ASSESSING LINGUISTIC I-PROXIMITY IN L3 PHONOLOGY

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Konstanz L3 Workshop

L3 PHONOLOGY

- Standing on the shoulders……
- Cabrelli Amaro & Wrembel (2016); Wrembel et al. (2019); Cabrelli Amaro (2016); Llama & Cardoso (2018); Gut (2010); Lloyd-Smith et al. (2016); Kopečková (2016), etc. etc.

PREDICTING L3 CROSS-LINGUISTIC INFLUENCE

- Proximity
  - Typological (Rothman et al. 2017)
  - Linguistic (Westergaard et al., 2017)

SCOPE OF L3 CROSS-LINGUISTIC INFLUENCE

- Wholesale (Schwartz & Sprouse, 2019)
- Piecemeal (Slabakova, 2017)

PROXIMITY/SIMILARITY

- So, how do we measure?

ROTHMAN'S CUE HIERARCHY

- Lexicon > Phonological cues > Functional morphology > Syntactic structures
- Lexical and phonological comparisons are viewed as more 'straightforward' than morphological or syntactic comparisons
- But *how*? Looks like a continuum of :
  - More surface true > less surface true

- There is a logical problem of phonological acquisition too
- It's not just *noticing*, but *learning*

TYPOLOGICAL PROXIMITY

- Rothman argues:
- the parser determines typology (and that typology determines proximity)

- But maybe we can go straight from the parser (~~to typology~~) to proximity

- Phonological parsing must, however, involve more than a linear comparison of surface properties of cognates
  - (*hound/hund/chien; glad/glad*)
- Phonological parsing is connected to representation, and representation to similarity

THE SCALPEL AND PIECEMEAL MODELS

- "There is no need for wholesale initial transfer because the scalpel can successfully single out the uniquely relevant features and properties."

  --Slabakova, 2017

- But *how*?

DIAGNOSIS BEFORE SURGERY

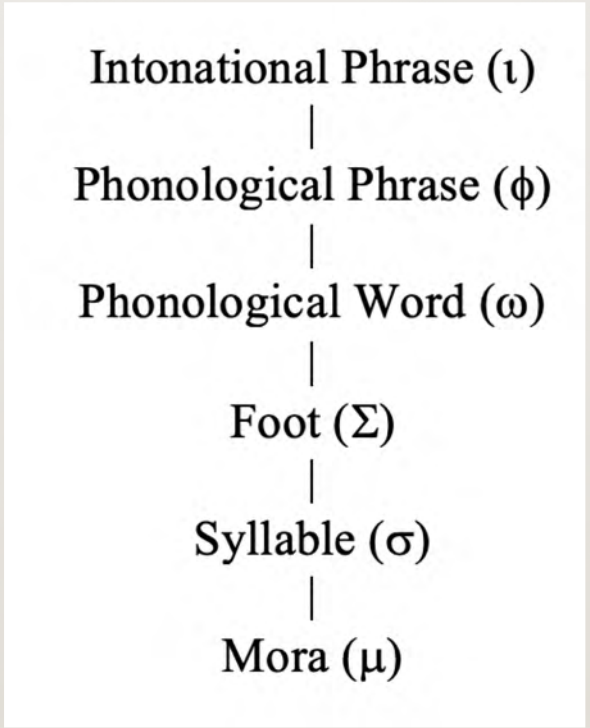
PHONOLOGICAL DIAGNOSIS

- Why phonology is not 'straightforward'
  - The epistemology of phonology
  - Blame assignment

PHONOLOGICAL COMPLEXITY

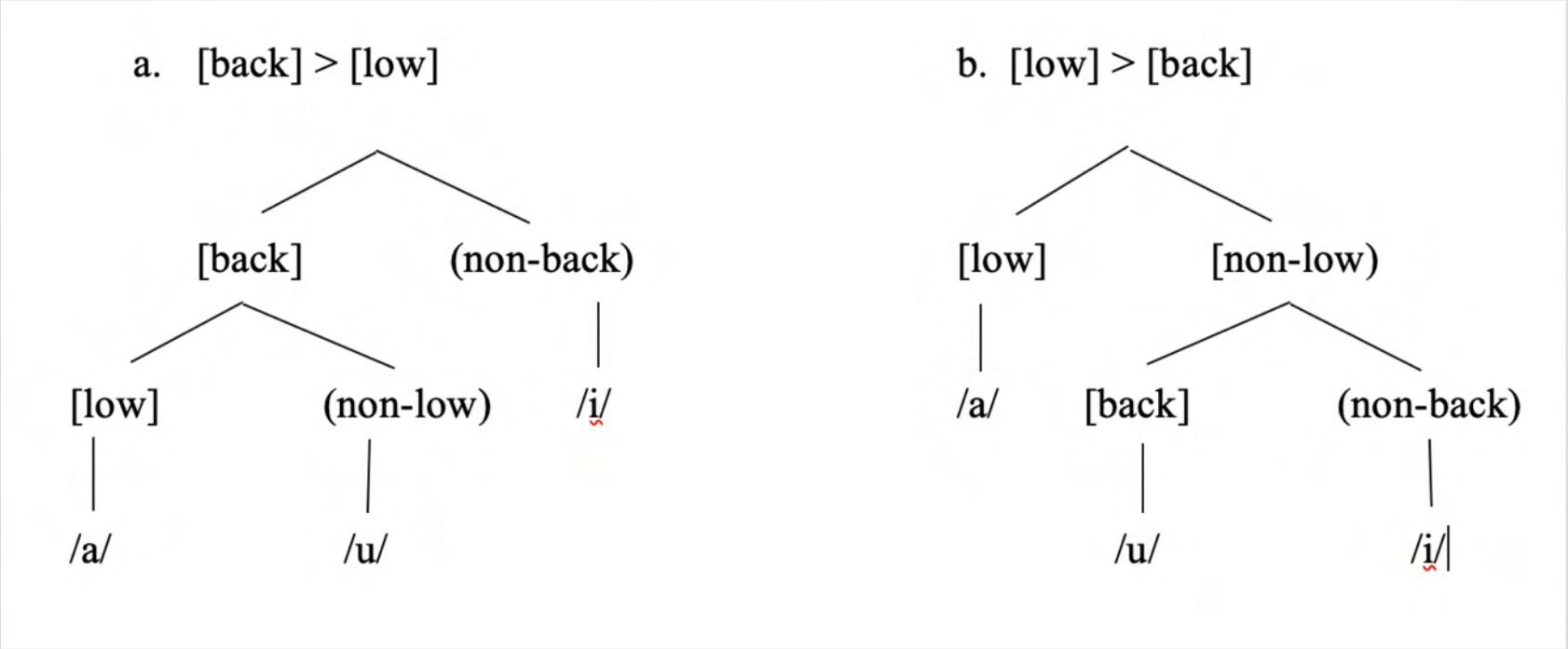
- Phonology as cognition
  - Phonological structure is rich and abstract, and not always read transparently off the input signal
    - Hale & Reiss, (2000); Burton-Roberts (2000)
  - Phonological triggers/cues/treelets are deep

PROSODIC HIERARCHY



FEATURE STRUCTURE FOR CONTRAST

- A long tradition of the contrastive hierarchy in linguistics (Jakobson, Halle, Dresher)



FEATURE RANKING

- Successive Division Algorithm (Dresher, 2009)
  - "Assign contrastive features by successively dividing the inventory until every phoneme has been distinguished."
- Identical surface inventories might have different underlying feature rankings

I-PROXIMITY

- Similarity is based on contrastive feature representations determined by the Successive Division Algorithm (Mackenzie, 2011)
- Proximity is, thus, a measure of I-language, thus: I-proximity

SURFACE PROXIMITY: AN EPISTEMOLOGICAL CHALLENGE

- Classic learnability issues arise when comparing two grammars via an evaluation metric (Yang, 2017); which grammar better accounts for the data? And how to know what to change if the grammar is wrong?
  - Blame Assignment (Pinker, 1989)
  - The Credit Problem (Dresher, 1999, 1995)

- This is analogous to the L3 CLI question. Does the L1 or the L2 grammar better fit the L3 data?
- If my current grammar is wrong, what do I change?
  - Answer: Cues
- When do I change it?
  - Answer: Tolerance

I-PROXIMITY

- Based on Fodorian-style phonological treelets
  - Segments
  - Syllables
  - Metrical feet

I-PROXIMITY: GENERAL PROPERTIES

- Based on bilingual parsing of the L3 input
- Draws on the literature of parsing ambiguous input (Gwilliams, et al. 2018)
  - No special machinery (Archibald, 2019)

A CASE STUDY (BENRABEH, 1991)

- L1 Arabic (Algerian)
- L2 French
- L3 English

PIECEMEAL CLI PATTERNS

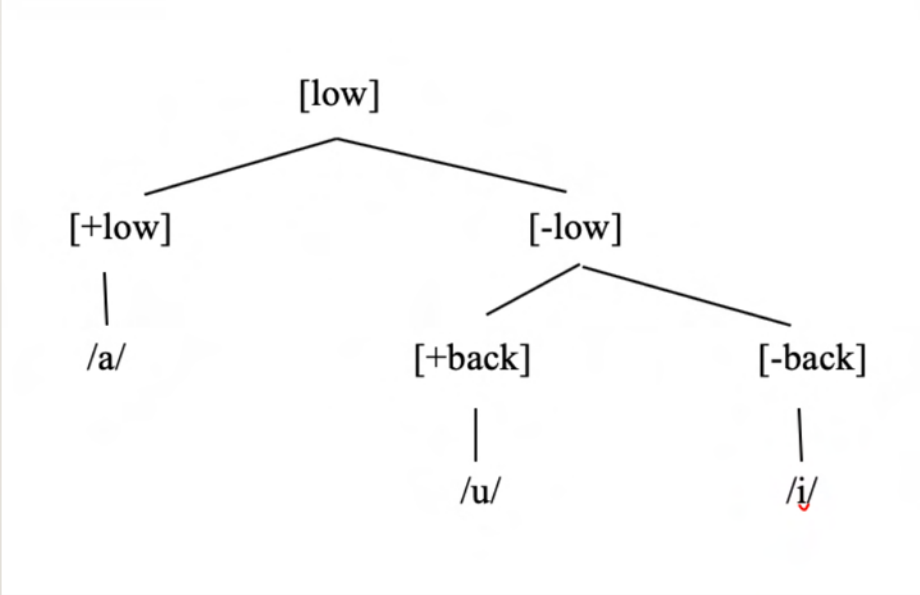
- 24 'balanced' bilingual subjects in spontaneous production task

- L3 English speakers use:
  - French vowels
  - Arabic consonants

(MODERN STANDARD) ARABIC VOWELS

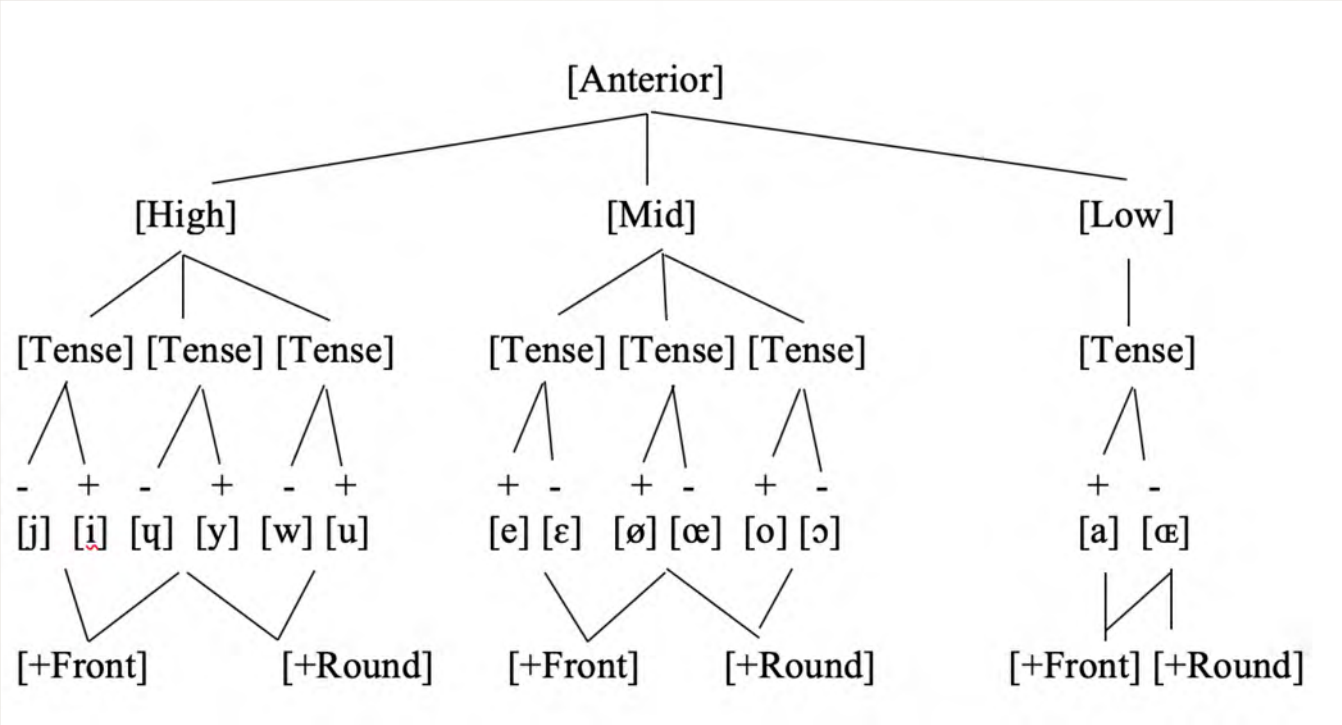
- Three short vowels [i, ɑ, u]
- Three long vowels [i:, ɑ:, u:]

ARABIC CONTRASTIVE VOWELS



[low] > [back]

JAKOBSON FRENCH HIERARCHY



[anterior] > [aperture] > [tense] > [front] > [round]

ENGLISH VOWELS

- 13 contrastive vowels
  - Active features
  - [anterior] > [aperture] > [tense] > [round] > [front]

VOCALIC I-PROXIMITY

Arabic	[low] > [back]
French	[anterior] > [aperture] > [tense] > [front] > [round]
English	[anterior] > [aperture] > [tense] > [round] > [front]

- The l-proximity of French vowels is closer to English vowels than Arabic vowels are when we take active contrastive features in a ranking as the measure of similarity
- Thus, French vowels transfer into the L3
- The actual inventory is an epiphenomenon

CONSONANTS

- Arabic
- Voiced and voiceless stops
  - [b, t/d, k, q, ʔ]
- Emphatic (pharyngealized) consonants
  - [$t^{ʕ}$/$d^{ʕ}$]

French

[p/b, t/d, k/g]

LARYNGEAL FEATURES

Language	Voiceless	Voiced	Feature
Arabic	Long VOT	Short VOT	[Spread Glottis]
French	Short VOT	Negative VOT	[Voice]
English	Long VOT	Short VOT	[Spread Glottis]

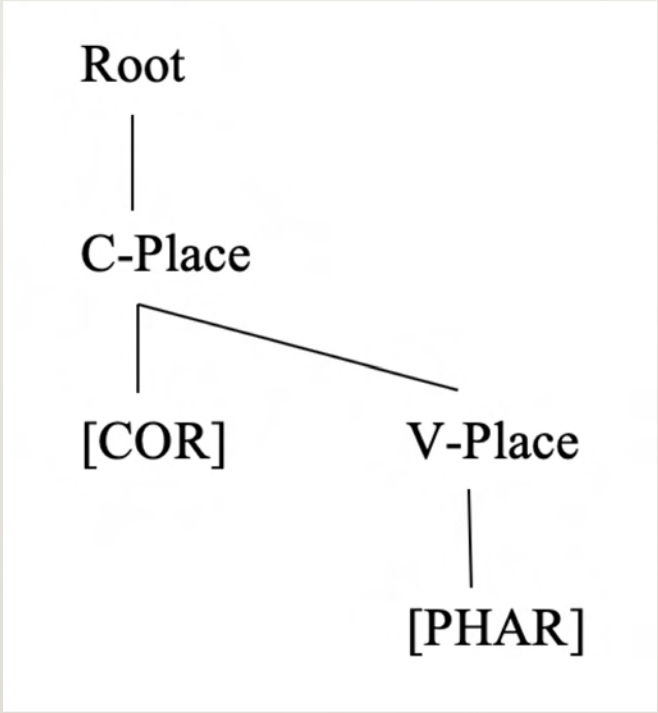
LARYNGEAL FEATURES

- In terms of l-proximity, Arabic laryngeal features are closer to English than French are.
- And, that's what transfers into the L3.

PLACE FEATURES

- Arabic has dental [t̪] and [d̪].
- Secondary pharyngealization happens only on the [CORONAL] consonants in Arabic
- Producing a pharyngealized stop results in a more back articulation in English, and that's what transfers into the L3

EMPHATICS



CONSONANTAL I-PROXIMITY

Arabic	[SG]	[dental] + [PHAR]
French	[Voice]	dental
English	[SG]	alveolar

I-PROXIMITY

- Is based on phonological representations

SYLLABLE STRUCTURE

- We need to consider markedness in cross-linguistic comparisons
- Comparison of unmarked structures won't tell the learner much; exposure to unmarked forms alone (e.g. CV) would never reach the Tolerance threshold for setting up a new grammar
- Also comparisons must be of deep (not surface) forms; evidence of L1 Persian transfer of coda appendices in L2 English onset appendices:
  - Persian is more similar to English than Portuguese

Lx S+C DISCRIMINATION (ABX)

Table 1. Syllabic properties of the L1s

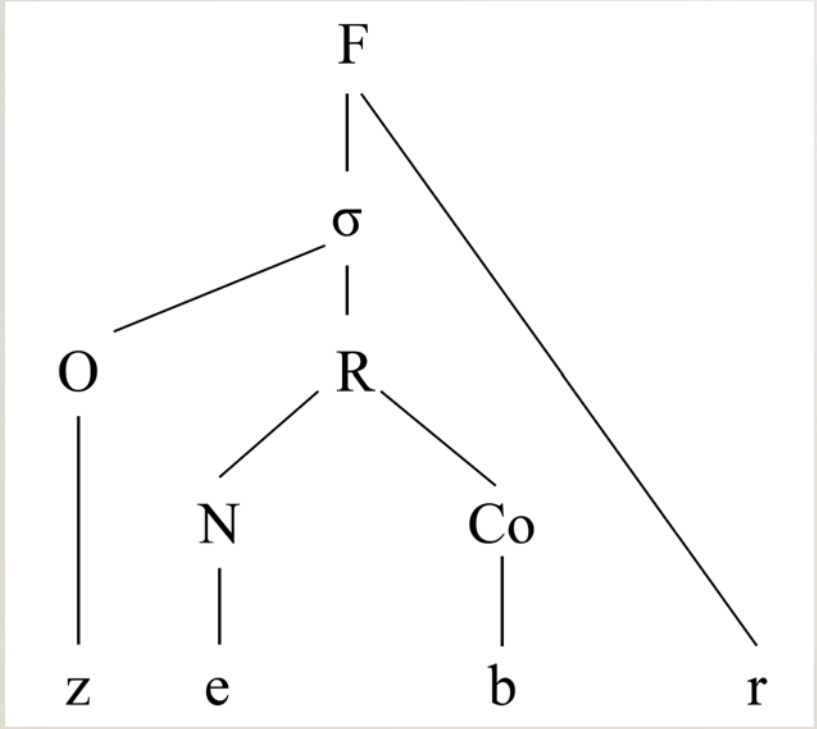
L1	*sC Onsets?*	*Branching Onsets?*	*Appendices?*	*% Error?*
Japanese	No	No	No	72
Brazilian Portuguese	No	Yes	No	50
Persian	No	No	Yes	16

3 =

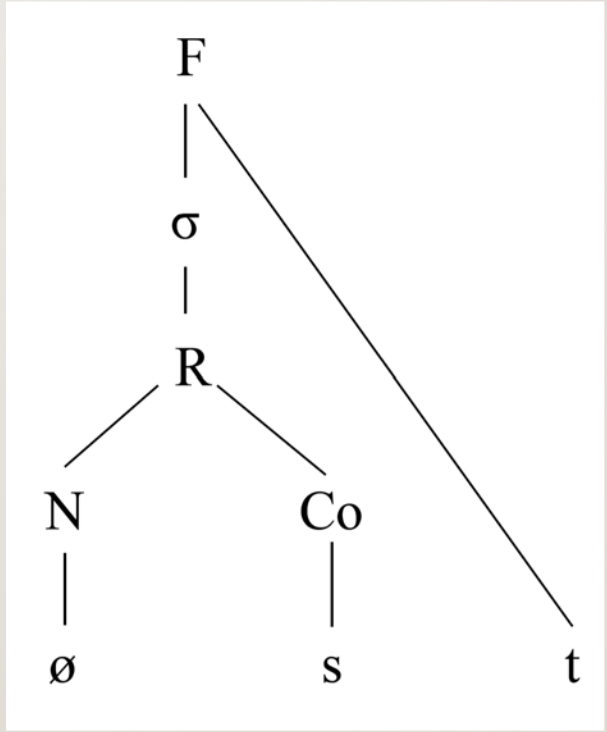
BP outlier

Persian outlier

PERSIAN/ENGLISH I-PROXIMITY



Persian right-edge appendix



English left-edge appendix

DEEP TRIGGERS

- Persian learners of English treat the appendix structures as similar, and redeploy the Persian structure into English.
  - (Archibald & Yousefi, 2018; Archibald, Yousefi & Alhemaid, in preparation)
- I-proximity is calculated with reference to deep triggers

STRESS

- Here we can see an input effect
- Following Yang's Tolerance-Principle approach the input will determine when a new structure would be set up
- But Tolerance comparisons must be of treelets or parameters not surface strings

METRICAL PARAMETERS

	English		
P2 Feet are	Binary		
P3 Feet are built from the	Right		
P4 Feet are strong on the	Left		
P8 There is an extrametrical syllable	Yes		

Dresher & Kaye, 1990

METRICAL PARAMETERS

	English	**Dutch**	
P2 Feet are	Binary	Binary	
P3 Feet are built from the	Right	Right	
P4 Feet are strong on the	Left	Left	
P8 There is an extrametrical syllable	Yes	Yes	

METRICAL PARAMETERS

	English	**Dutch**	**Portuguese**
P2 Feet are	Binary	Binary	Binary
P3 Feet are built from the	Right	Right	Right
P4 Feet are strong on the	Left	Left	Left
P8 There is an extrametrical syllable	Yes	Yes	No

METRICAL PARAMETERS

	English	**Dutch**	**Portuguese**
P2 Feet are	Binary	Binary	Binary
P3 Feet are built from the	Right	Right	Right
P4 Feet are strong on the	Left	Left	Left
P8 There is an extrametrical syllable	Yes	Yes	No

REPRESENTATIONALLY-CONSTRAINED INDUCTION

Find (Environment)	Where Expecting (Grammar)	Change
Stress at edge	None	Direction [P3]
No stress at edge	Stress at edge	Extrametricality [P8]

Archibald, 1998

INPUT FREQUENCY

3-syllable words	Antepenultimate	Penultimate	Final
English	60%	37%	3%
Dutch	67%	24%	9%
Portuguese	75%	19%	30%

Clopp, (2002)

INPUT PROPERTIES

3-syllable words	Antepenultimate	Penultimate	Final
English	60%	37%	3%
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Portuguese	75%	19%	30%

TOLERANCE PRINCIPLE (YANG, 2017)

- When do you set up a new grammar?

Tolerance Principle

If R is a productive rule applicable to N candidates in the learning sample, then the following relation holds between N and e, the number of exceptions that could but do not follow R:

$$e \leq \theta N \text{ where } \theta N := \frac{N}{\ln N}$$

(Could be couched in Multiple Grammars theory (Roeper & Amaral, 2015))

N	θ_N	%
10	4	40.0
20	7	35.0
50	13	26.0
100	22	22.0
200	38	19.0
500	80	16.0
1,000	145	14.5
5,000	587	11.7

INPUT EFFECTS

- So, *if* you are expecting no stress at the edge ([+extrametrical]), -- i.e., English or Dutch L1 –
- and are learning Portuguese ([-extrametrical]) as L*x*
- *then* the input will tell you much more quickly to change your setting i.e., (abandon exceptions) because of the frequency of final stress in the target language

CONCLUSIONS

- Proximity is a construct of I-language, hence **I-proximity**
- I-proximity is based on a comparison of deep representational properties at all phonological levels
- CLI can be piecemeal including elements from the L1 and the L2
- Input patterns influence the developmental timeline including when exceptions are abandoned to trigger new representations
- Potential reconciliation of foundations of TPM, LPM, FTFA and Scalpel approaches

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THANK YOU

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ALGERIAN ARABIC

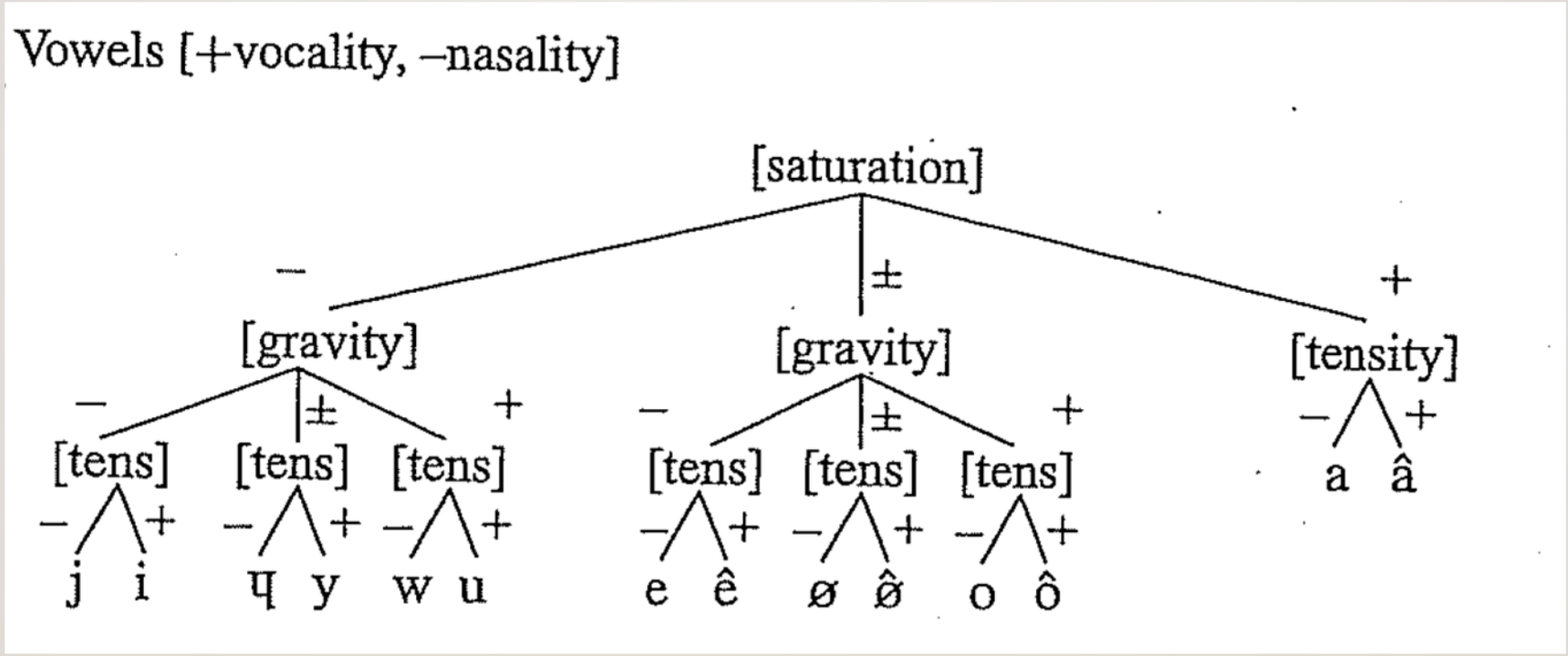
ALGERIAN ARABIC

- No V-length contrast (unlike MSA)
- A possible 4th vowel phoneme /ɨ/
- Has French borrowings

FRENCH LOANWORD PHONOLOGY

- French [ʁ] becomes Arabic [r]
- French [s] becomes Arabic [sˤ]
- French [ü] becomes Arabic [i]

FRENCH CONTRASTIVE VOWELS



(MODERN STANDARD) ARABIC

Consonants

	Bilab.	Lab.dent.	Dental	Alv.	Postalv.	Retrofl.	Palatal	Velar	Uvular	Pharyng.	Glottal
Plosive	b		t d					k	q		ʔ
Nasal	m		n								
Trill			r								
Fric-ative		f	θ ð	s z	ʃ			x ɣ		ħ ʕ	h
Approx-imant							j	w			
Lateral			l								

Pharyngealized consonants: tˤ dˤ sˤ ðˤ lˤ Affricate: ʤ

METRICAL PARAMETERS: DEFAULTS

P1 The word tree is strong on the	Left
P2 Feet are	Unbounded
P3 Feet are built from the	Left
P4 Feet are strong on the	Left
P5 Feet are quantity-sensitive (QS)	No
P6 Feet are QS to the	Rhyme
P8A There is an extrametrical syllable	No
P8 It is extrametrical on the	

INPUTS: ENGLISH

	Preantepenultimate	Antepenultimate	Penultimate	Final
2-syllable			77%	23%
3-syllable		60%	37%	3%
4-syllable	.5%	46%	35%	18%

INPUTS: DUTCH

	Preantepenultimate	Antepenultimate	Penultimate	Final
2-syllable			85%	15%
3-syllable		67%	24%	9%
4-syllable	45%	24%	21%	10%

INPUTS: PORTUGUESE

	Preantepenultimate	Antepenultimate	Penultimate	Final
2-syllable			74%	26%
3-syllable		75%	19%	30%
4-syllable	8%	72%	20%	17%

ONE UNRESOLVED ISSUE

- Adaptive parsing
  - Segments (Kennedy & Trofimovich, 2008)
    - Listeners with greater experience with non-native speech were more accurate in transcribing sentences read by non-native speakers
  - Stress (Reinisch & Weber, 2012)
    - Dutch listeners heard input with Hungarian stress (initial). These subjects (compared to a control group) adapted quickly to processing words with non-targetlike stress (as indicated by reduced eye-fixation times)

BAYESIAN PERCEPTION

- given an accented phone {z}, the probability that a native listener will assign {z} to the category /x/ is ‘proportional to the probability that /x/ would be realized as {z} multiplied by the probability of /x/ in English’
- $p(\{z\}|/x/) \cdot p(/x/)$

L3A AND HVPT

- For both L3A and High Variability Pronunciation Training, the assessment of prior perceptual likelihood is changed
- These more elastic category boundaries will have to be addressed in models of parsing and I-proximity

INTELLIGIBILITY ASYMMETRIES

- Danes can understand spoken Swedish better than Swedes can understand spoken Danish (Frinsel, Kingma, Gooskens and Swarte (2015))
- A surface comparison of cognates would not handle such asymmetries in a straightforward way

BILINGUAL ARCHITECTURE

- Homogeneity (Libben and Goral, 2015)
  - Bilingual grammars are representationally equivalent to monolingual grammars
- Non-selective access (e.g., Dijkstra et al., 1999)
  - All languages active all the time

NON-SELECTIVE ACCESS AND PROXIMITY

Not all cognates are created equal.

SOP Cognates	**SO Cognates**	**SP Cognates**
hotel	fruit [frøyt]	news / nieuws
film	chaos [xaɔs]	boat / boot
lip	jury [ʒyri]	wheel / wiel
OP False Friends	**IL Homographs**	**IL Homophones**
step (scooter)	glad	[lif]
arts (doctor)	[xlɑt] (slippery)	'leaf' 'lief'
kin (chin)		(dear)

HOMOGENEITY AND NON-SELECTIVE ACCESS

- Individual lexicons are not encapsulated
- Cross-linguistic priming is a robust phenomenon
- Interlingual homographs can facilitate lexical access; interlingual homophones can inhibit lexical access

- I-proximity cannot be based solely on segmental linearization

EFFECTS OF [PHAR] ON VOT

	Arabic	English
d	12-22 ms	18 ms
t	38-93 ms	60 ms
$d^{ʕ}$	12 ms	
$t^{ʕ}$	18.5 ms	

So the [PHAR] VOT would actually be *less* targetlike. It helps with place but not VOT.

UNCLEAR [PHAR] ACOUSTICS

- Secondary pharyngealization lowers F2 (AlMasri, 2010)
- Fasola et al, xxx show that dental have lower F2 transition than alveolars

- F2 correlates with vowel backness; higher F2 is more back?