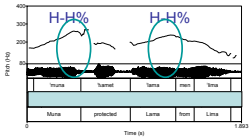
Rise (Wh-Questions)



Rise (Declarative Yes/No Questions)

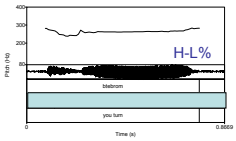


Rise (Incompleteness)

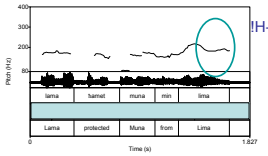


I. Phrasing Related Tones

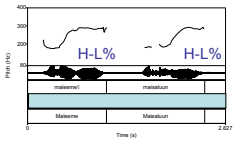
Plateau (Incompleteness)



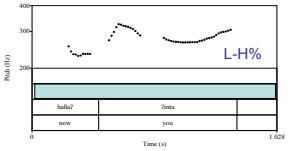
Mid-Fall Plateau (Reproach)



Plateau (Calling)



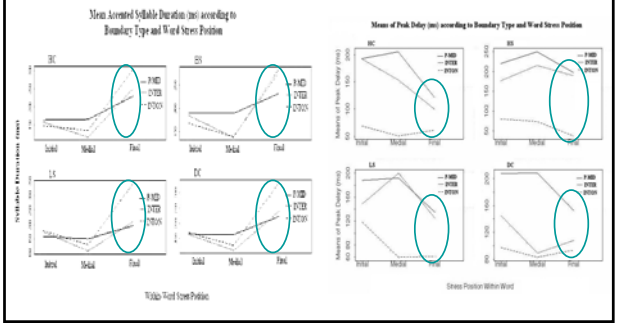
Fall-Rise (Stylised Continuation)



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

Phrase-final lengthening

Peak alignment cues

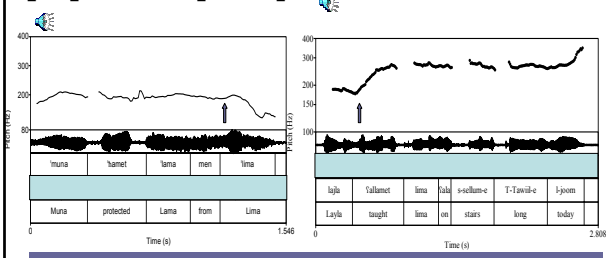


Phonetic Observations from LA Data

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*]



- contrast in sufficient segmental material
- L in L+H* not explained in terms of a preceding L edge tone
- L in L+H* not explained in terms of sagging interpolation

/H*/ **/L+H*/**

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

Further issues for experimental verification

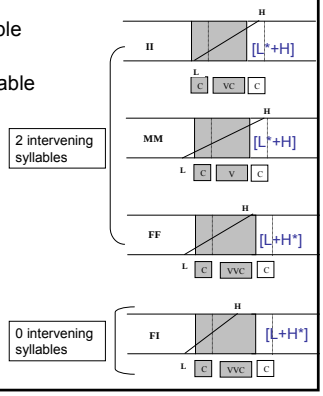
- Is the lack of L or its presence in these rising accents the consequence of pitch range span effects?
  - e.g. degree of prominence on accented word
  - e.g. large versus compressed pitch range

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

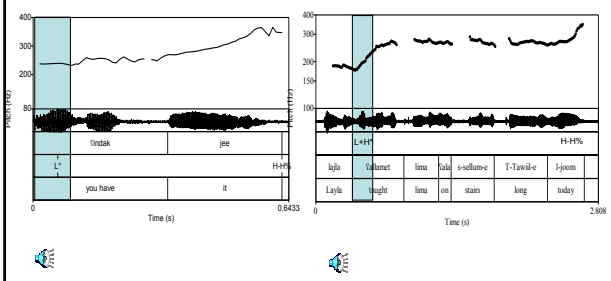
- H peak within accented syllable [L+H*]
- H peak outside accented syllable [L*+H]

Prosodic conditioning effects on peak alignment

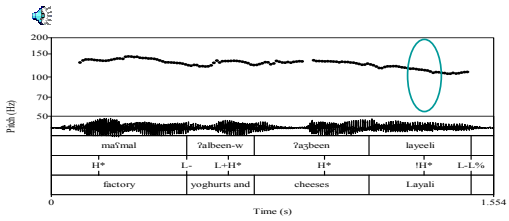
/L+H*/



Distinction between L+H* versus L* H-



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



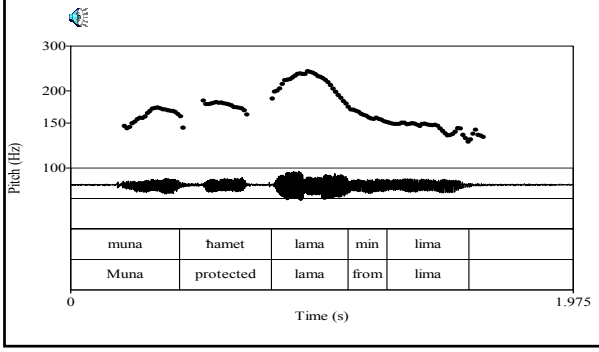
- not necessarily triggered by bitonals
- meaning of finality

- analysed as phonological categories

Proposed LA Tonal Inventory

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

Activity



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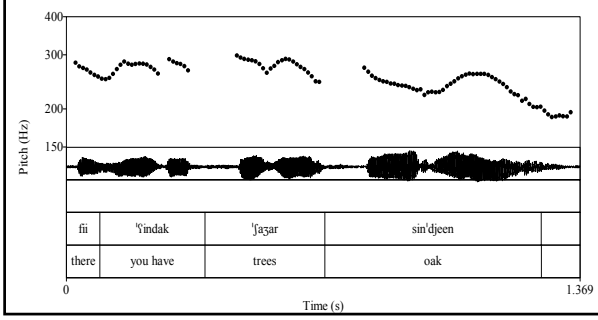

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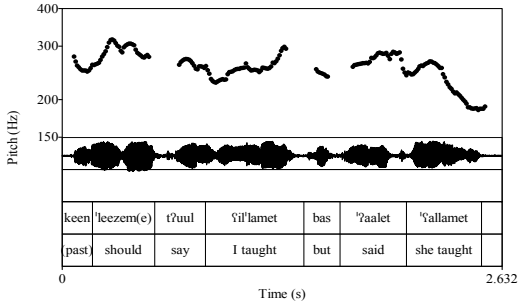


Some Transcription Challenges

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):

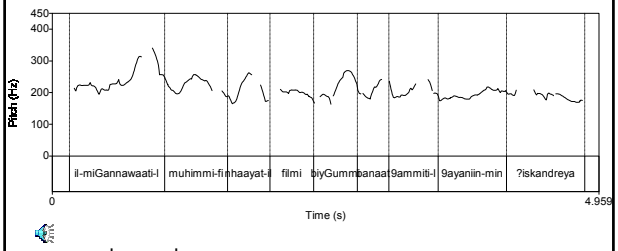
- Regions of ambiguity (with more than one plausible transcription) → disproportionate amount of transcription time
- Making arbitrary decisions among competing labels → loss of information

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

Egyptian Arabic

Testing an analysis using an
IViE-based transcription system

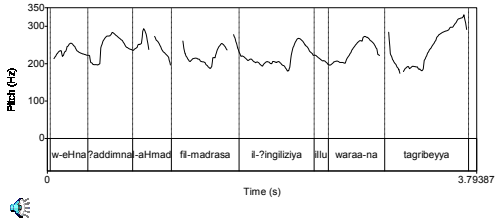
EA pitch accent distribution



- read speech
  - data collected for experimental purposes

Hellmuth, S. (2004). Prosodic weight and phonological phrasing in Cairene Arabic. *Proceedings of Annual Meeting of Chicago Linguistic Society*, 40.1

EA pitch accent distribution



- spontaneous speech
  - LDC Call Home corpus speech sample - telephone calls

CallHome Egyptian Arabic Speech Supplement LDC2002S37

preliminary model of EA intonation

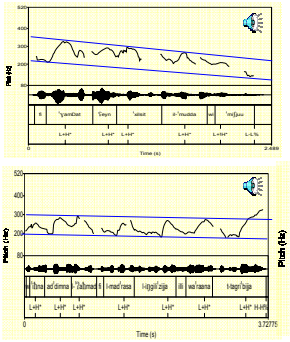
pitch accents:
- L+H*

edge tones:
- L- H- at 'MaP' edge
- L% H% at IP edge
  - yields:
    - L-L%
    - H-H%
    - L-H%
    - H-L%

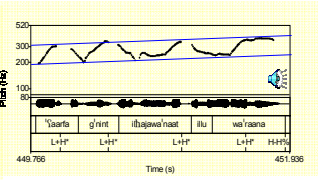
implications:
- a phonological analysis
  - a 'broad' transcription
    - e.g. downstep treated as phonetic realisation
      - no "!" tones in inventory
- restrictive > makes predictions:
  - meaning can't be expressed by paradigmatic means
    - e.g. using a different pitch accent
  - meaning will 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%



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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%

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. [p3.]

target tier labelling domain

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

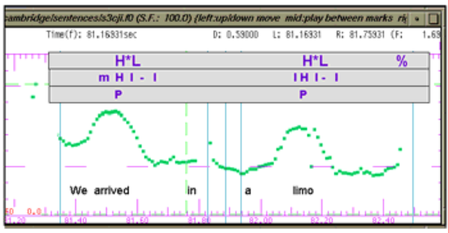
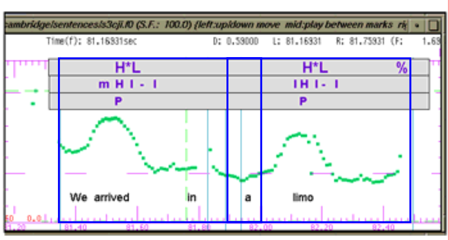


Image from: Grabe, Esther. 2001. The IViE Labelling Guide. (Version 3.0). University of Cambridge. [p6.]



how to fill in the target tier:

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

transcription study: methodology

corpus:

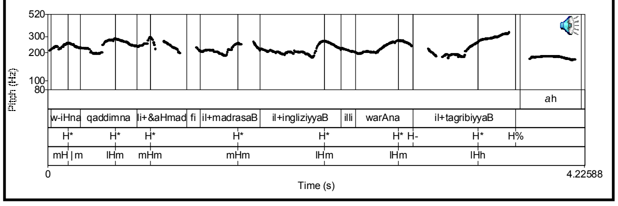
- 100 target words from a spontaneous speech telephone conversation (two female speakers, Call Home corpus)
  - selection criterion: little or no perturbation of the f0 contour

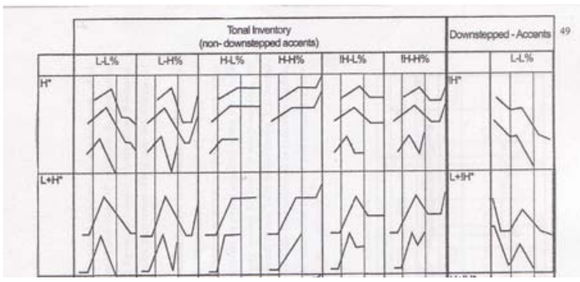
transcribed on three tiers:

- *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 '|'





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 -initial*	*local*	*time*	*phrase-medial*	*local*	*time*	*phrase -final*	*local*	*foll by:*	*time*
initial	*CV*	rigic	mHlm	325.1	giri (name)	mHlm	359.1	baqa	mH-	L-L%	325.4
								kutub	mHh	H-H%	344.1
								caʕaraB	mHm	L-L%	360.9
								nacam	mHh	H-H%	389.6
					GaayaB	mHm	352.3	baqa	lHh	H-H%	446.8
CVV		naaxud	mHm	343.7	ceeni	-Hm	368.0	ah	mHm	L-	328.7
					?amiiraB	mHm	370.1	Daruuri	mHm	L-	393.1
					Hatsaafir	mHm	370.9	leelaB	lHm	L-H%	417.3
					iqaamaB	lHm	372.3	waraana	lHh	H-H%	451.5
CVC		wiHna	mHm	330.7	laHmad	mHm	331.3	Tabcan	mHl	L-L%	329.7
		Hayuqcud	mHm	352.0	lissa	mH-	341.4	sanya	mHl	L-L%	364.1
		hiyya *	lHm	369.5	bukra	mHm	360.5	miʕyu	mHm	L-	367.5
		aywa	mHm	402.9	aSh	mHm	369.7	tirgac	mHm	L-L%	388.8
					lissa	mH-	370.3	aywa	mHm	L-L%	393.9
					tigaddid	mHm	372.7	aywa	mHm	L-L%	403.3
								lissa	mHm	H-L%	423.2
								lissa	mHl	L-L%	425.7
penult	*CV*				madrasaB	mHm	332.0	dafacnalu	mHm	hes.p	336.2
					dafacnalu	mHm	336.2	gambina	mHh	H-H%	348.3
					madarasB	mHm	347.2				
CVV		baqeena	mHm	360.3				waraana	lHm	H-	333.2
		?amiiraB	lHm	433.3				foqiina	mHm	L-L%	463.9
		?amiiraB	lHm	442.5				taalit	mHh	H-H%	475.7
								taalit	mHm	L-L%	478.1
CVC					qaddimna	mH lm	331.0	ingliziyyaB	lHm	H-	332.7
					nidfacha	mHm	342.1	tabarruc	lHh	H-	340.2
					disambir	mHm	352.9	qurayyib	mHh	H-H%	342.5
					dafacna	mHm	345.2				
final	*CVVC*				maSariif	mH-	341.1	inʃa?allaah	mlHm	L-L%	353.6
					HanruuH	mHm		naymiin	mHh	H-	410.2
					Hilaal	mHm		itneen	-Hl	L-L%	412.3
					calaʃaan	lHm		tureel	mlHl	L-L%	435.2
CVV								ahuu	mMm	H-L%	359.5
								babaa	mMl	L-L%	383.7
CVCC					camr	mHm	346.7				

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: [inʃaʔalˈlaah], [tuˈreːl]
  - 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. [ˈɣaːja]
- 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 hijja…]
  - large number of unstressed syllables between successive accents ('low plateau') e.g. [ingiliˈzijja]
  - when the word is followed by high pitch, such as a high phrase tone (H-) e.g. [waˈraːna]

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. [tagriˈbijja]
    - 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

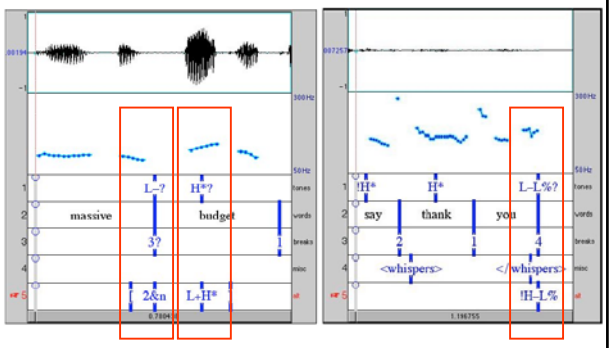
results: summary

- 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 (Hellmuth 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

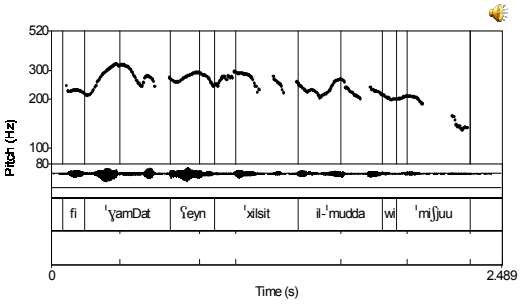
issues with IViE:

- 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



Brugos, A., N. Veilleux, M. Breen, & S. Shattuck-Hufnagel (2008). The alternatives (Alt) tier for ToBI: advantages of capturing prosodic ambiguity. *Speech Prosody 2008 (Campinas, Brazil)*, 273-276.

Task 3: assign labels on a 'local f0 tier' for these EA utterances (e.g. 'mHl')



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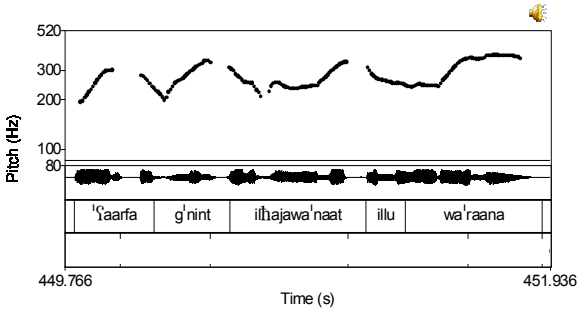

conclusion → discussion

- 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..?