EXPLAINING L3 PHONOLOGY

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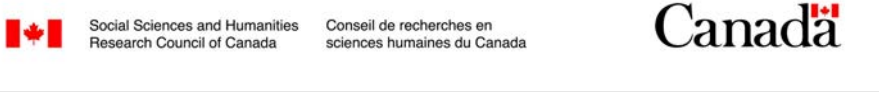
中央大学
CHUO UNIVERSITY

GRATITUDE

•Conference organizers; John Matthews & Makiko Hirakawa

•UVic L*x* Lab Team: Eloisa Cervantes, Martin Desmarais, Jie Deng, Emma Hayter, Willem Kuun, Mitchell Li, Junyu Wu

•and all the L3 phonologists out (t)here



“It’s not easy to live your own way. You can’t blame anyone but yourself.”

Whisper of the Heart

“It’s not easy to live your own way. You can’t blame anyone but yourself.”

Whisper of the Heart

"Listen to the voice of the wind, it carries a dream.”
Kiki’s Delivery Service

DECONSTRUCTING MY TITLE

Explaining

- We will explore what constitutes explanation
  - The representation and algorithm level of cognition

L3

- We will explore how/whether L3 is special
  - Null Theory

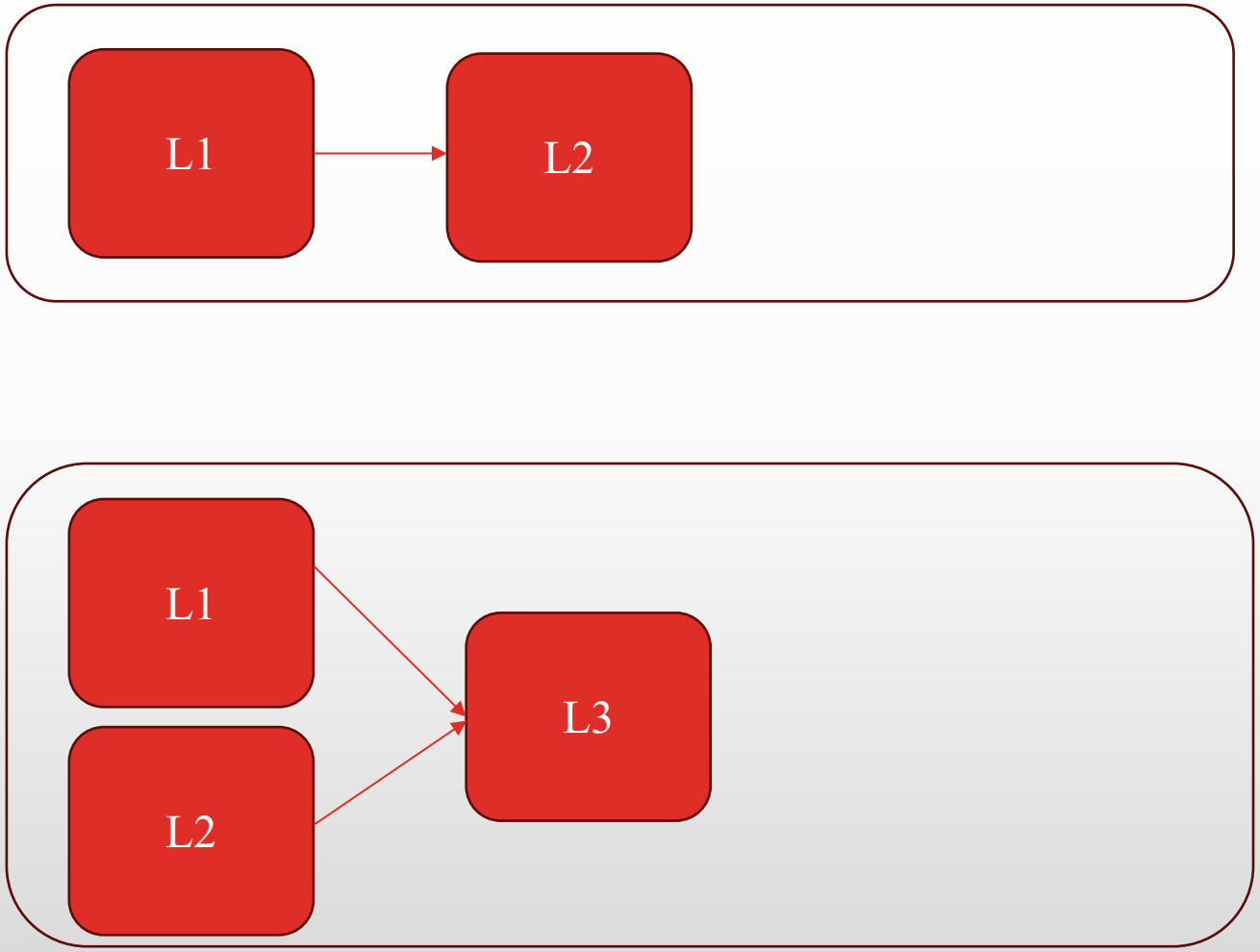
Phonology

- We will explore what constitutes phonology (as distinct from but linked to phonetics)

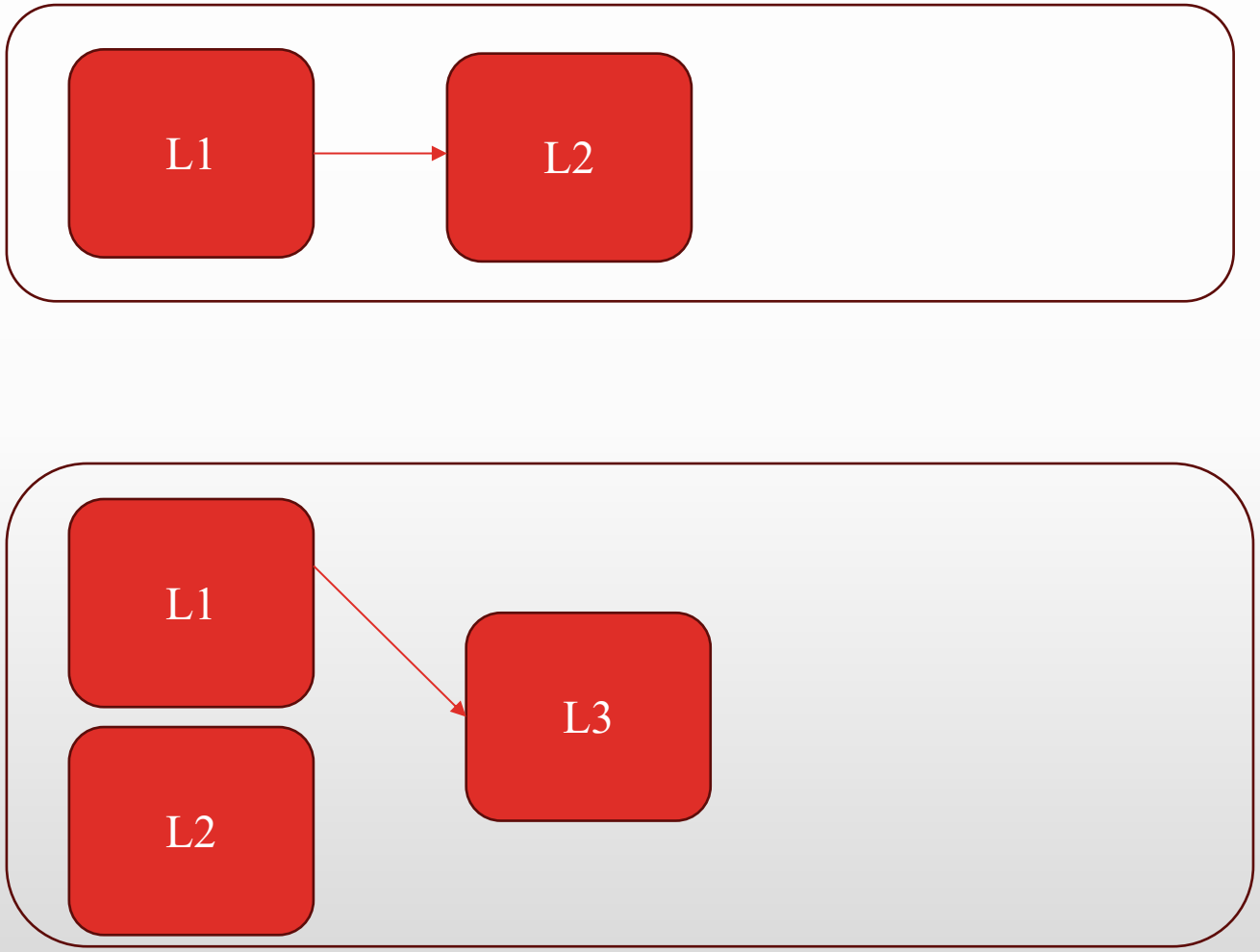
EXPLAINING

- Explanatory adequacy (Chomsky, 1965; 2023)
  - For any data set there are multiple possible grammars
  - How does the learner choose? (Yang, 2017)
- Models of what is acquired; explaining *knowledge*
- Property *and* transition theories of L3 phonology (Cummins, 1983; Gregg, 1993)
- Principles of grammatical restructuring
- A Null Theory approach (Occam's Razor)
  - Explaining L1A, L2A, L3A, L*x*A

L3



L3



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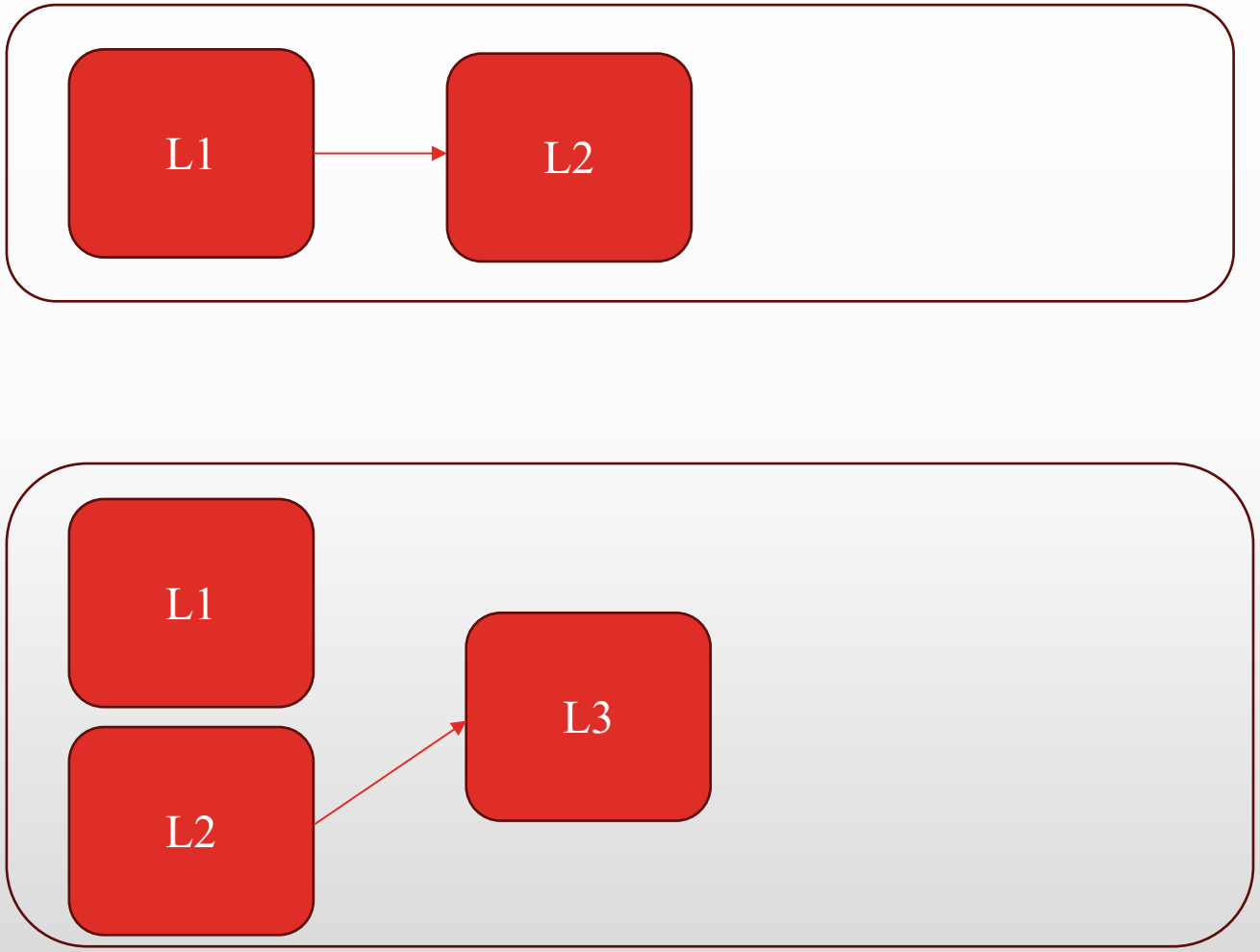
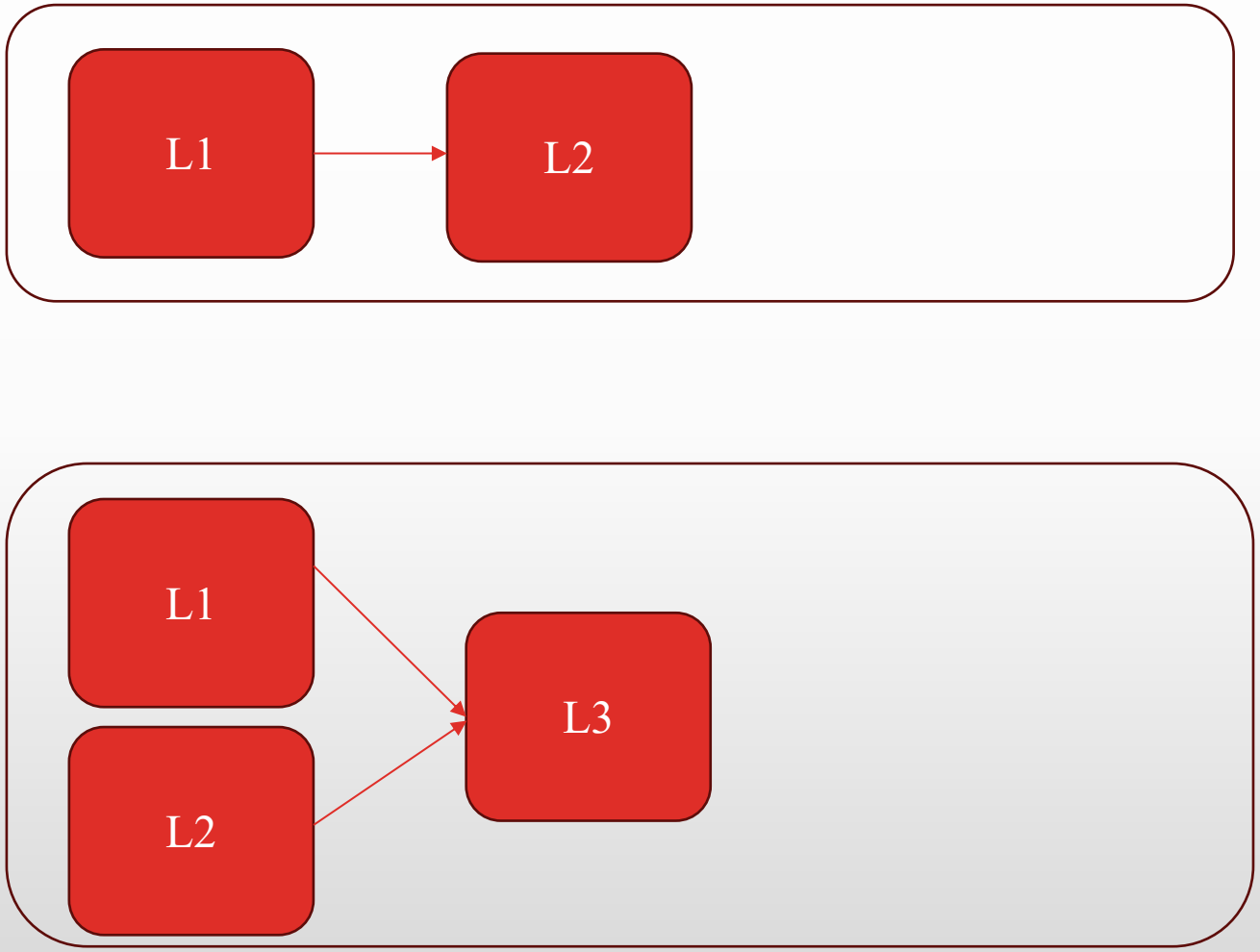


L3



L3

- Is L3A fundamentally different from L2A? Or from L1A?

- Schwartz & Sprouse (1996) L2A = L1A
- Schwartz & Sprouse (2021) L3A = L2A

- Thus we need a theory of L*x*A of phonology

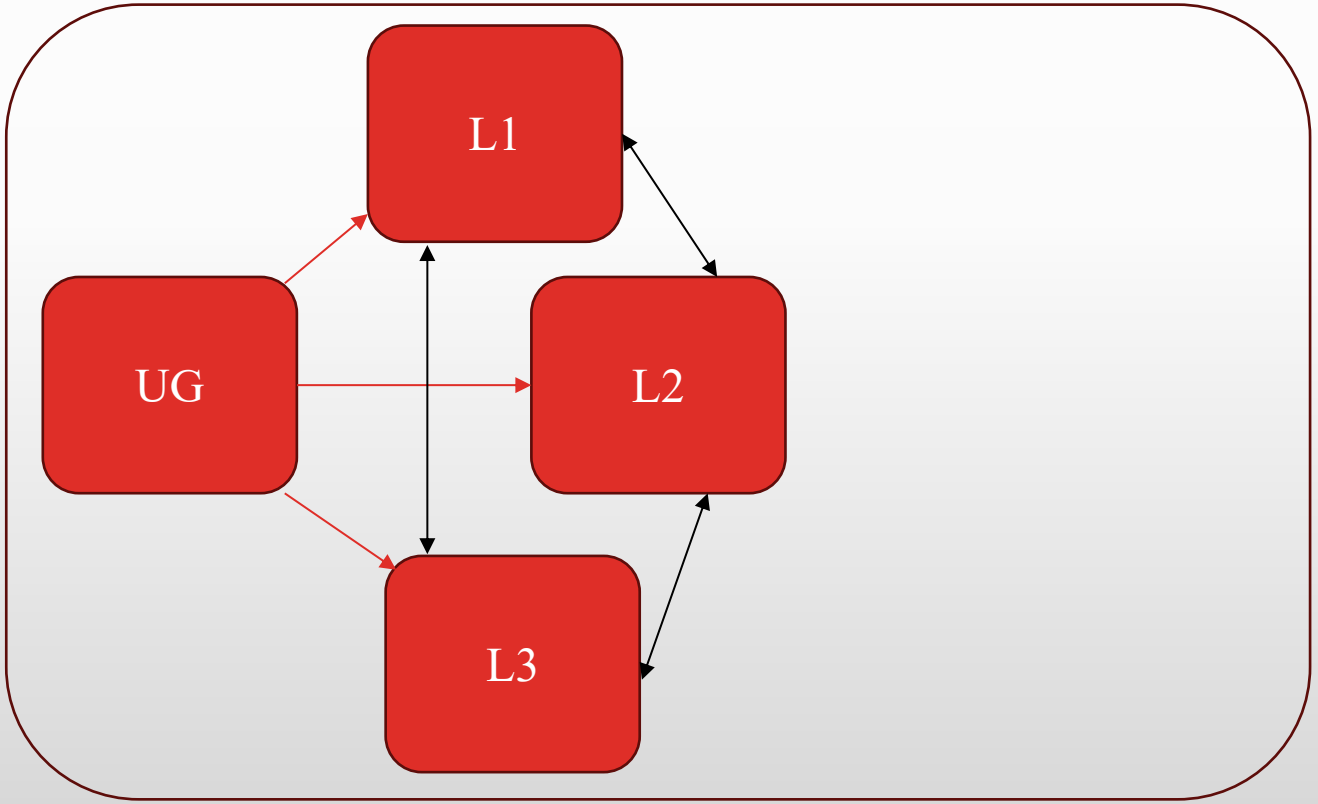
EXPLANATORY FACTORS

- Domain-specific effects
  - Archibald (2024) *Phonology in Multilingual Grammars*
- Input effects:
  - Cumulative Input Threshold Hypothesis (Cabrelli & Iverson, 2023)
  - Cue re-weighting principles (Kim & Tremblay, 2021; Hayter & Archibald, 2022).
- Third factors:
  - Tolerance Principle (Yang, 2005, 2016)
  - Attention control (Mora & Darcy, 2023)

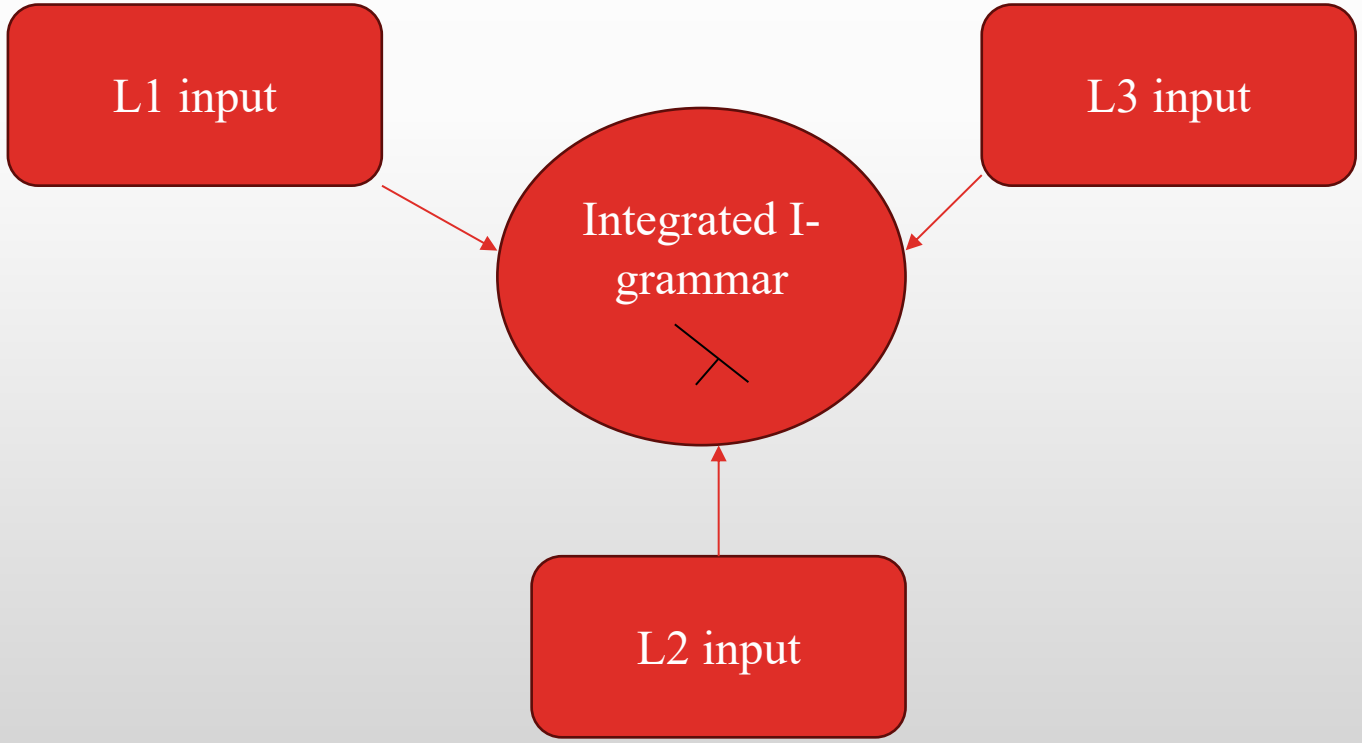
CROSS-LINGUISTIC INTERACTIONS

- Phonological Permeability (Cabrelli, 2010, 2013, 2017)
- L1 attrition (Montrul, 2023)
- Redeployment (D. Flynn, 2024; Nelson, 2023)

SEPARATIONIST?



INTEGRATED?



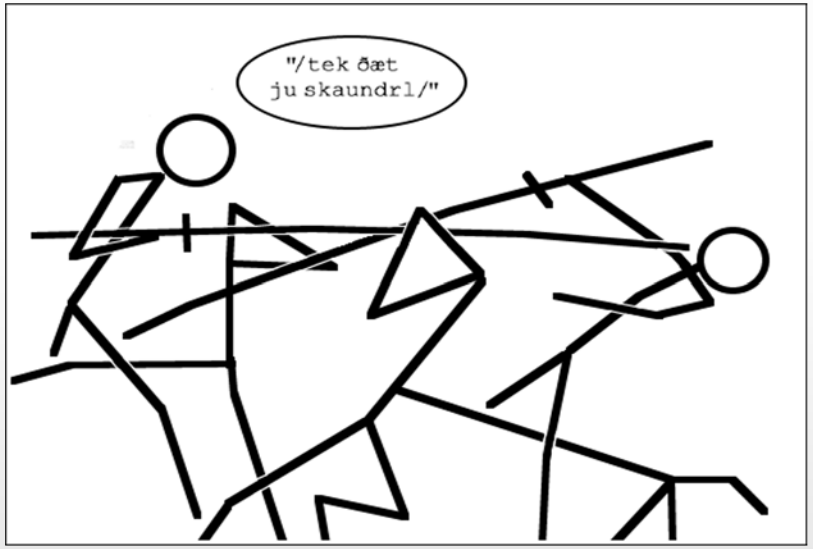
PHONOLOGY

- The cognitive interface of sound (or gesture) and meaning
- Representational contrast
- Marr (1982): representation and algorithm level; Pylyshyn (1984): symbolic level

L3 SPEECH

- We are starting to establish a reasonable foundation of works looking at the properties of L3 speech; controlling for many important factors
- The research program I outline today is one component of the study of L3 speech and, I hope, complements the work in L3 phonetics

PHONOLOGY VS. PHONETICS



Parenchyma, Hilário. 2007. Cartoon theories of linguistics— Part E— Phonetics vs. Phonology. Speculative Grammarian, Vol. CLIII, No. 1.

PHONETICS/PHONOLOGY INTERFACE

- Zsiga (2020) provides nice metaphors about the interface:
  - A fence?
    (Myers, 2000)
  - A transducer ?
    (Reiss & Volenec, 2022)
  - A beach/tidal zone?
    (Natvig & Salmons, 2021)

INTERFACE MODEL

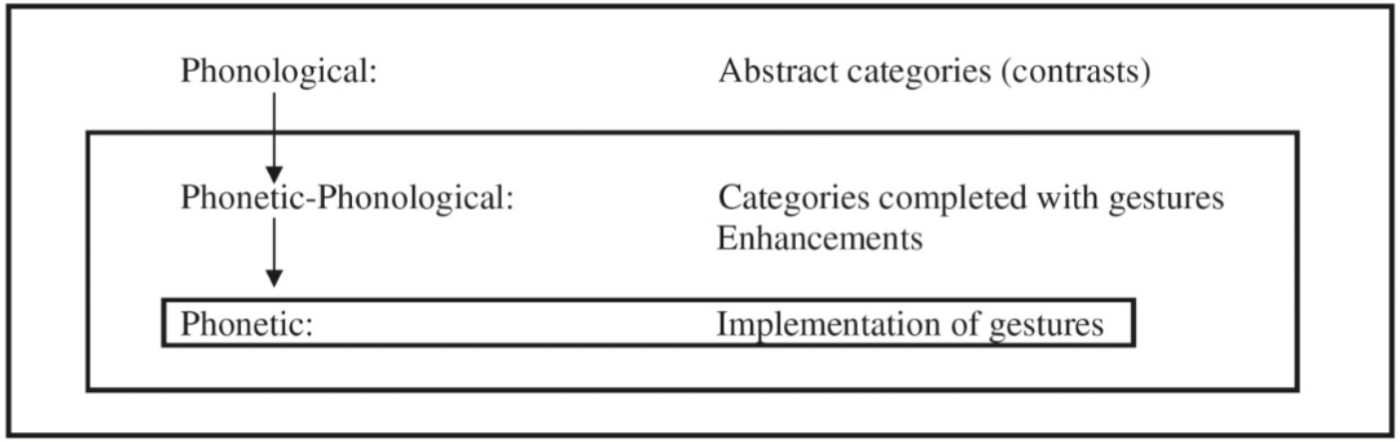
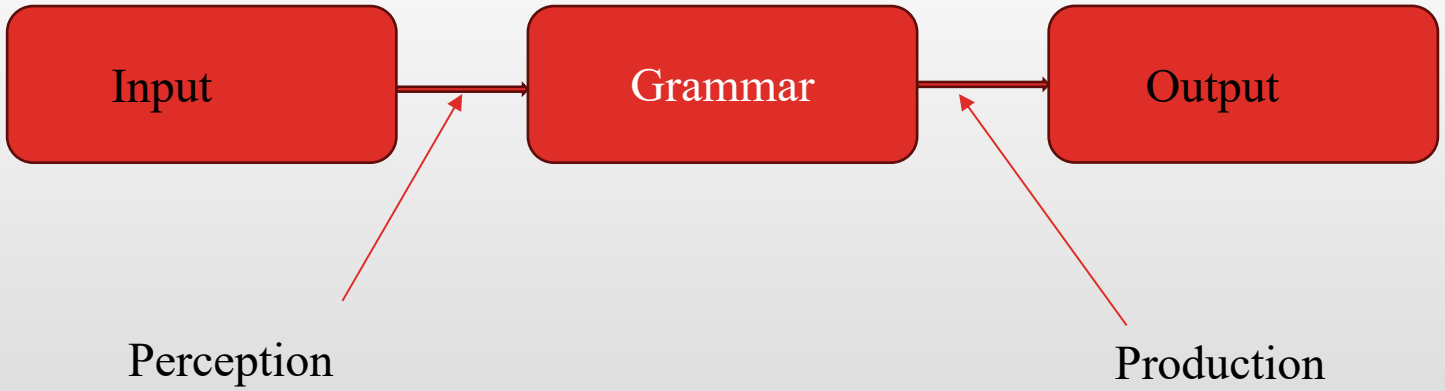


Figure 1. Levels of representation in the sound system.

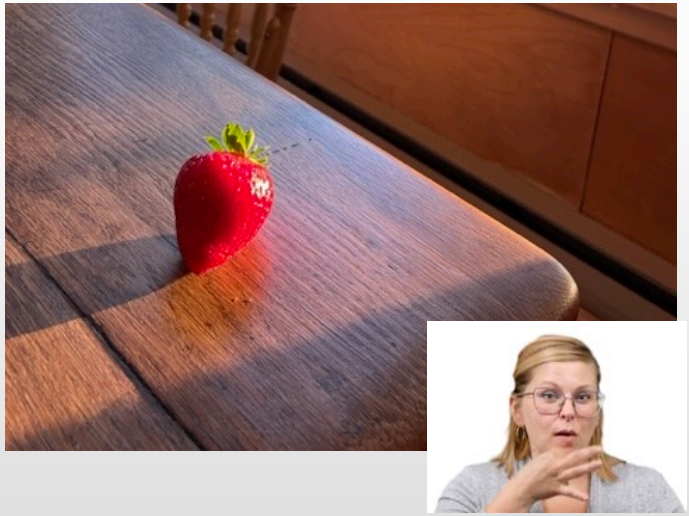
Natvig & Salmons (2021); Dresher (2009)

PHONOLOGY IS GRAMMAR



PHONOLOGY MAPS SOUND (OR GESTURE) ONTO MEANING

It’s cognition not physics.



strawberry, fraise, ichigo

dog, perro, inu

PHONOLOGY AND THE FACULTY OF LANGUAGE NARROW

"…it has been suggested that only syntactic recursion is part of the narrow faculty of language (FLN; Hauser, Chomsky & Fitch, 2002), and that phonology is outside FLN. However, the contrastive hierarchy has a recursive digital character…. Like syntax, phonology takes substance from outside FLN and converts it to objects that can be manipulated by the linguistic computational system."

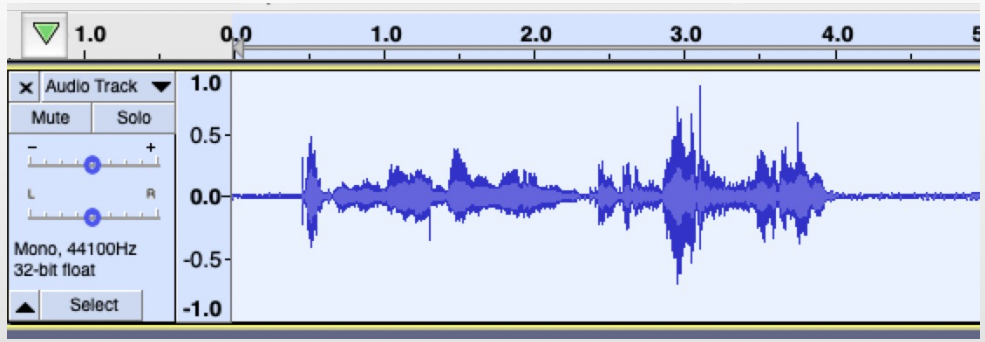
-Dresher (2014)

L3 PHONOLOGY IS LEARNED NOT NOTICED

- Problems of knowledge
  - Plato's Problem
  - Orwell's Problem
  - Escher's Problem
  - Euler's Problem

PLATO'S L3 PROBLEM

- We come to know things that are not present in the input: aka the poverty of the stimulus
- E.g. category labels
  - Onset
  - Mora
  - Foot



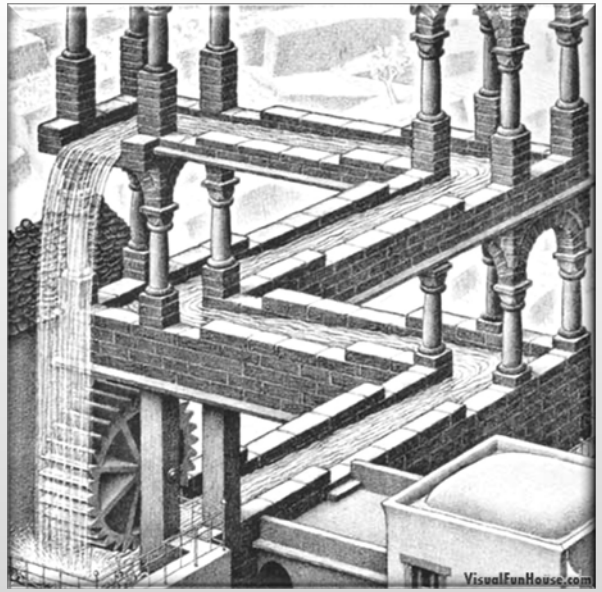
- Auditory acuity won't help here

ORWELL'S L3 PROBLEM

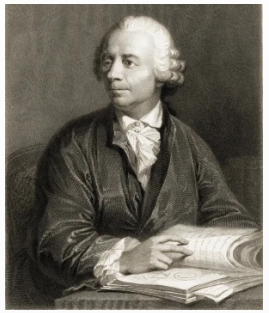
- We are resistant to acquiring knowledge that is frequent in the input
- E.g.
  - English 'th' [θ]
  - French high, front vowel [ü]
  - Swedish clusters: 'stockholmskt' (Stockholmish)

ESCHER'S L3 PROBLEM

- We hear things that aren't in the input
- E.g., illusory vowels in L3 consonant clusters
  - 'snow' heard as '[i]snow'
  - 'ebzo' heard as 'eb[ɯ]zo'



EULER'S L3 PROBLEM

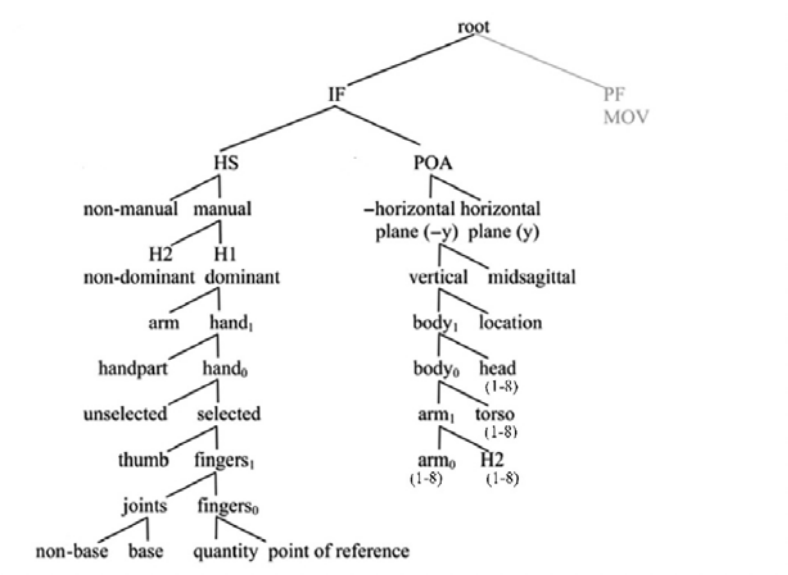


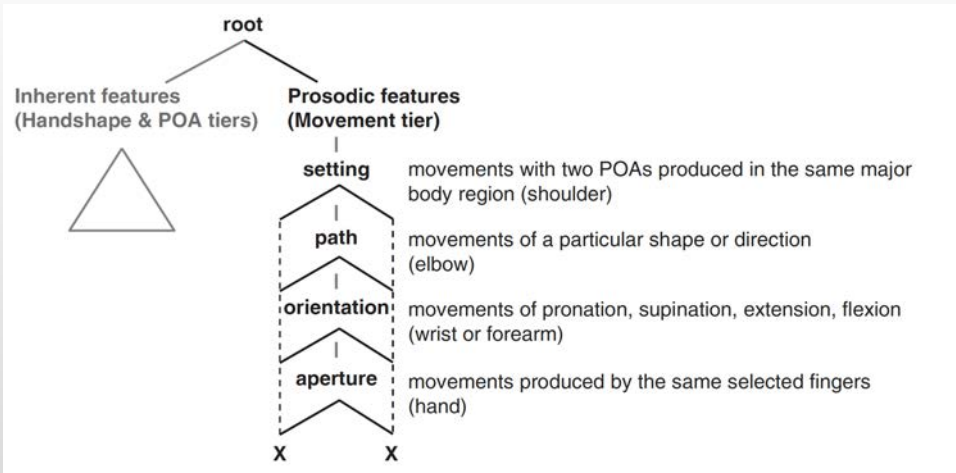
- The many-to-one mapping problem

Phonology	Phonetics
[spread glottis]	[vocal fold vibration]
[voice]	
α [+back]	[ɑ]
ɑ	

Global determinacy
(Dresher & van der Hulst, 1995; Archibald, 2021)

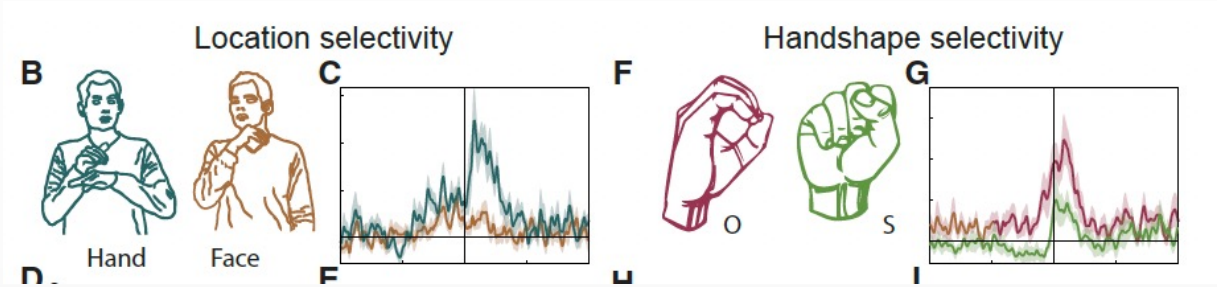
GESTURAL PHONOLOGY





Fenlon, Cormier & Brentari (2017)

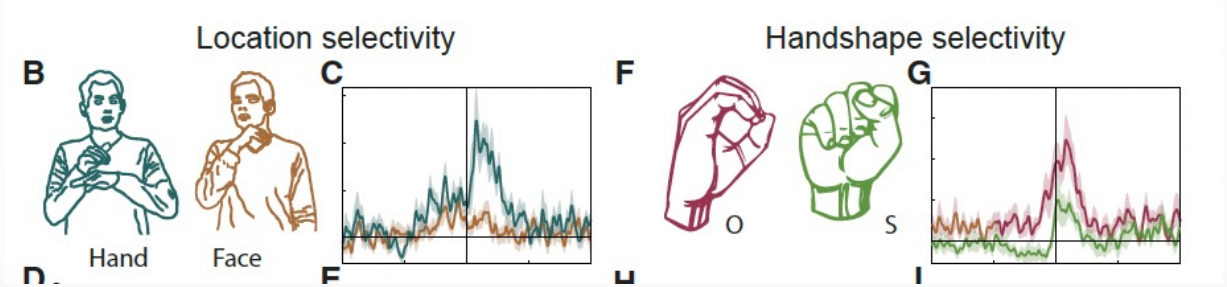
GESTURAL PHONOLOGY



- Brain scanning reveals that phonological *feature* effects are found for gestural as well as spoken languages
- This suggests that the 'substance' of features is quite abstract, and not just acoustic

Leonard (2020)

GESTURAL PHONOLOGY



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EVOLUTION

- The study of the evolution of language (Fitch, 2018) demonstrates that while there are some vocal traits that humans share with common ancestors (animals have phonetics), there are elements of human phonology with have no homologues in animal communication or animal minds
- Animals lack algebraic representations (Samuels, Hauser & Boeckx, 2016); no natural classes

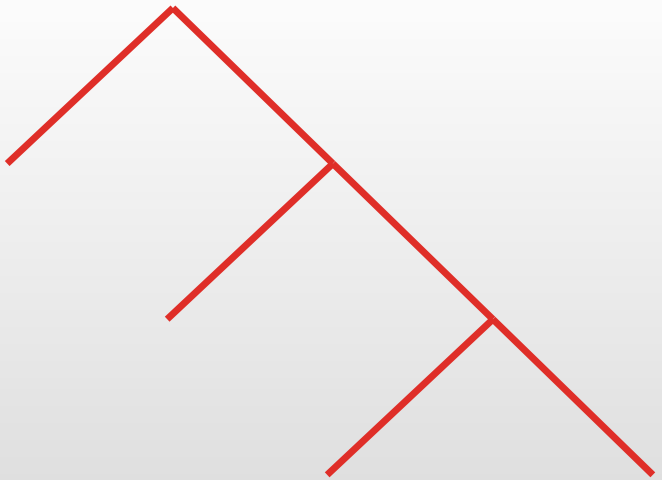
L3 PHONOLOGY IS ALGEBRAIC

- Phonological rules/patterns reference *natural classes*
  - Voiced stops; front, rounded vowels, etc.
- Humans can assign novel environmental input to abstract categories
  - MMN study (Eulitz & Lahiri, 2004) shows things that are closer acoustically can trigger the mismatch (e.g., German [ø] and [o] compared to [e]) because they are the *phonological* oddballs
  - This can't be handled by a finite-state grammar (Idsardi, 2019)

Berent (2017)

THE L3 *EXPLANANS*

- Hierarchical representations at multiple levels of phonology



L3 PHONOLOGY IS RECURSIVE

THE L3 PHONOLOGICAL PARSER

- "Why buy a phonology?" (Jonathan Kaye, 1990); components at the L3 store
- Phonology can provide cues to the edges of domains
  - English examples:
    - Aspiration; velarized [l]
  - Japanese examples:
    - Rendaku; /Q/; /N/
- It anchors inflectional morphology (Richards, 2016)
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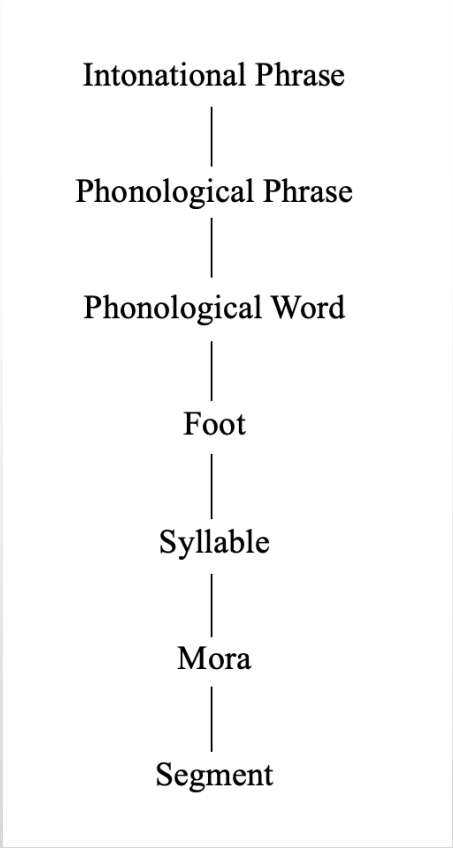
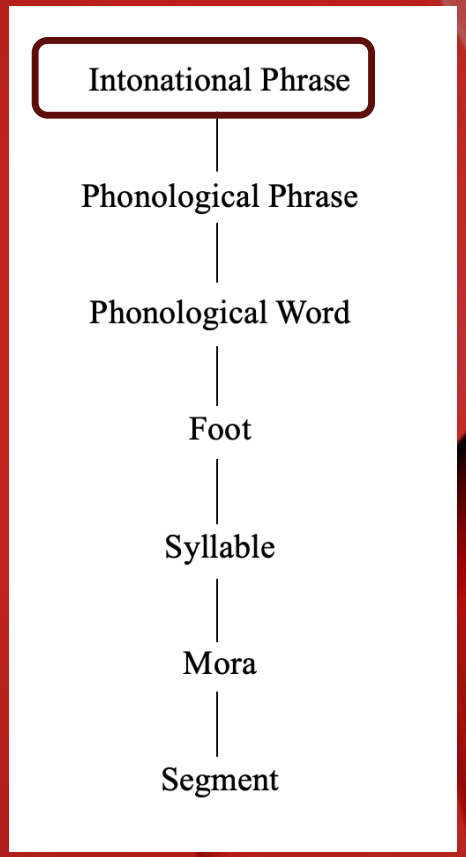
- What do you get when you buy a phonology?

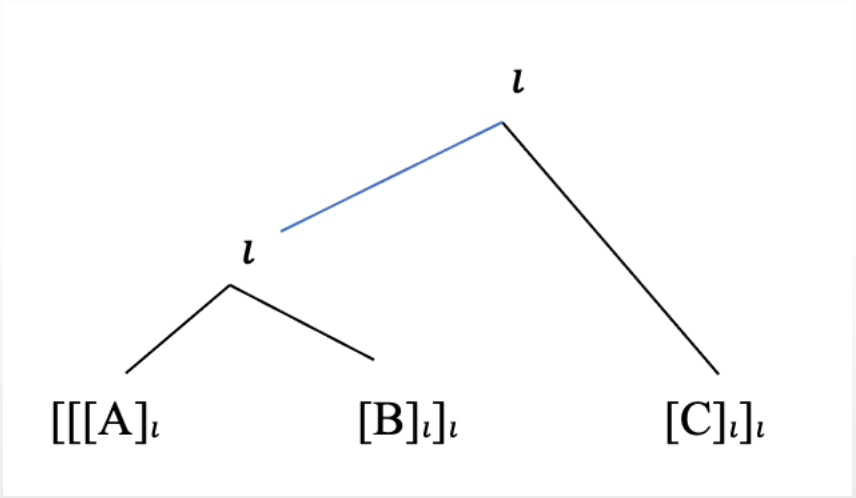
THE L3 PROSODIC HIERARCHY



These are *representational* levels.

L3 INTONATIONAL PHRASES

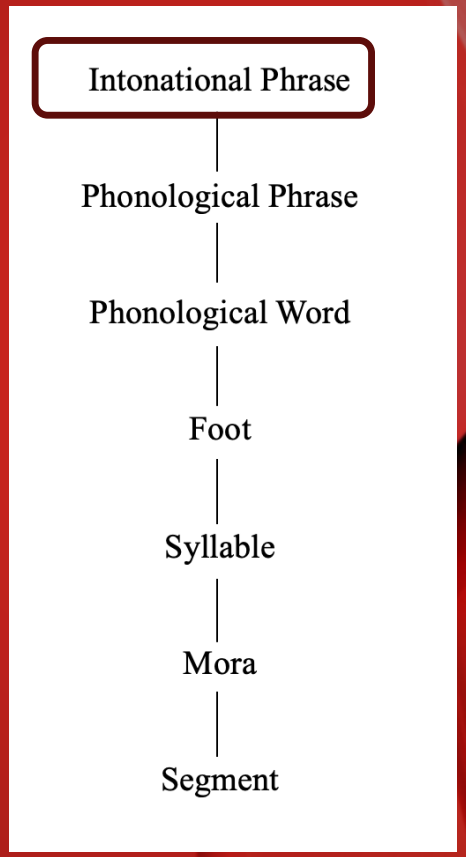




Warren is a stronger campaigner, and Ryan has more popular policies, but Allen has more money.

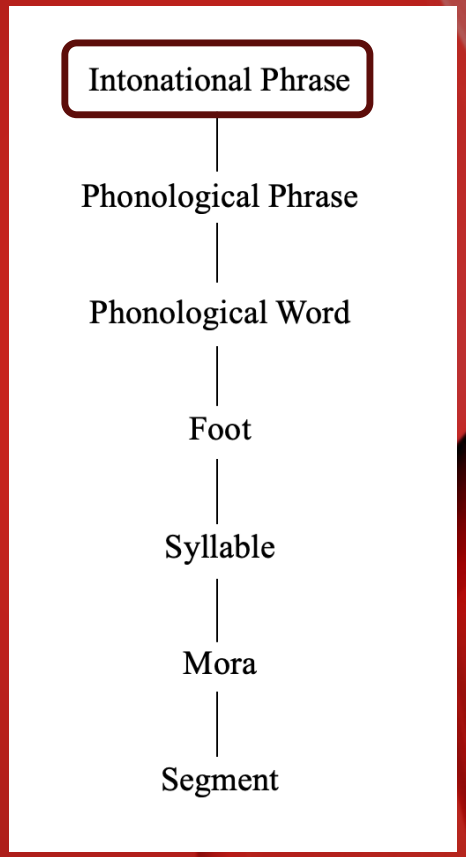
Ladd, 1986; Féry & Truckenbrodt, 2005

L3 INTONATIONAL PHRASES



- These are the phonological structures necessary to help the listener understand the syntactic constituency

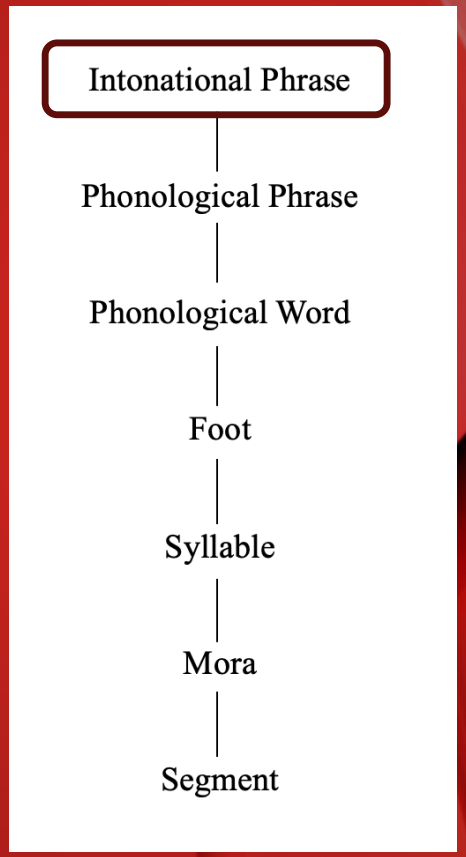
L3 INTONATIONAL PHRASES



- First, hang the *blue* drum, then hang the *yellow* drum ("blue" and "yellow" are contrastive and not at phrasal boundaries).
- First, hang the blue *drum*, then hang the blue *ball* ("drum" and "ball" are contrastive and at sentence phrasal boundaries).
- First, hang the blue drum, then hang the pink *ball* (distractor: no contrastive information in the sentence).

Liu & Reed (2021)

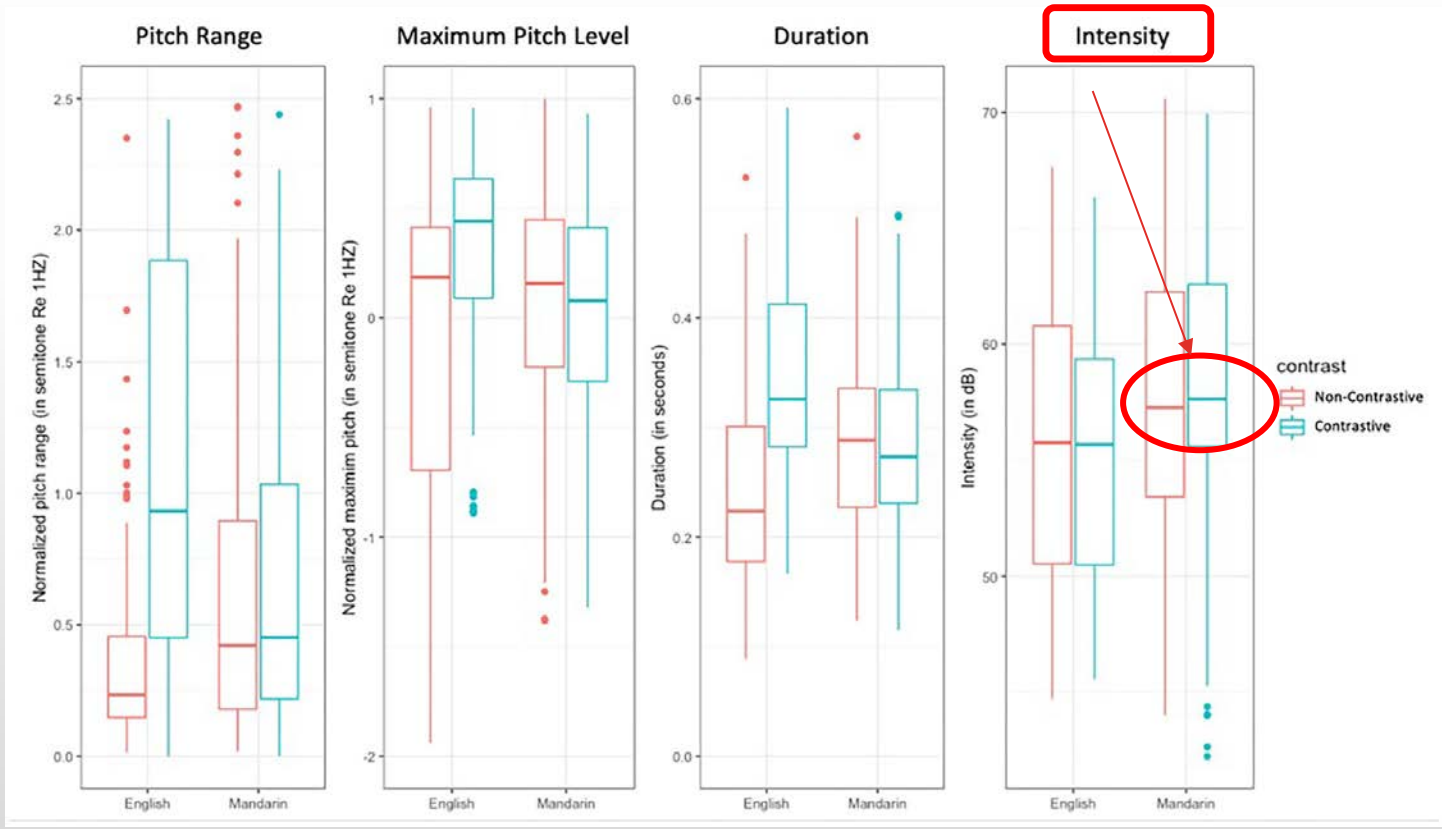
L3 INTONATIONAL PHRASES



- Mandarin/English bilinguals used intensity for contrastive stress while English monolinguals used pitch and duration

L3 INTONATIONAL PHRASES

- Intonational Phrase
- Phonological Phrase
- Phonological Word
- Foot
- Syllable
- Mora
- Segment



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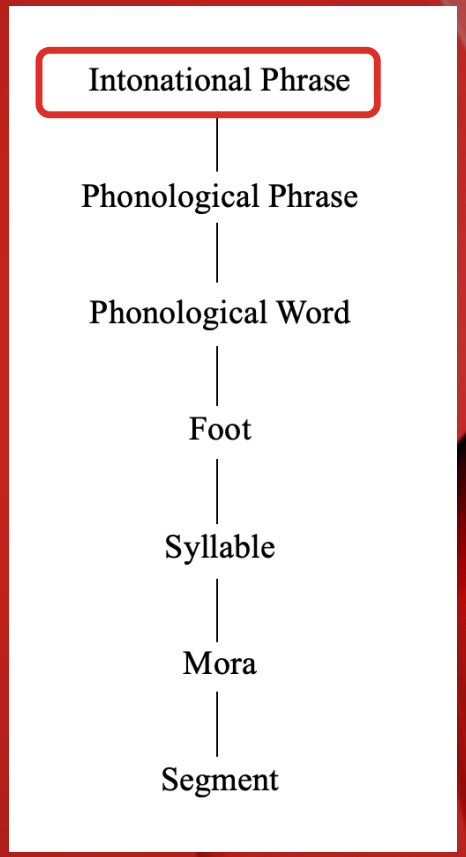
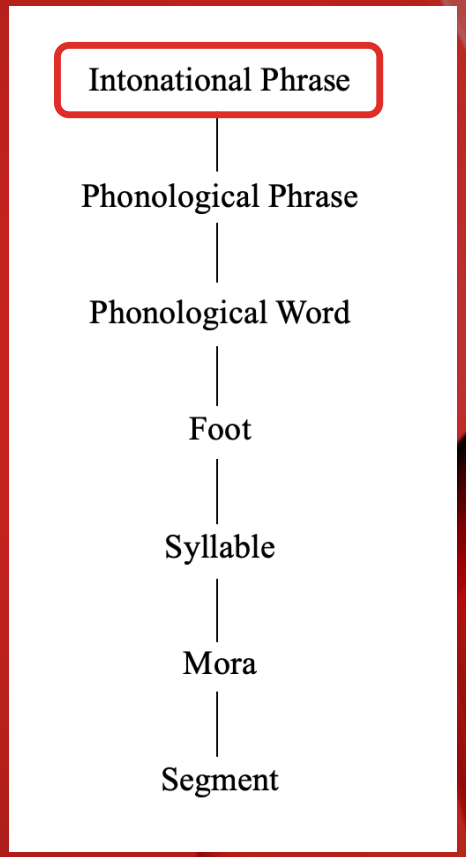


- See also Colantoni & Mennen (2023)
- Pešková's (2023) participants were more target-like with boundary tones (which mark the end of an intonational phrase) than with non-boundary pitch accents.

In Colantoni & Mennen, eds (2023)

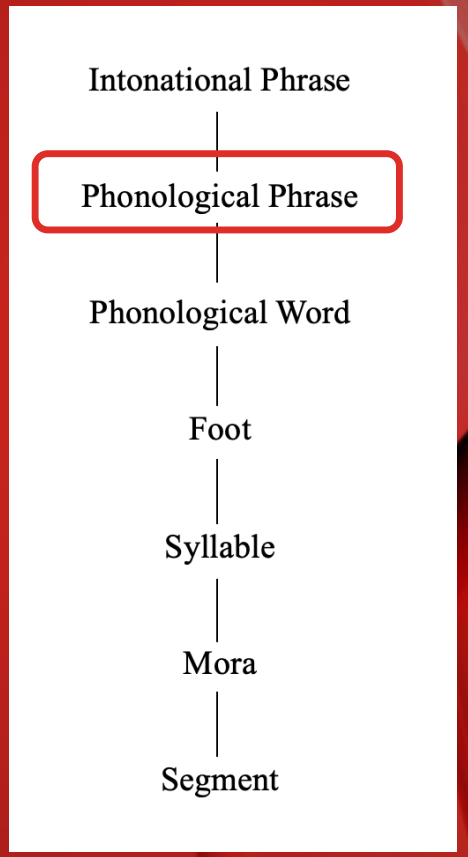
L3 INTONATIONAL PHRASES

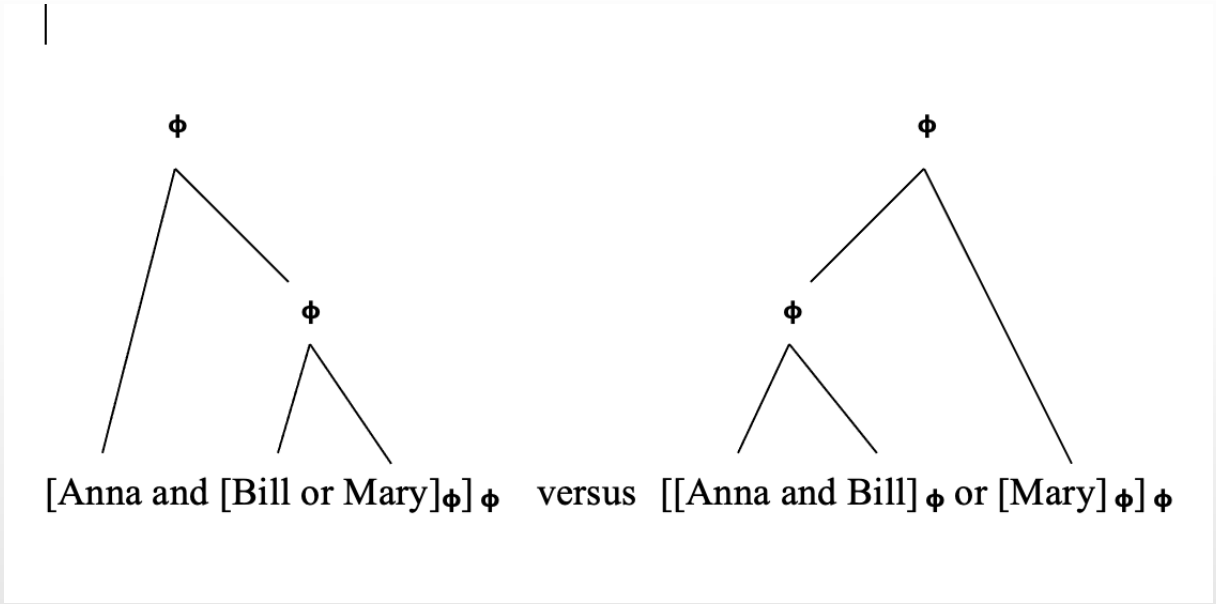


- Colantoni et al. (2022) look at the English production of L1 Inuktitut speakers.
- They find that participants have difficulty ….. in the phrase-internal region, …..and this is also the case for perception.

Colantoni, Klassen, Patience, Radu & Tararova (2022)

L3 PHONOLOGICAL PHRASES

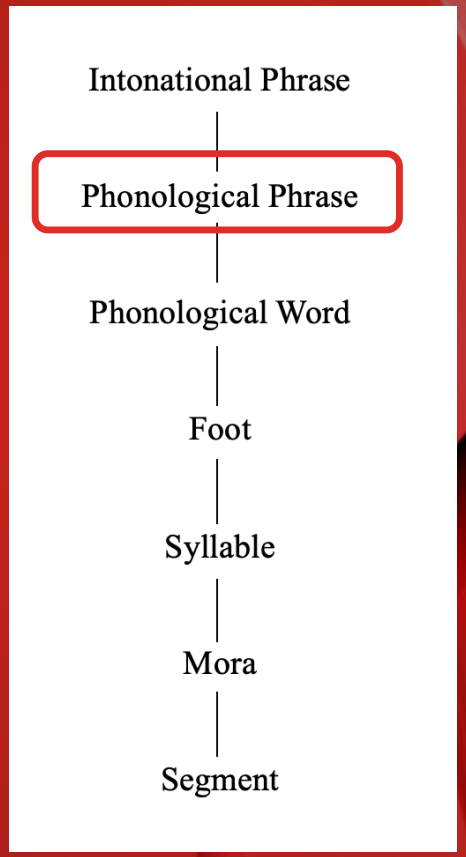




Anna and Bill or Mary ….

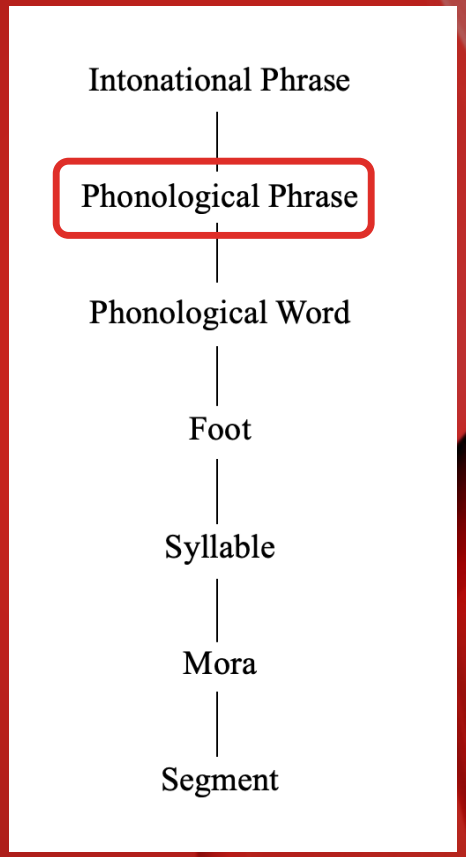
Féry (2010)

L3 PHONOLOGICAL PHRASES

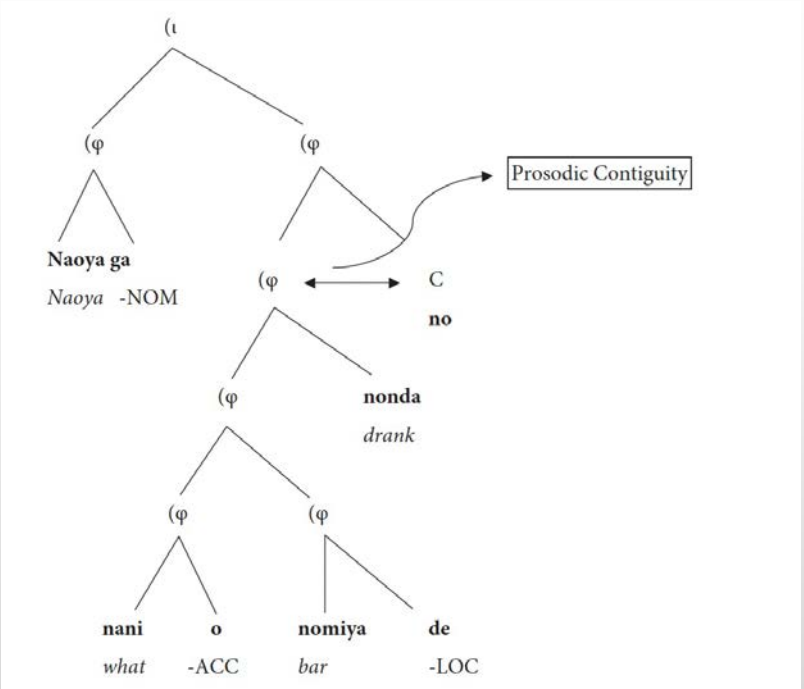


- These are the phonological structures necessary to disambiguate syntactic ambiguities

L3 PHONOLOGICAL PHRASES

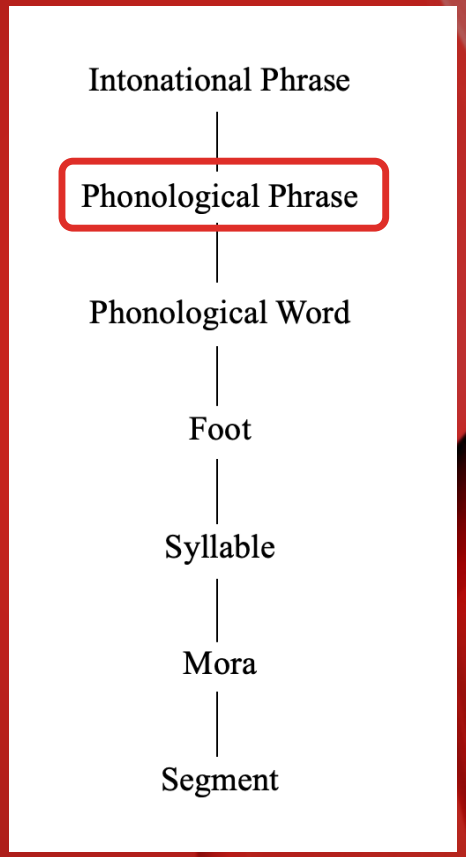


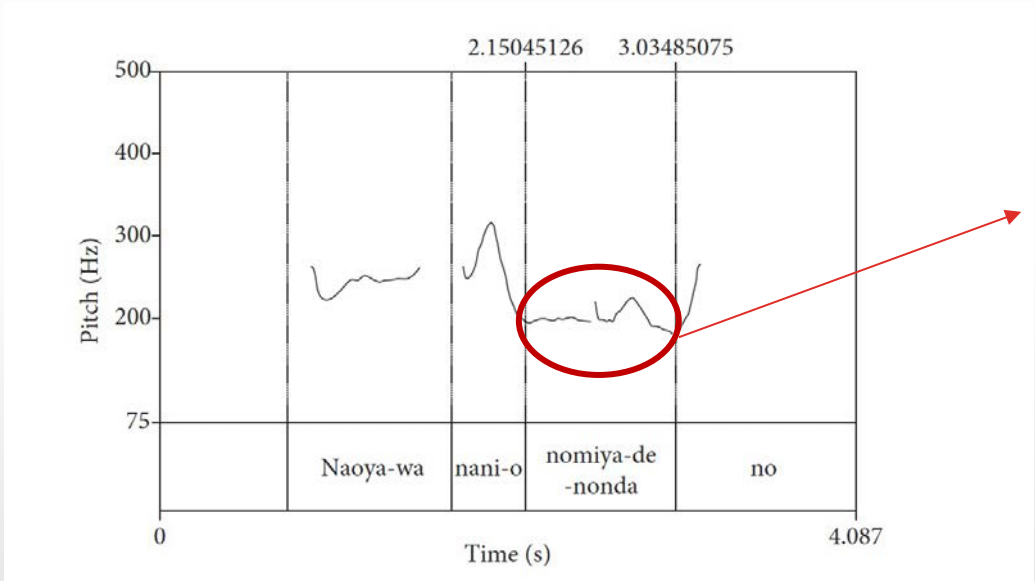
- Contiguity Theory (Richards, 2016)



This is the phonological structure necessary to licence WH *in situ*

L3 PHONOLOGICAL PHRASES

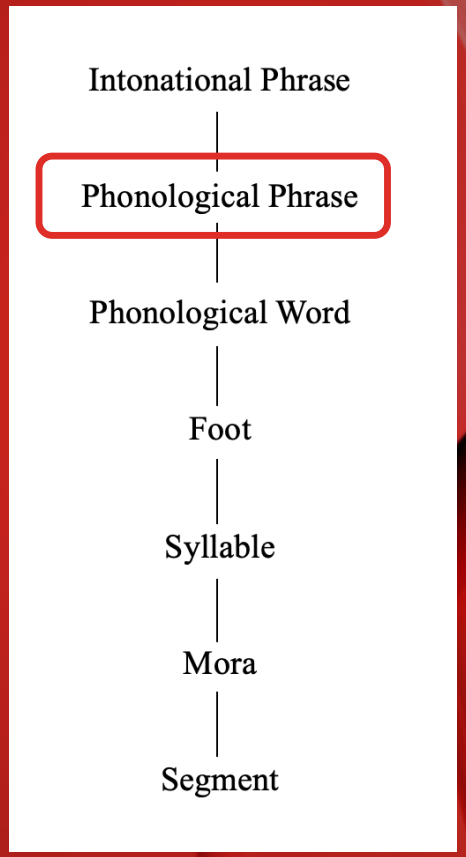


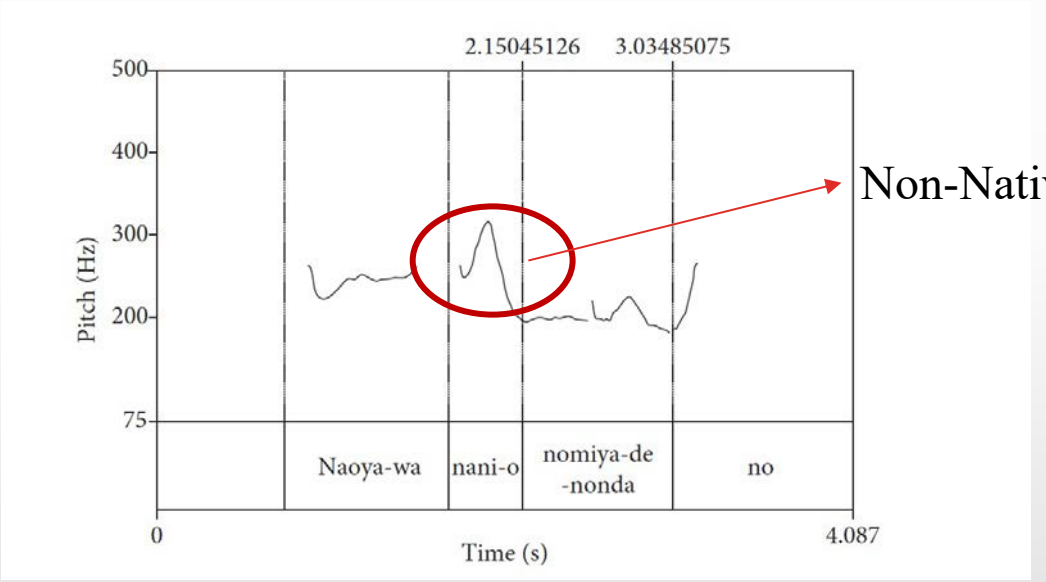


Nativelike

Archibald & Croteau (2021)

L3 PHONOLOGICAL PHRASES

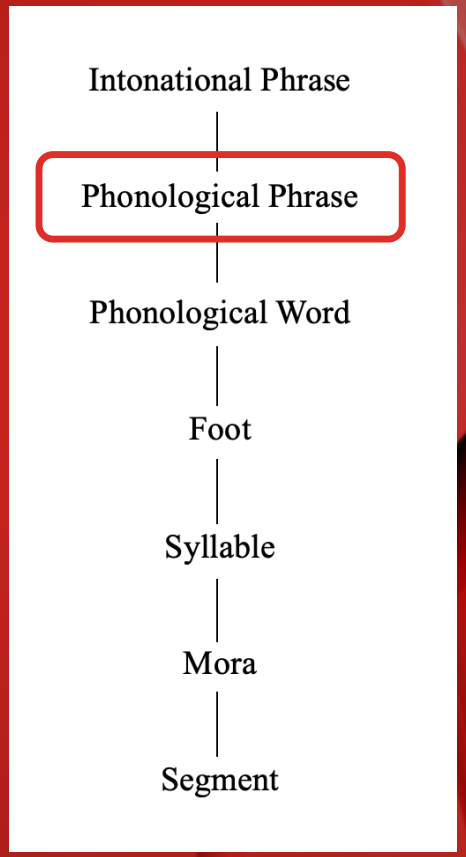




Non-Nativelike

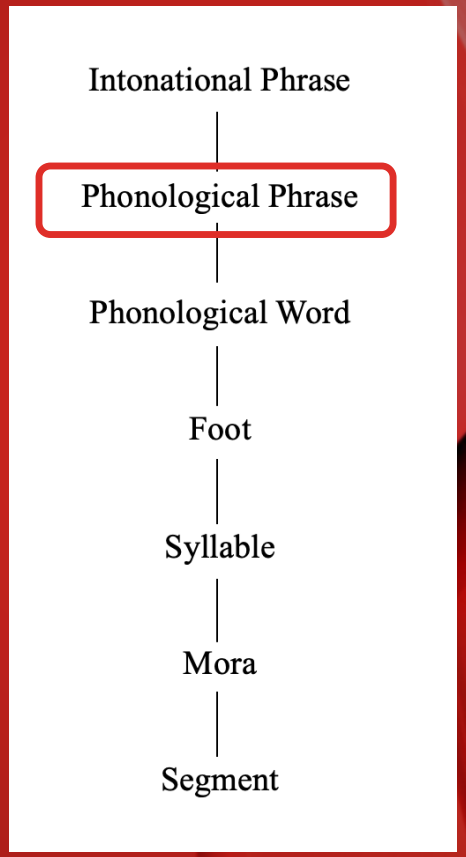
Archibald & Croteau, 2021

L3 PHONOLOGICAL PHRASES



- Learners had acquired the categorical phenomena but not the gradient ones

L*3* PHONOLOGICAL PHRASES



- Syntax can dictate sentential phonology (López, 2023)

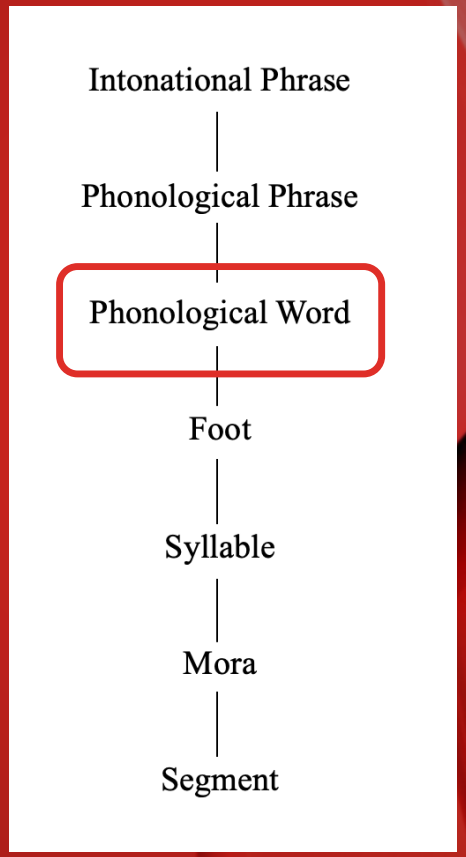
  hizo nähen // das Hemd

  do.PAST sew the shirt

  "S/he sewed the shirt."

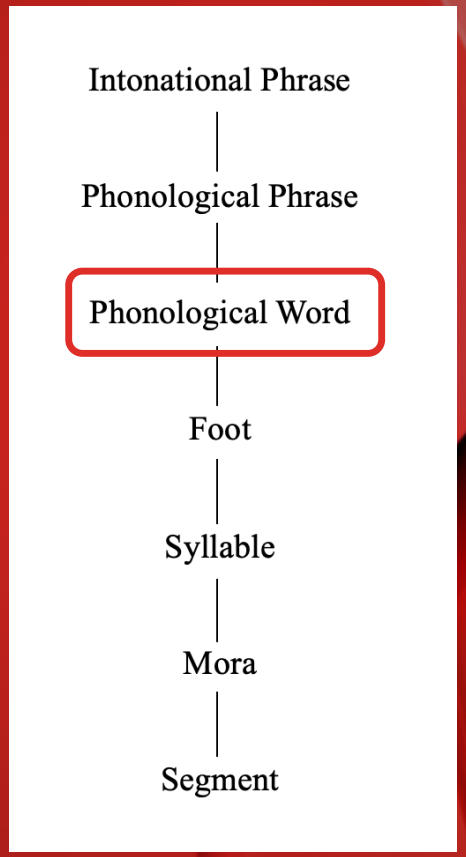
- The Spanish light verb (*hizo*) triggers Spanish phonological phrasing with the main verb and the complement in separate phonological phrases (which is unlike German)

L3 PHONOLOGICAL WORD



- This is the prosodic domain of *phonological uniformity* in codeswitching (López, Alexiadou & Veenstra, 2017; Delgado, Cabrelli & López, 2022)
- Morphological switching but no phonological switching within the phonological word
  - E.g., kalpify; mipeando

L3 PHONOLOGICAL WORD



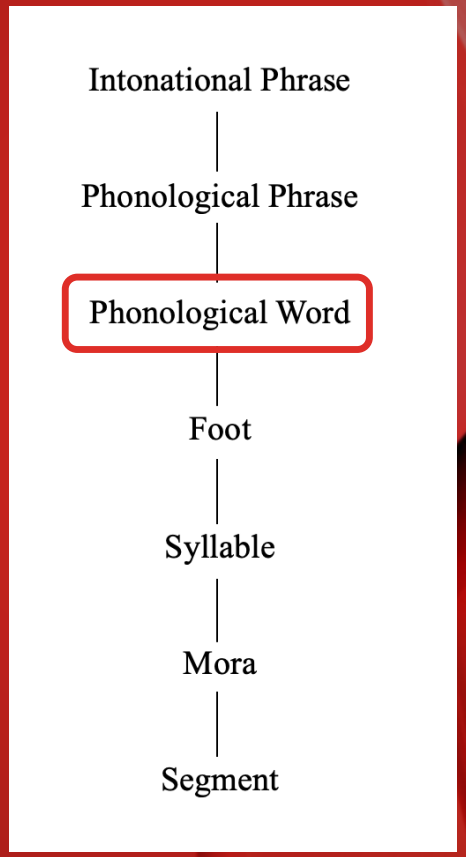
- Archibald (in press b) argues against a phase-based account; but still uniformity within the phonological word
- A free clitic (like English *the*) inherits the phonology from the head of the phonological phrase
- Modelled in Co-phonologies (Sande, Jenks & Inkelas, 2020)

$/\text{mesa}/_{Sp}^{(P1+2,\ R1+2)} \rightarrow [_{\omega Sp}\ \text{mesa}]$

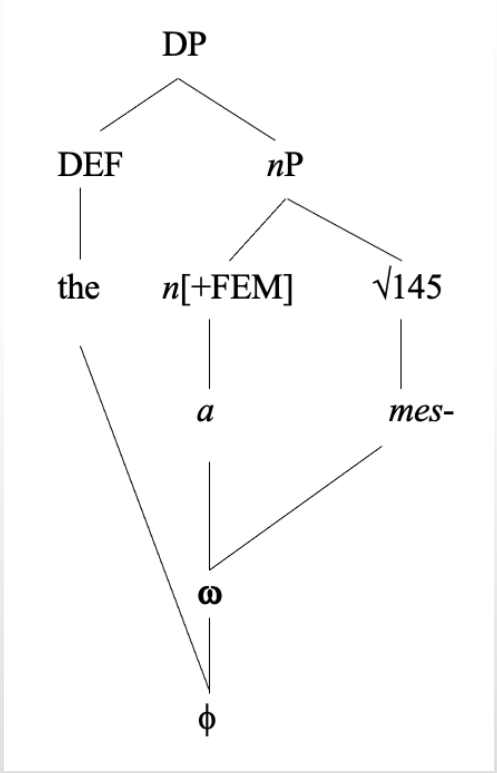
$/\text{brawn}/_{Eng}^{(P4,\ R4)} + [_{\omega Sp}\ \text{mesa}] \rightarrow [_{\omega Eng}\ \text{brown}] + [_{\omega Sp}\ \text{mesa}]$

$/ðə/_{Eng} + [[_{\omega Eng}\ \text{brown}]\ [_{\omega Sp}\ \text{mesa}]] \rightarrow [_{\phi Eng}\ /ðə/\ [_{\omega Eng}\ \text{brown}]\ [_{\omega Sp}\ \text{mesa}]$

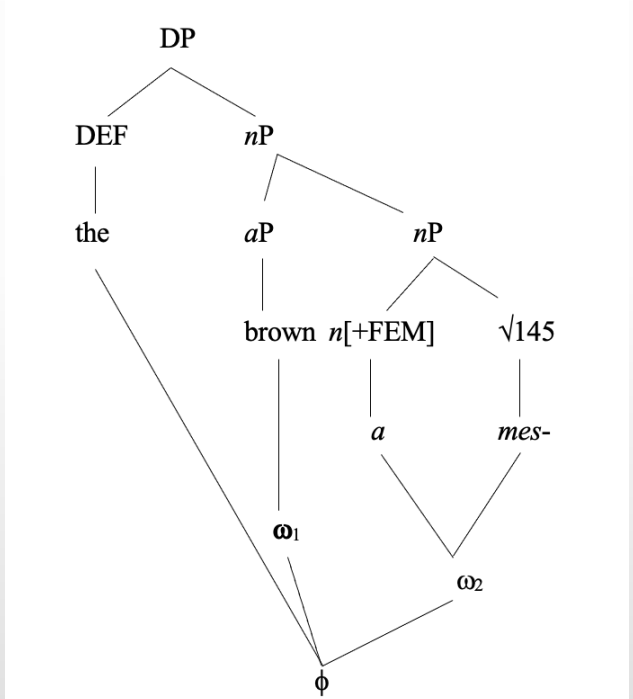
L3 PHONOLOGICAL WORD



[d]

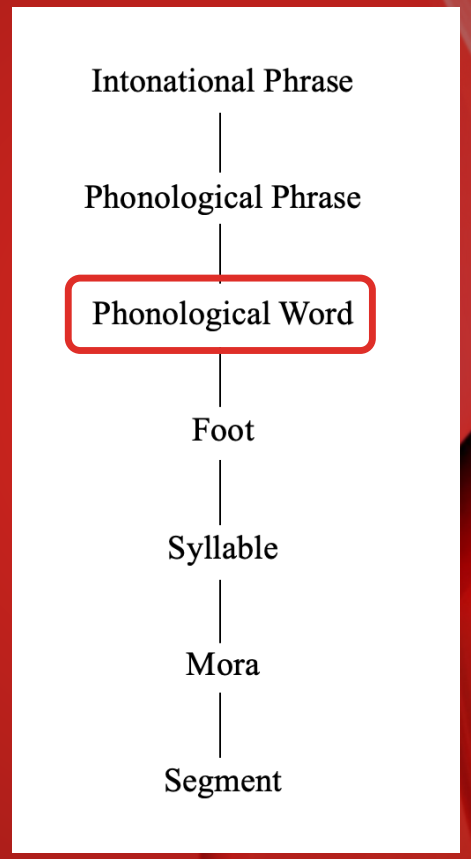


[ð]

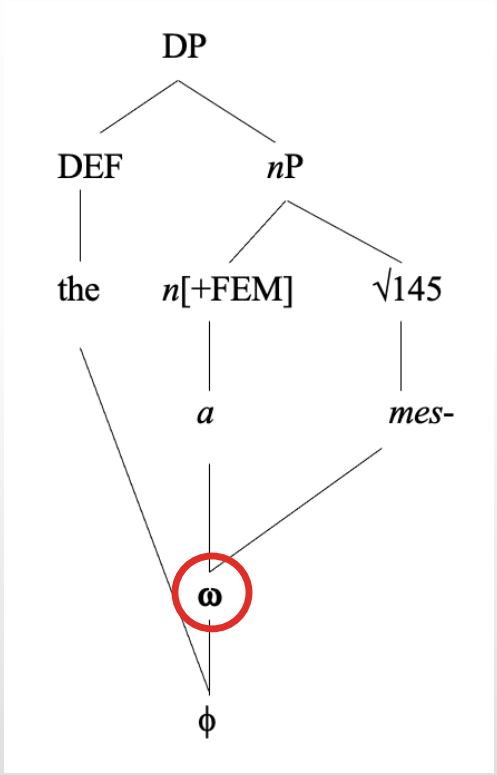


(Delgado, Cabrelli & López, 2022)

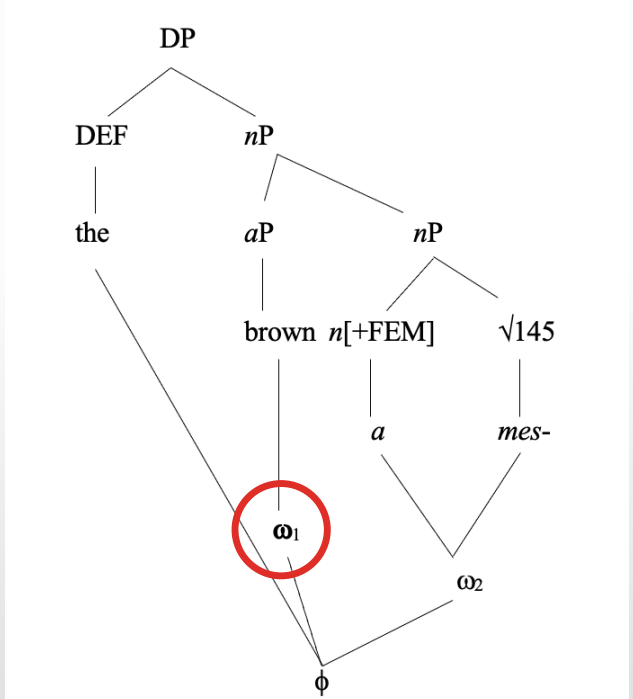
L3 PHONOLOGICAL WORD



[d]

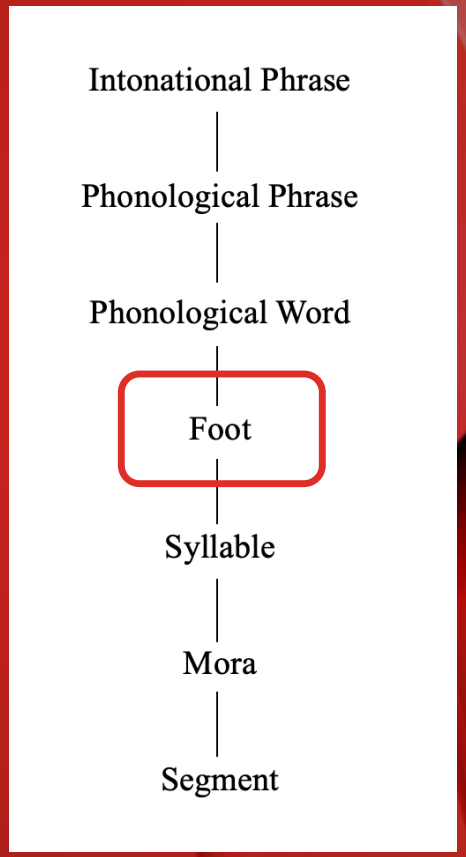


[ð]



(Delgado, Cabrelli & López, 2022)

L3 METRICAL FEET

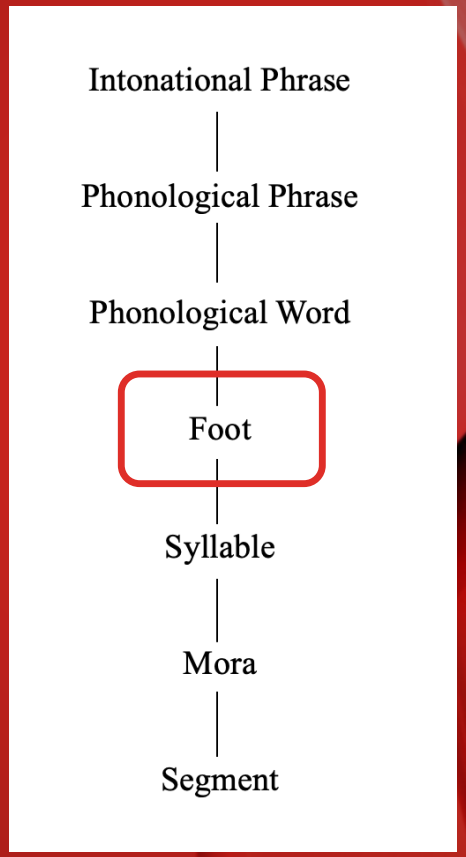


- This is the prosodic domain which governs accurate stress placement.

	English	Hungarian	Polish
Foot type	trochaic (s w)	trochaic (s w)	trochaic (s w)
Built from	right	left	right
End rule	right	left	right
Weight	yes (rhyme)	yes (nucleus)	no
Extrametricality	yes	no	no

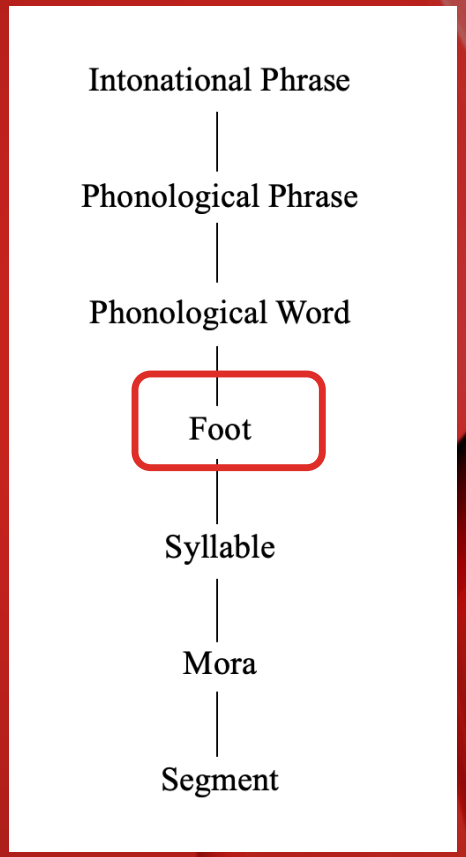
Stress is not a ‘single thing’ to be acquired.

L3 METRICAL FEET

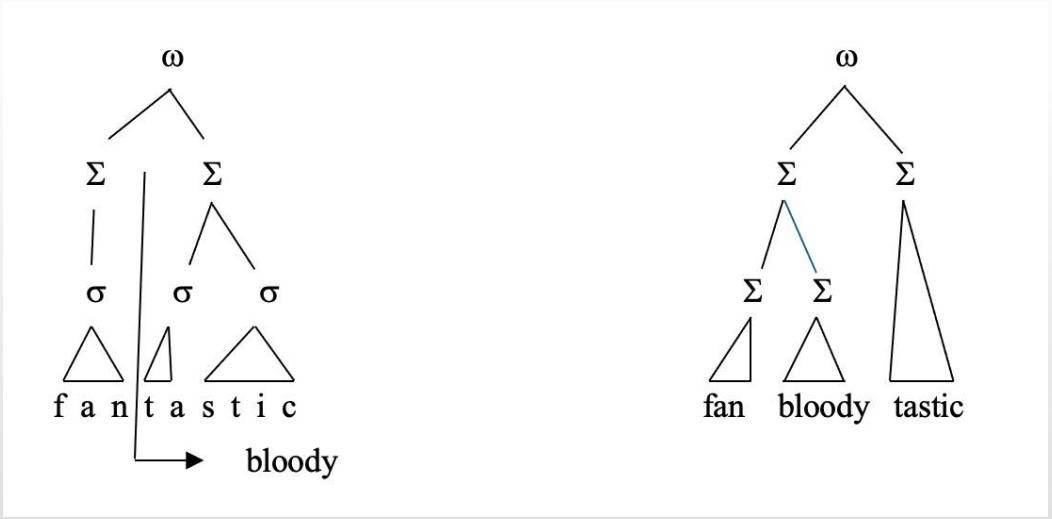


- What if the L1 doesn't have metrical feet?
- Garcia & Guzzo (2017) looked at L1 Canadian French (which has pitch accent (or phrasal prominence)) and those subjects were able to acquire trochaic feet
- They marked both primary and secondary stresses correctly which indicates they had acquired a hierarchical foot structure

L3 METRICAL FEET



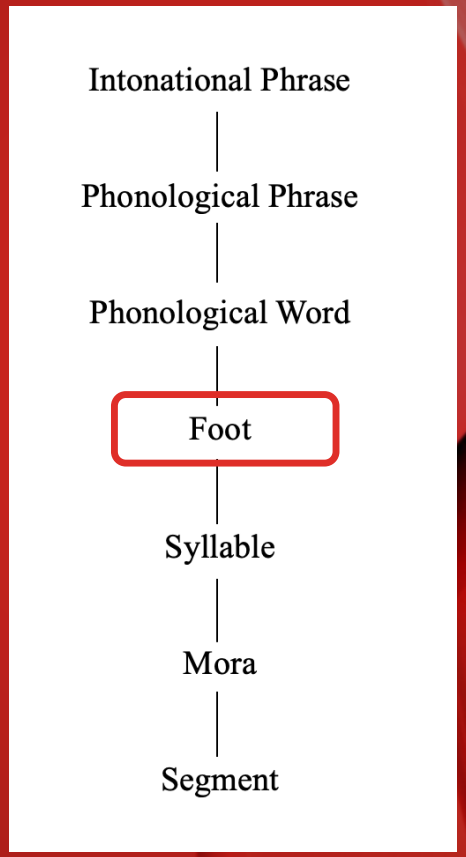
This is the phonological structure governing novel word creation.



fan-bloody-tastic

McCarthy (1982)

L3 METRICAL FEET

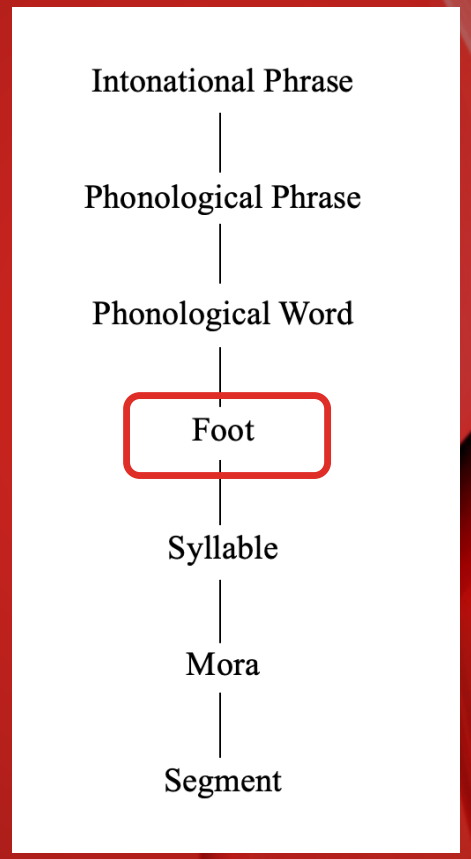


- A lexical preference task

fan-bloody-tastic versus *fantas-bloody-tic*

Archibald & Li (submitted)

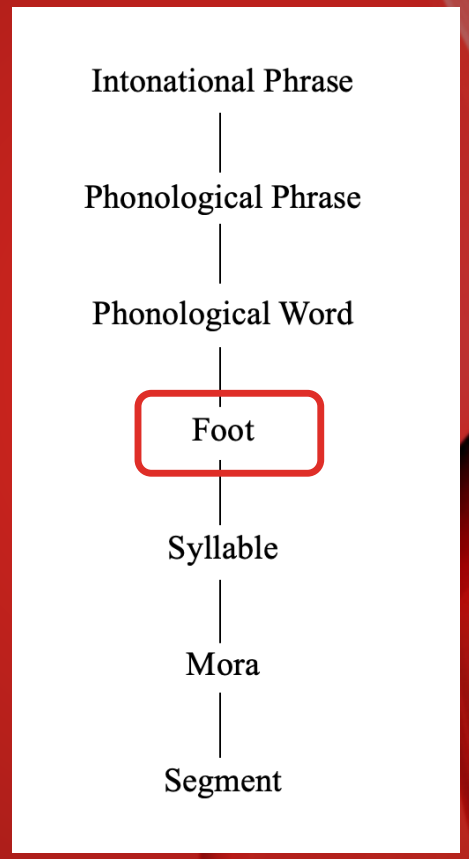
L3 METRICAL FEET

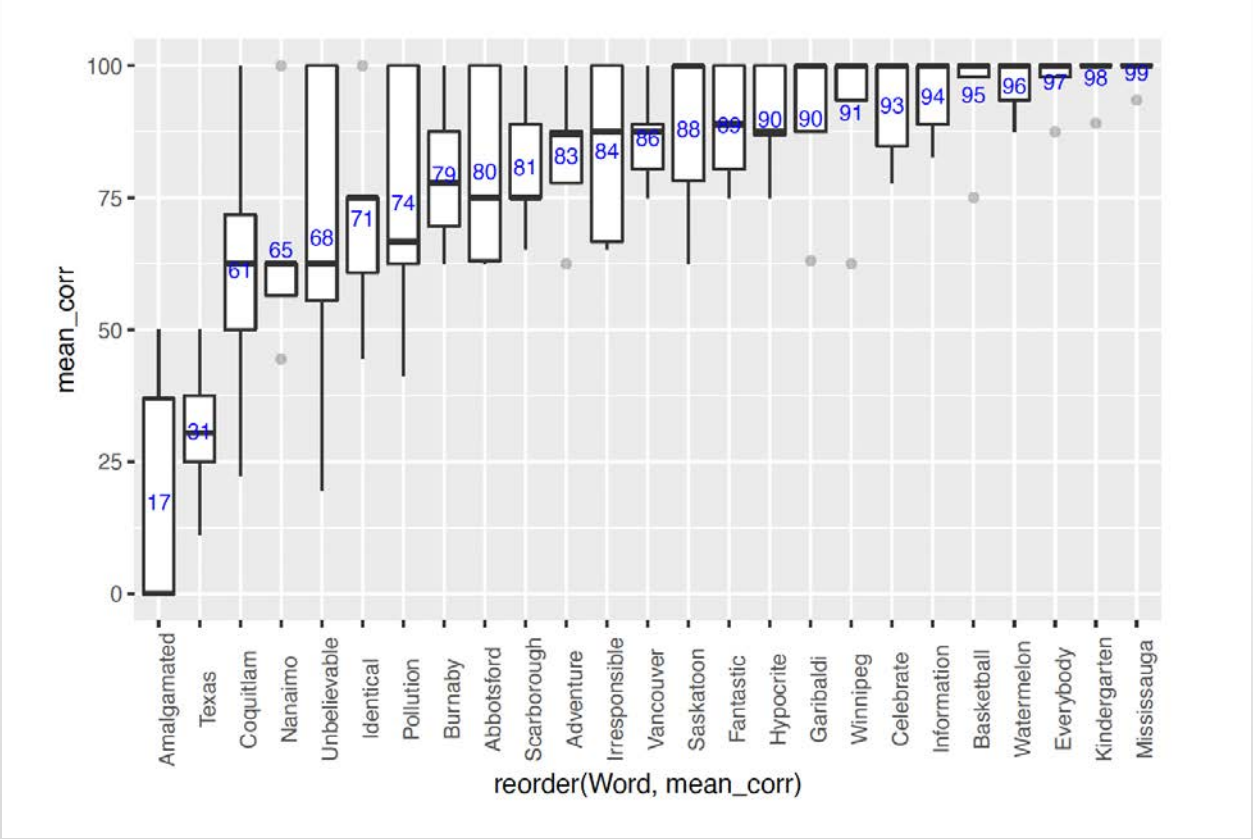


- A lexical preference task

fan-bloody-tastic versus ~~*fantas-bloody-tic~~

L3 METRICAL FEET





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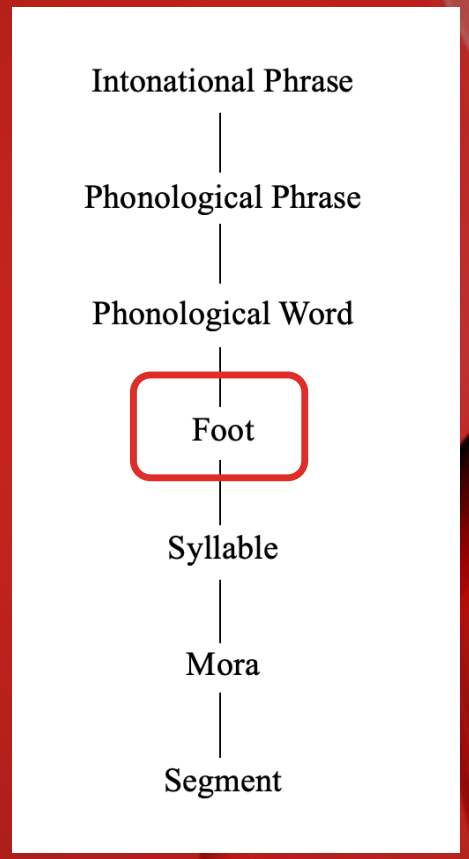

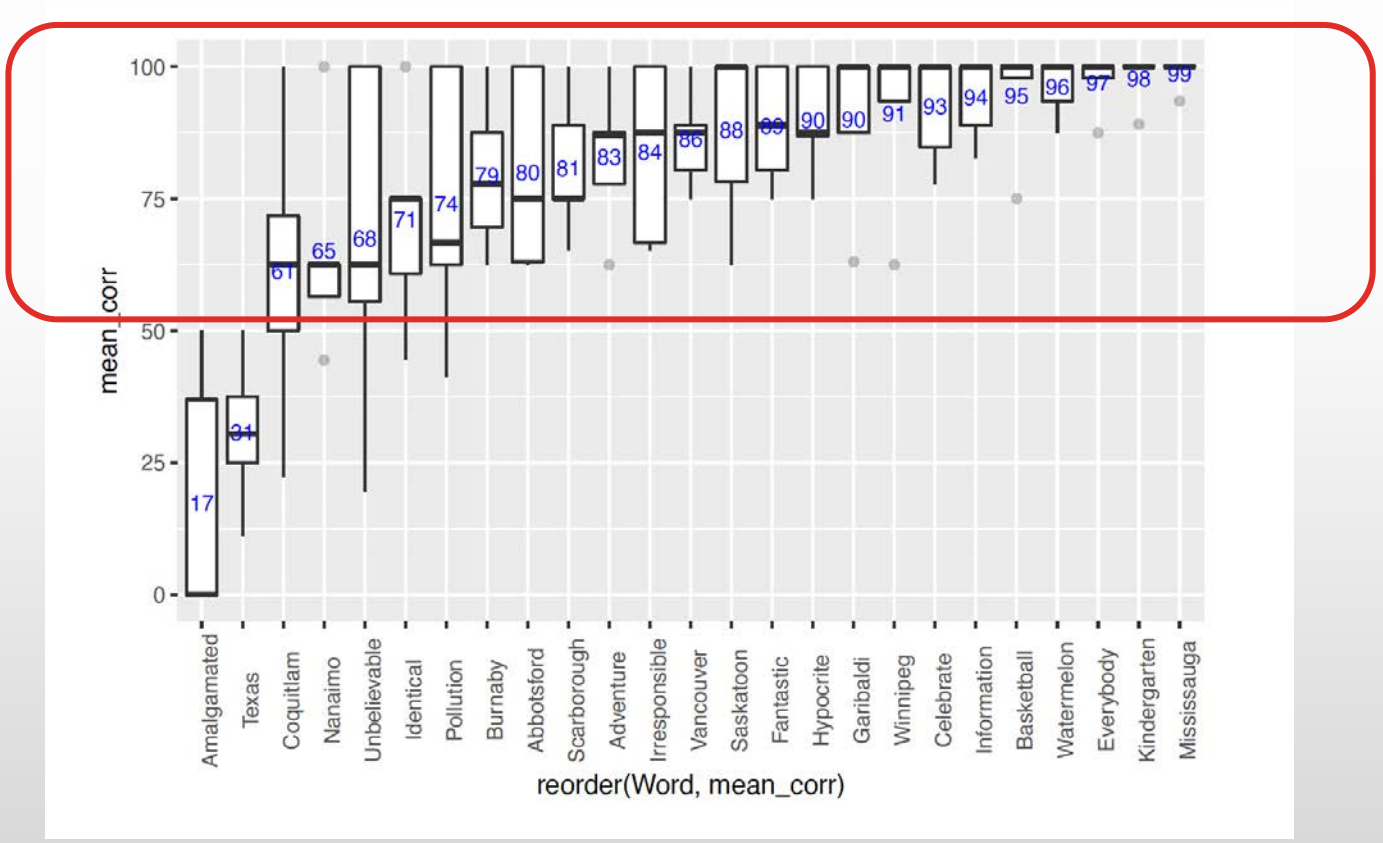

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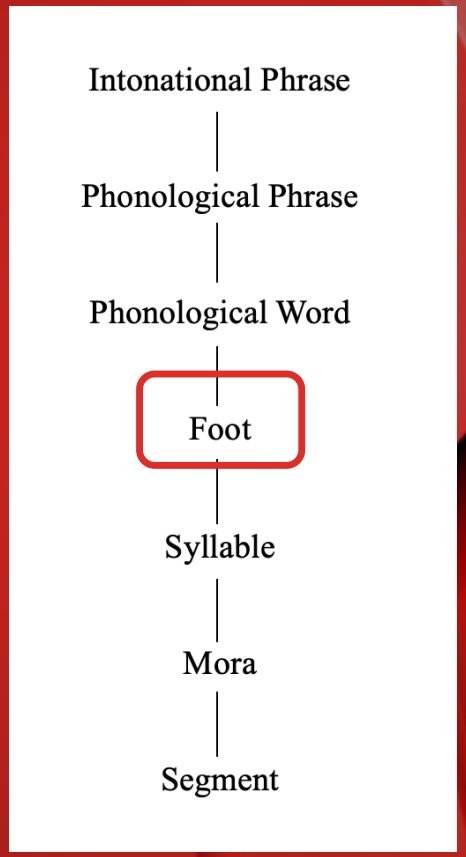
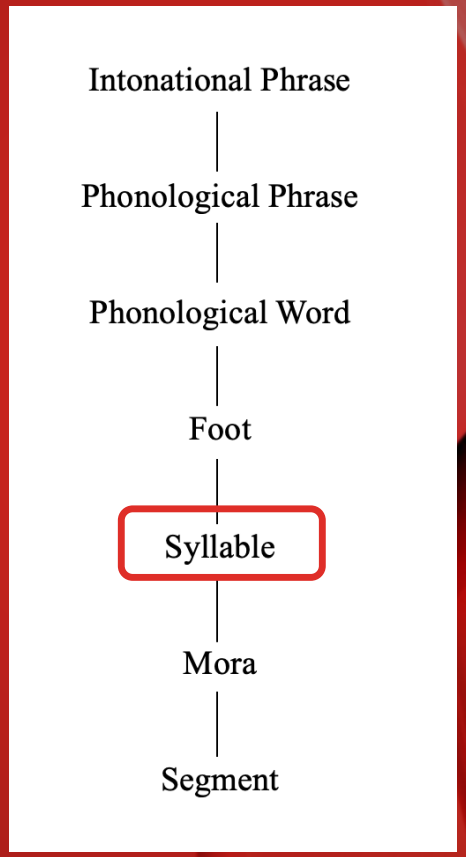
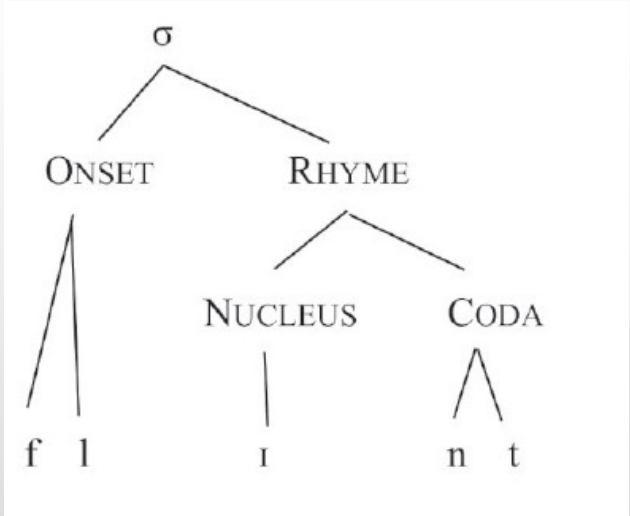


Accuracy Rate	Lexical Items
>90%	hypocrite, Garribaldi, Winnipeg, celebrate, information, basketball, watermelon, everybody, kindergarten, Mississauga
>80%	Abbotsford, Scarborough, adventure, irresponsible, Vancouver, Saskatoon, fantastic
>70%	identical, pollution, Burnaby
50%-70%	Coquitlam, Nanaimo, unbelievable
<50%	amalgamated, Texas

L3 SYLLABLES



This is the prosodic domain which drives the phonotactics of a language (e.g., allowable onsets).



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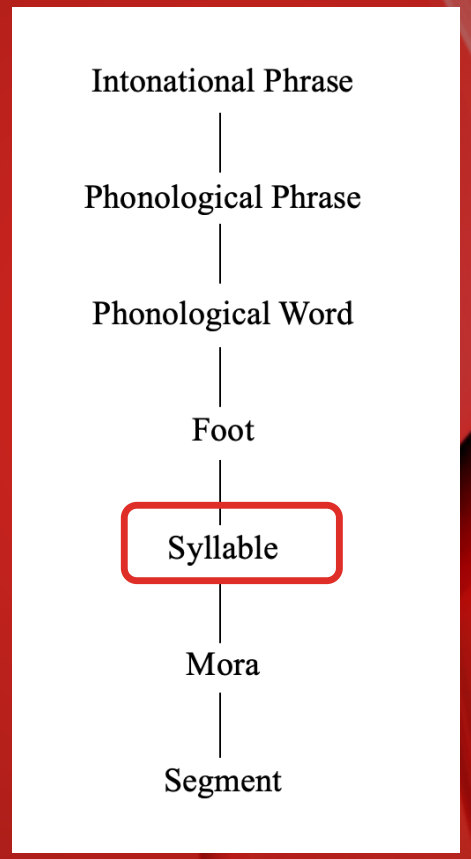

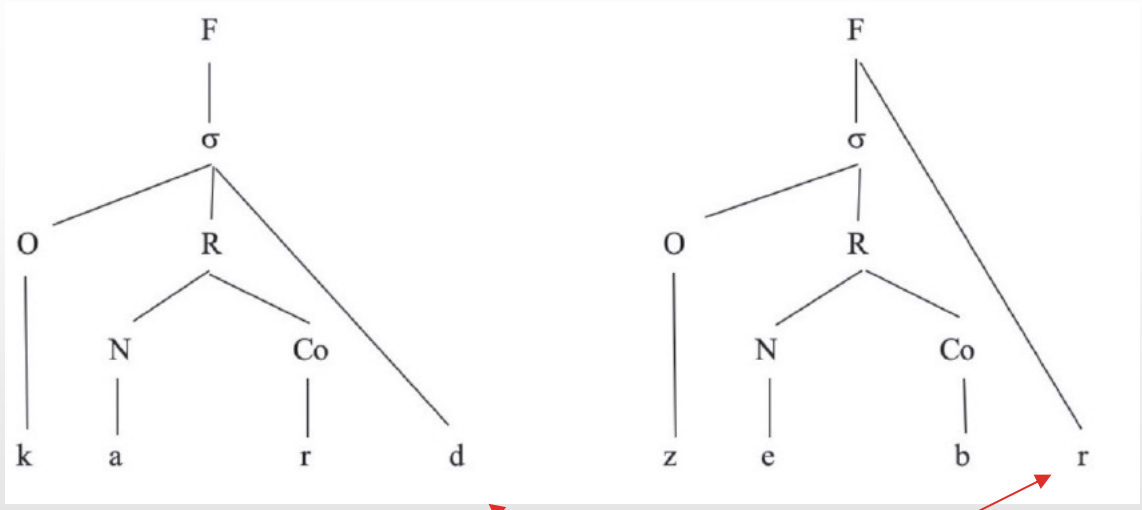

Appendices

ILLUSORY VOWELS

L1	sC Onsets	Branching Onsets	Appendices	% Errors
Japanese	No	No	No	72
Thai	No	No	No	60
Brazilian Portuguese	No	Yes	No	50
Persian	No	No	Yes	14
Hajizi Arabic	No	No	Yes	10
Najdi Arabic	No	Yes	Yes	7

Archibald, Yousefi & Alhemaid, 2022

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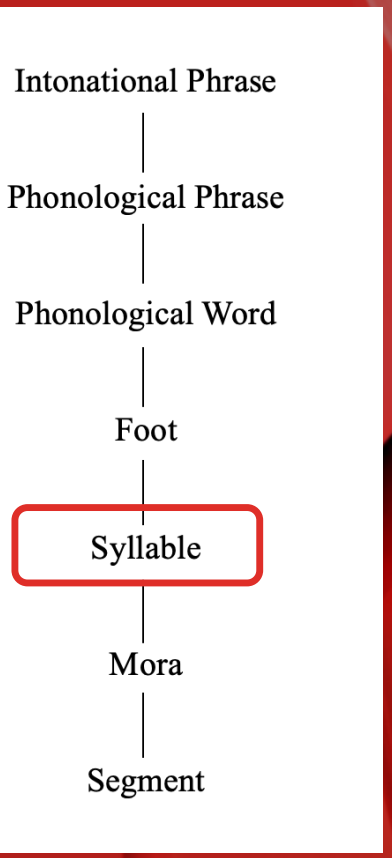
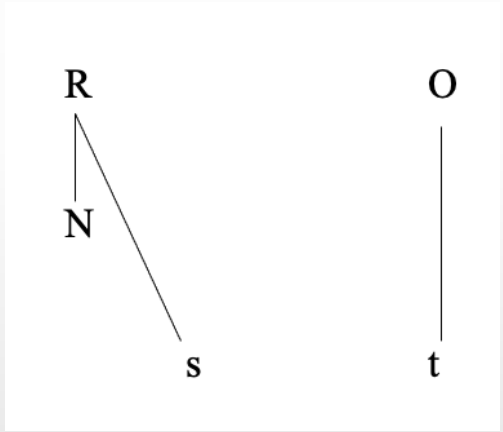
Archibald, Yousefi & Alhemaid, 2022

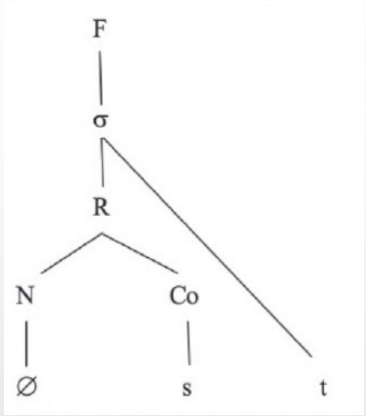
L3 SYLLABLES



- Exceptional s-clusters

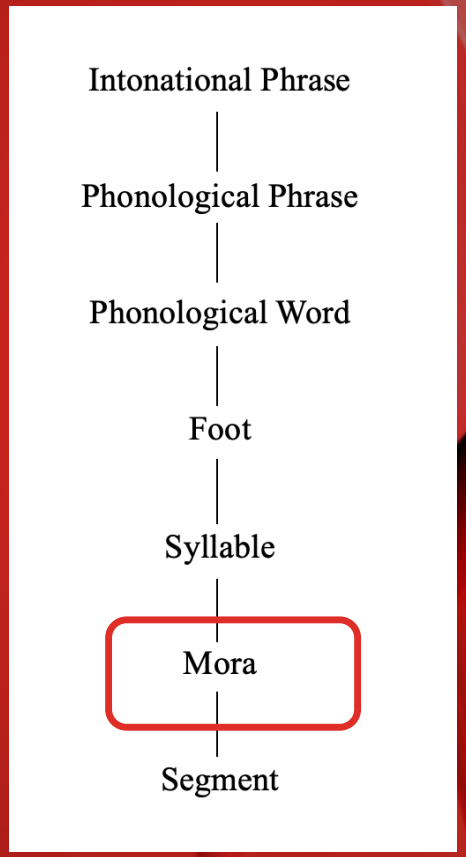


L3 target



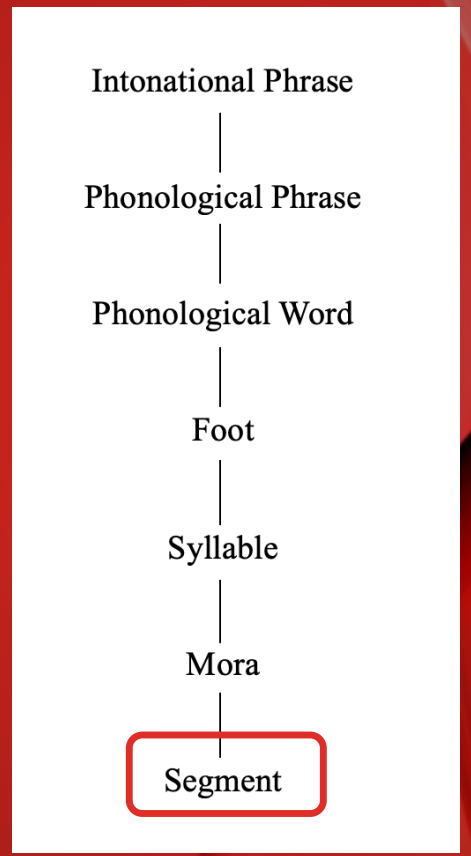
Transitional stage

L3 MORAS

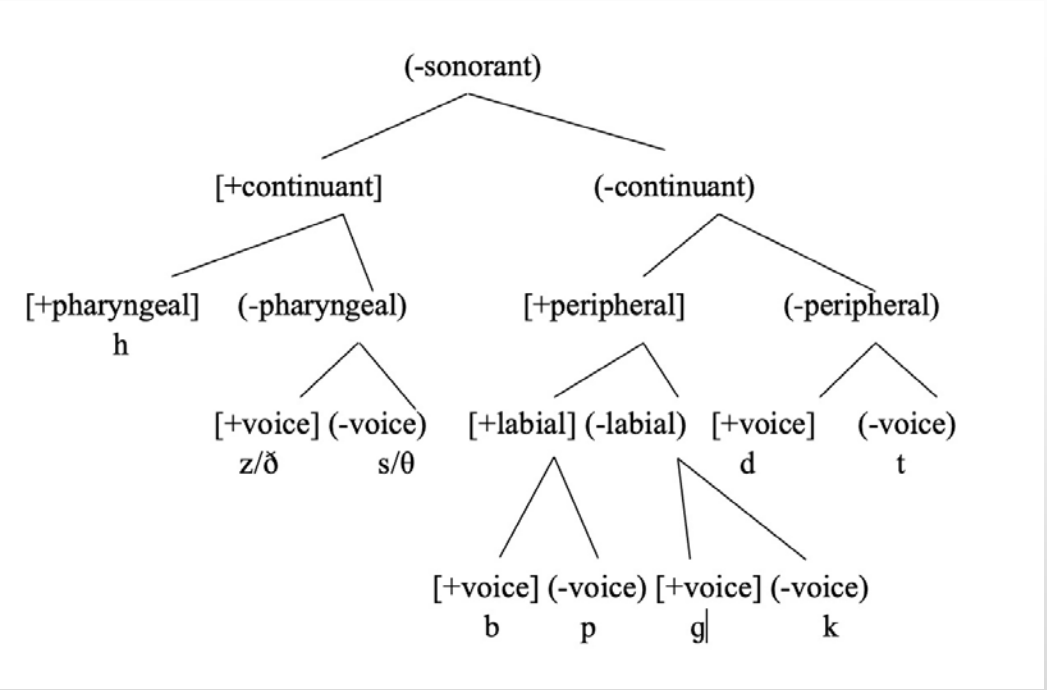


- This is the phonological structure necessary for weight-sensitive stress placement
- Archibald (1993) showed that L1 Hungarian (QS to the Nucleus) could acquire English (QS to the Rhyme)
- Özçelik (2021) showed that L1 English (QS Rhyme) could acquire Khalkha Mongolian (QS Nucleus)
- Crucially weight is not something present in the acoustic signal; it's about foot structure

L3 FEATURE HIERARCHIES

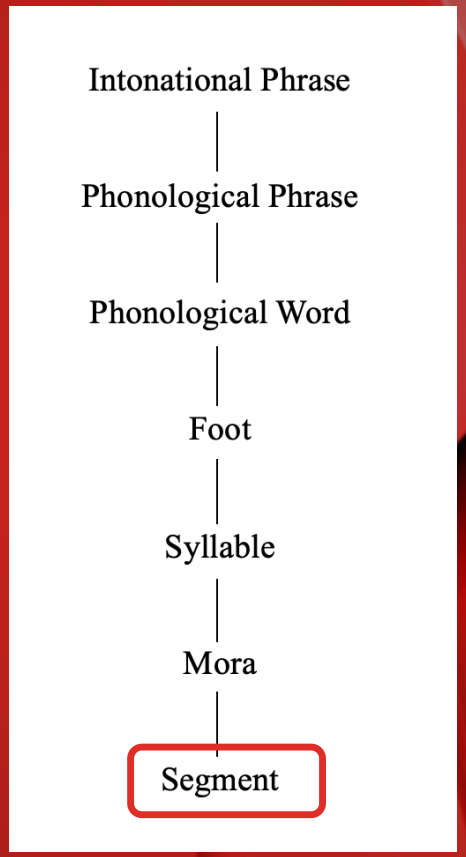


This is the prosodic domain which governs contrastive segments to create minimal pairs.



Dresher, 2009, 2018

CONTRAST



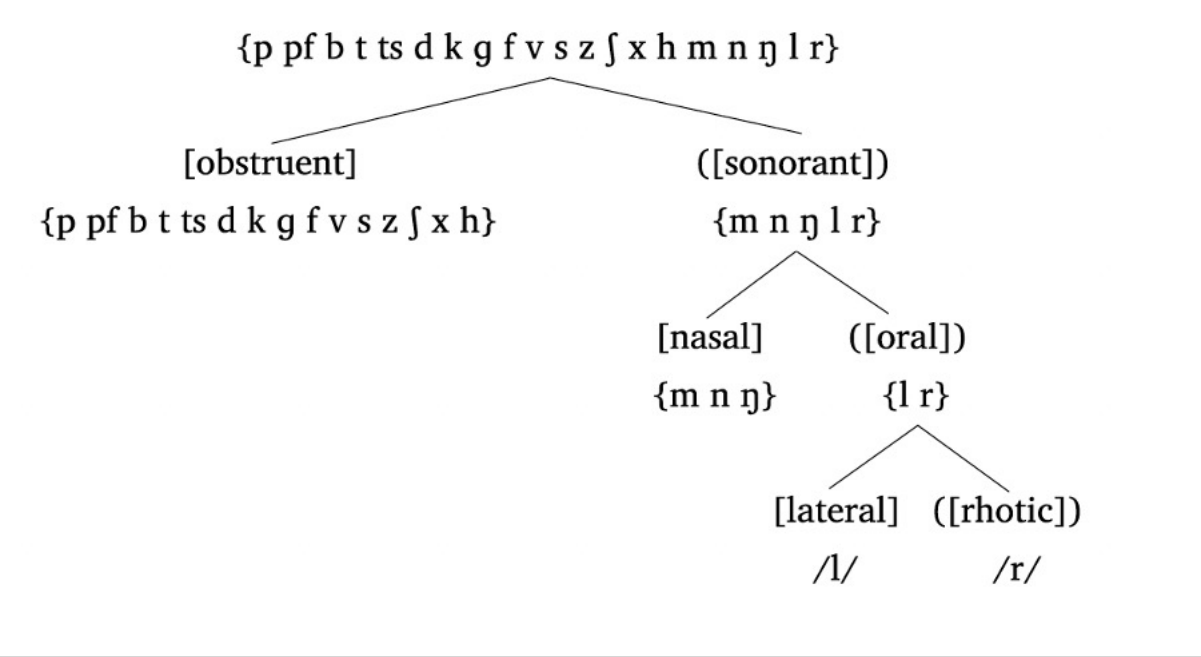
- Phonological knowledge is about *inventories* not just segment-by-segment comparisons (as in the SLM-r)
- Equivalence classification is the beginning of the learning story not the end (Archibald, 2023)
- Universal principle: *contrast* (Cowper & Hall, 2014)

A TRANSITION THEORY

- Principles of restructuring
- Third factors
  - Tolerance Principle (Yang, 2005; 2016)
- Incremental and conservative
  - Redeploying features and ranking
  - Re-ranking
  - Triggering new features
- The role of markedness

UNMARKED RHOTICS

- Natvig (2020): “Rhotic is always the unmarked member within any liquid set.”



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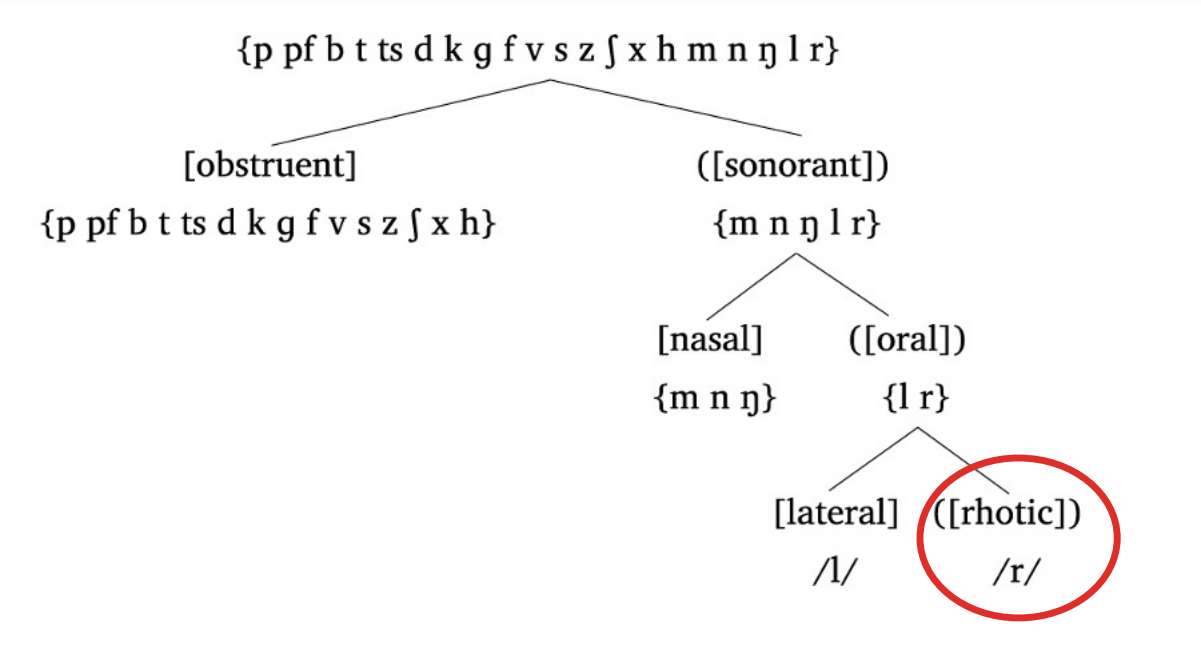


UNMARKED RHOTICS

- Processes like coda r-deletion of vocalization can occur with English [ɹ], German [r, ɽ, ʀ, ʁ], and Norwegian & Swedish [ɾ, r, ʀ, ʁ]
- This suggests the *phoneme* /r/ is the locus of explanation regardless of the phonetic substance
- Rhotic underspecification is widely argued for (Natvig, 2020; Dresher, 2009; Rice, 1992; Fu & Monahan, 2021)
- This leads to great phonetic variation in different varieties of German (Salmons, 2018)
  - coronal [r, ɽ] and dorsal [ʀ, ʁ]
- And in Polish (Chabot, 2019)
  - [r], [ʒ/ʃ], [ɾ]

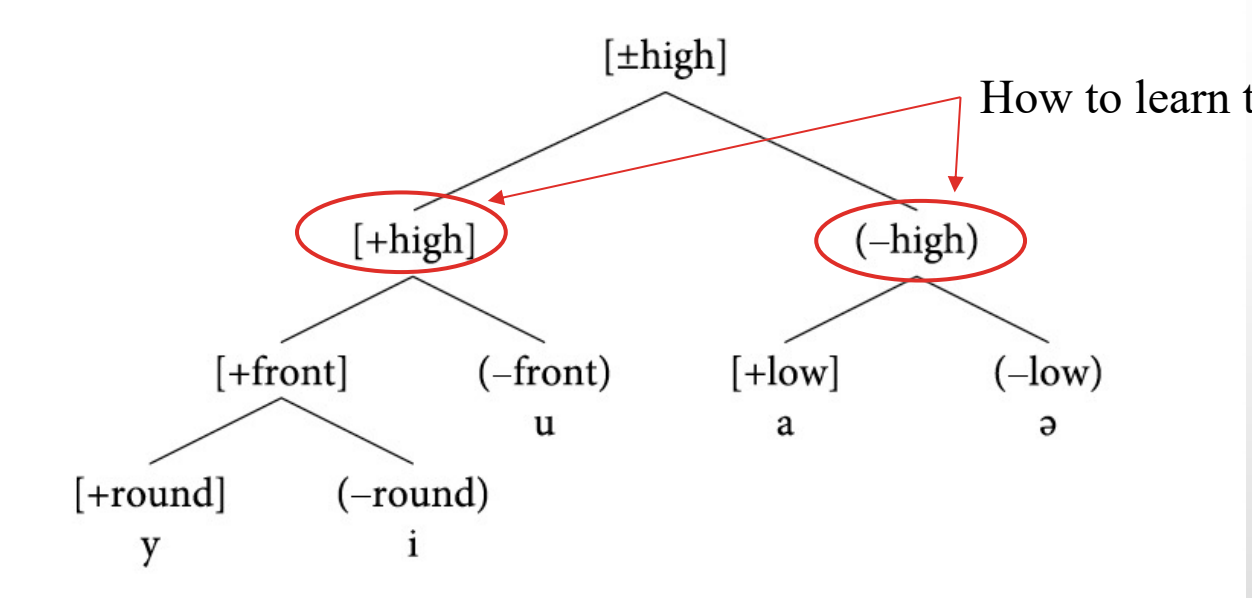
PHONETICS/PHONOLOGY INTERFACE REDUX

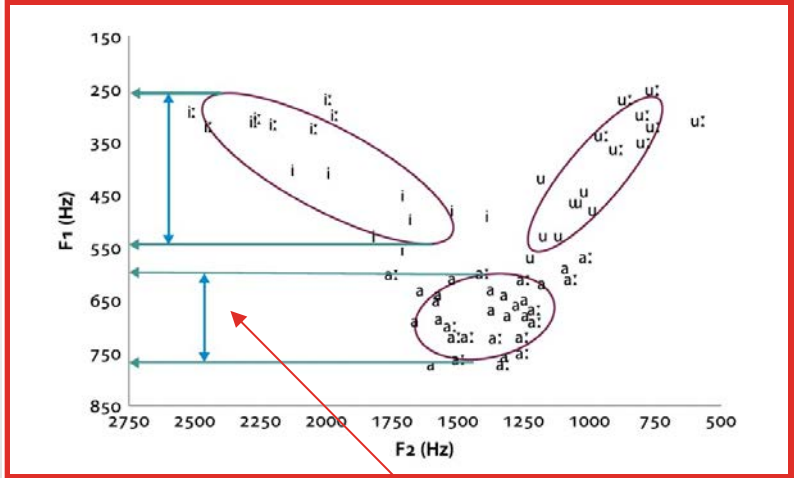
- Kopečková et al. (2023) show fascinating data of variation in the production of L3 rhotics by German/Polish/English (in various orders learners)
- Thus, the observed phonetic variation in L3 could be the result of an underspecified rhotic phonological representation that could come from either German or Polish

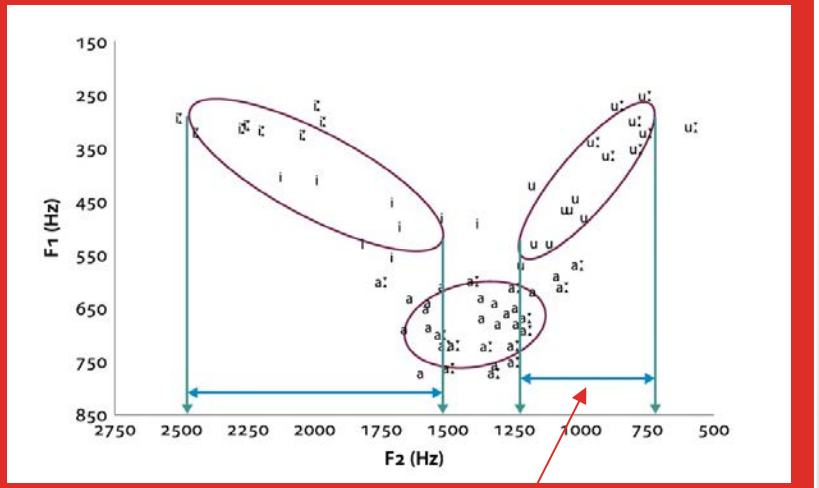
PHONETICS/PHONOLOGY INTERFACE REDUX

- The phonetics provides the cues for phonological learning
- Variation in marked and unmarked values
- The production system generates more variation for unmarked values than for marked values (Natvig & Salmons, 2021)
- The perception system can reverse engineer this variation to discover the underlying features (Archibald, in press a)

PHONETICS/PHONOLOGY INTERFACE REDUX







Marked
(High/Low)

Marked
(Front/Back)

Hall (2011)

THE CONSTRUCT OF REDEPLOYMENT

- Basically the idea (Archibald, 2005) is the learners can take the building blocks from their L1 (feature, mora, etc.) and redeploy them to acquire a new structure/contrast in the L2
- E.g., taking English [posterior] from fricatives and using it to acquire Czech palatal stop contrasts (Atkey, 2001)
- E.g. taking English bimoraic rhymes and using them to acquire Japanese geminates (Summerell, 2007)

REDEPLOYMENT IN L3 UVULARS

- Nelson (2024) looks at the [RTR] features in L3 acquisition
- the feature can be used to capture traditional ‘tense/lax’ vowel distinctions
- It is also used to mark pharyngealization on oral consonants (e.g., [tˤ], and place on uvular consonants (e.g., [q])

KAQCHIKEL

- Kaqchikel is a Mayan language spoken mainly in Guatemala by about 400,000 people
- Has 5 lax vowels specified for [RTR]
- Has 5 tense vowels unspecified for [RTR]
- Has a consonantal velar-uvular contrast that also involves [RTR] (Shahin, 2002)

ENGLISH

- Has a tense/lax vowel contrast
- Brown & Golston (2006) analyze it via [RTR]
- English has no post-velar phonemes

SPANISH

- No tense/lax vowel contrast; 5 vowels contrasting on height and backness
- No post-velar consonants

NELSON (2024)

- They look at the L3A of Kaqchikel by learners who know Spanish and English
- One group has Spanish as the L1
- One group has English as the L1
- The research question is whether the two groups differ in their categorical perception of Kaqchikel stops based on differential access to the [RTR] feature

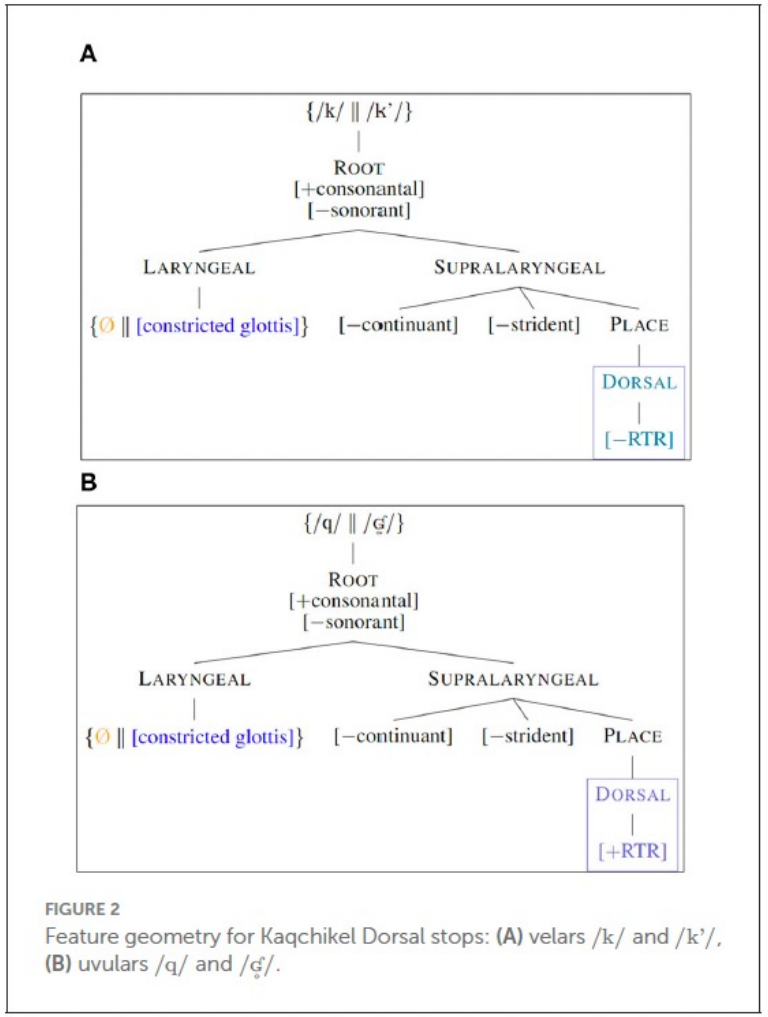


FIGURE 2
Feature geometry for Kaqchikel Dorsal stops: **(A)** velars /k/ and /kʼ/, **(B)** uvulars /q/ and /ɢ/.

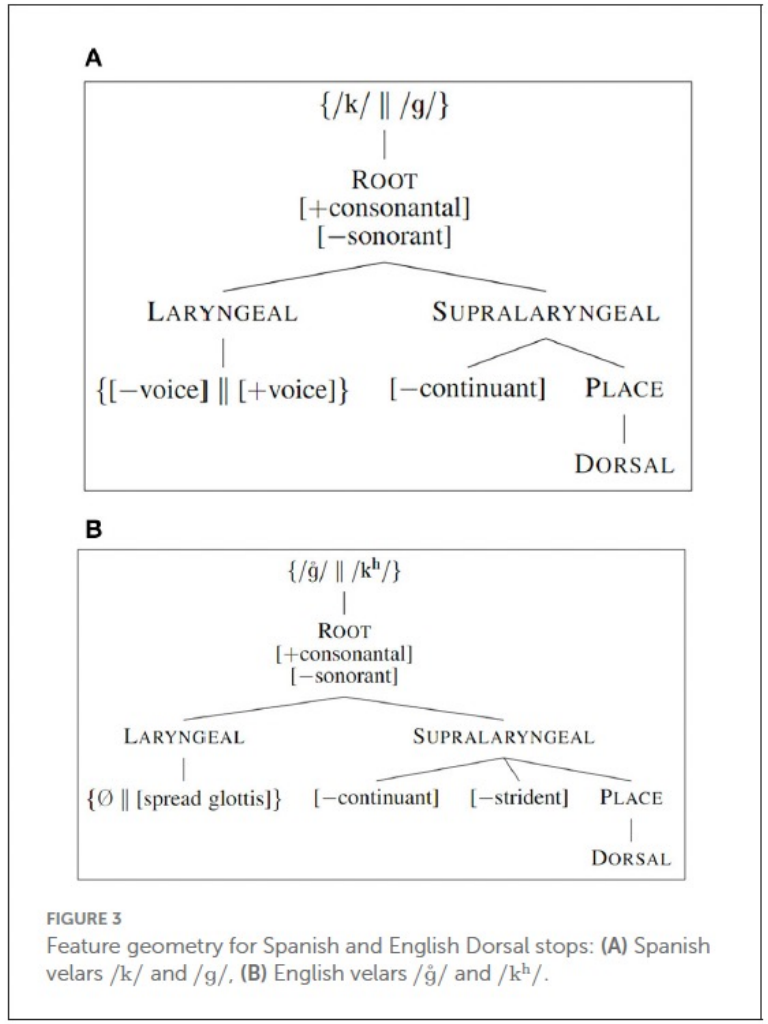
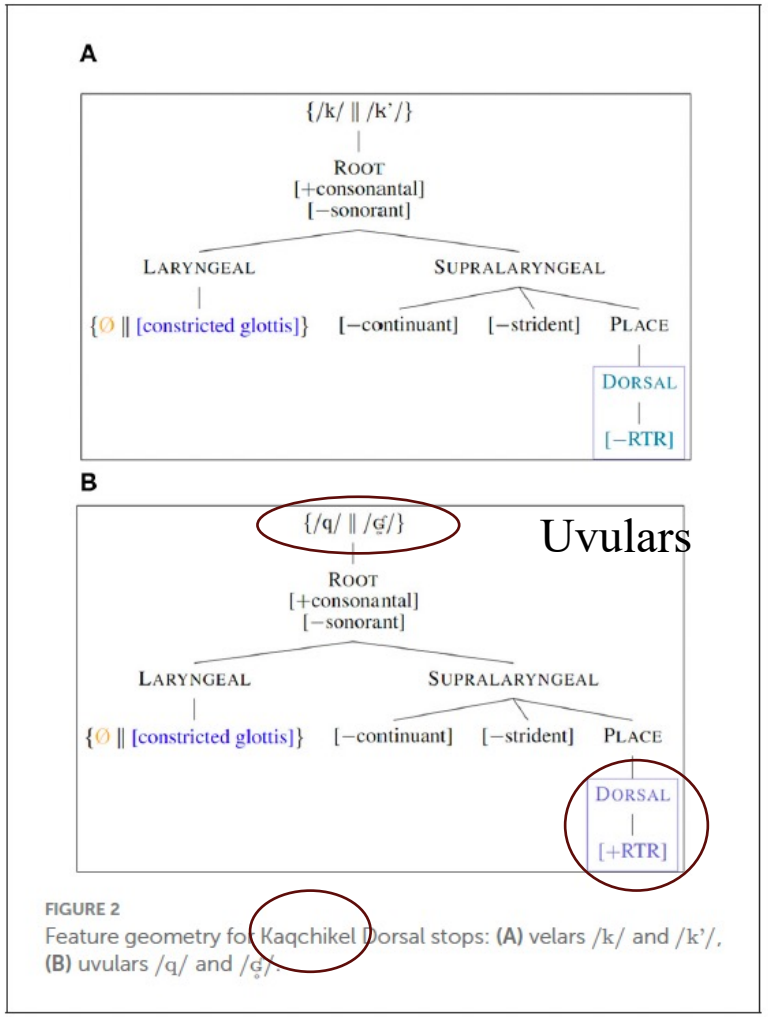


FIGURE 3
Feature geometry for Spanish and English Dorsal stops: **(A)** Spanish velars /k/ and /g/, **(B)** English velars /g̊/ and /kʰ/.



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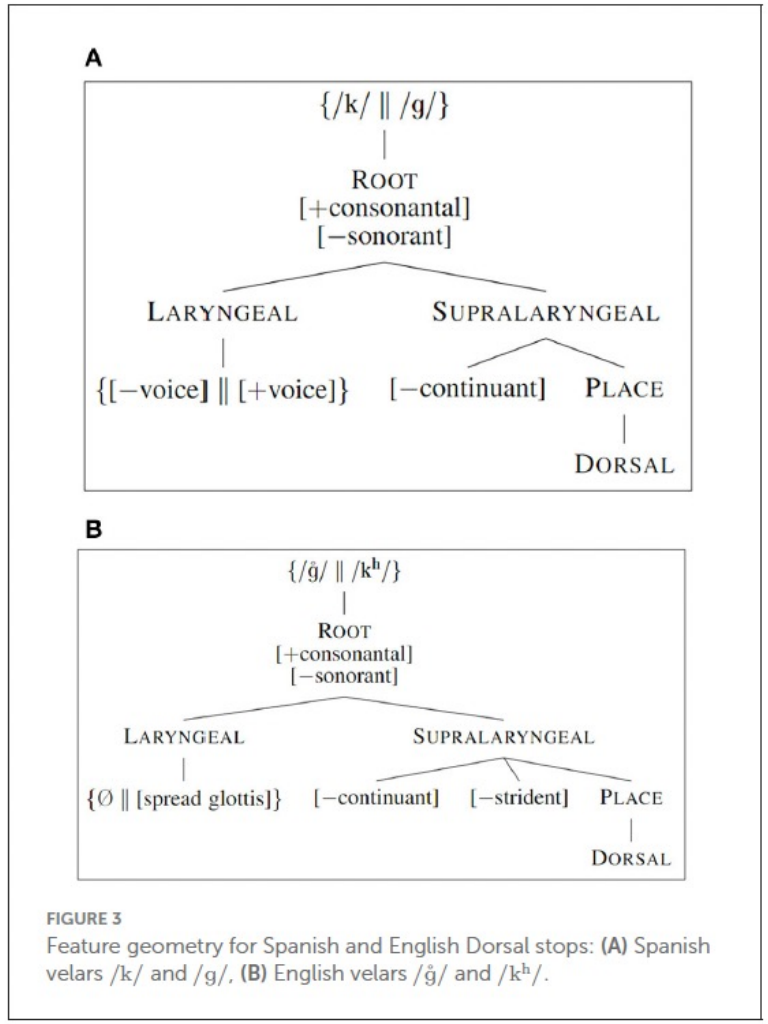

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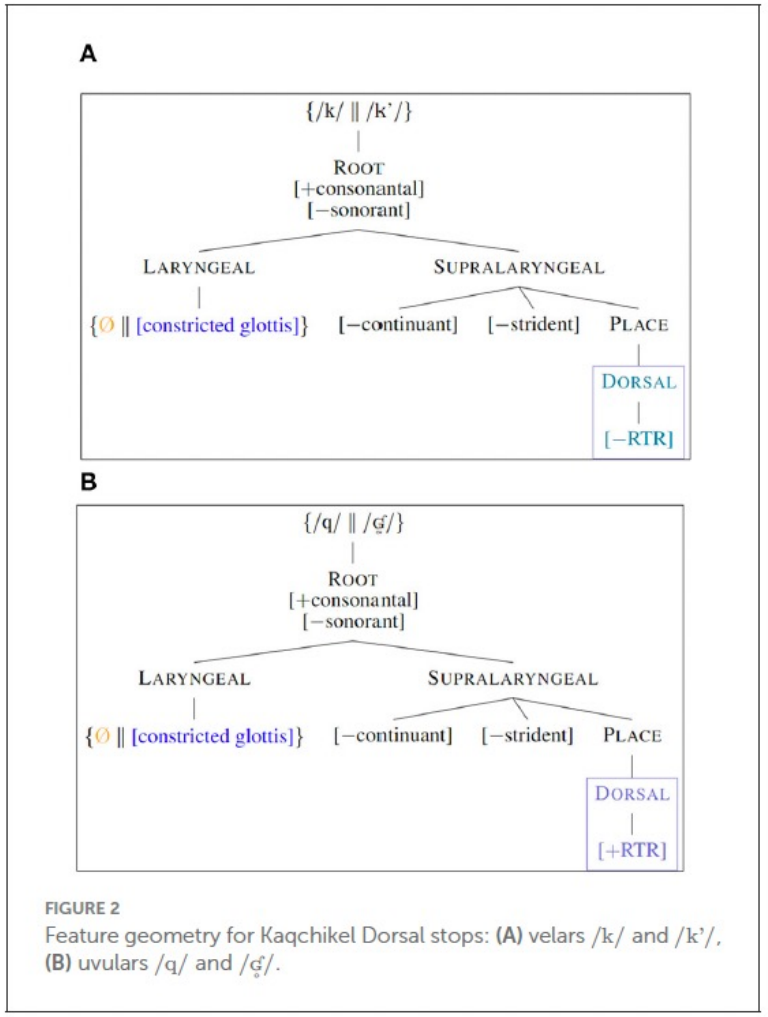

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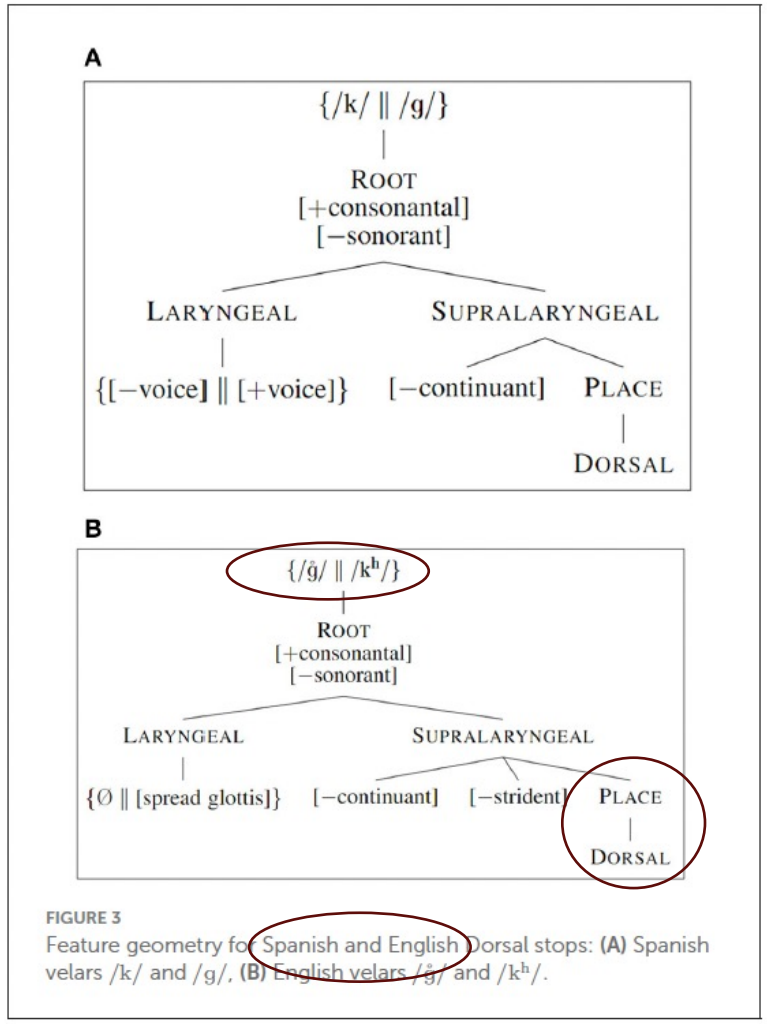

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THE LEARNING PROBLEMS

- Spanish has [voice]
- English has [spread glottis]
- Kaqchikel has [constricted glottis]

- Spanish and English have 3 places of articulation for consonants
- Kaqchikel has 4

THE LEARNING PROBLEM

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→ Nelson, González Poot, Flynn & Archibald, (2024)

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Kaqchikel

Spanish

English

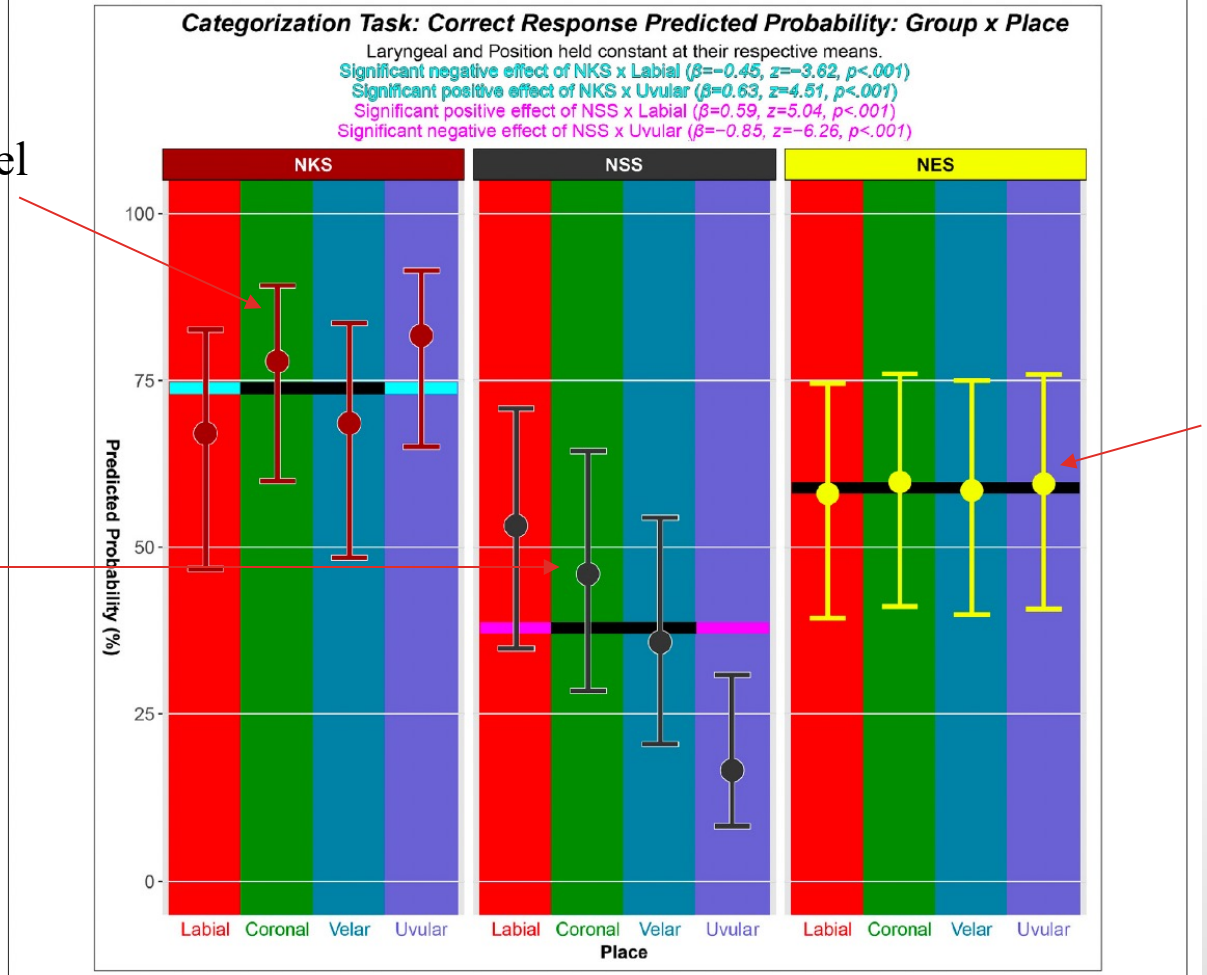
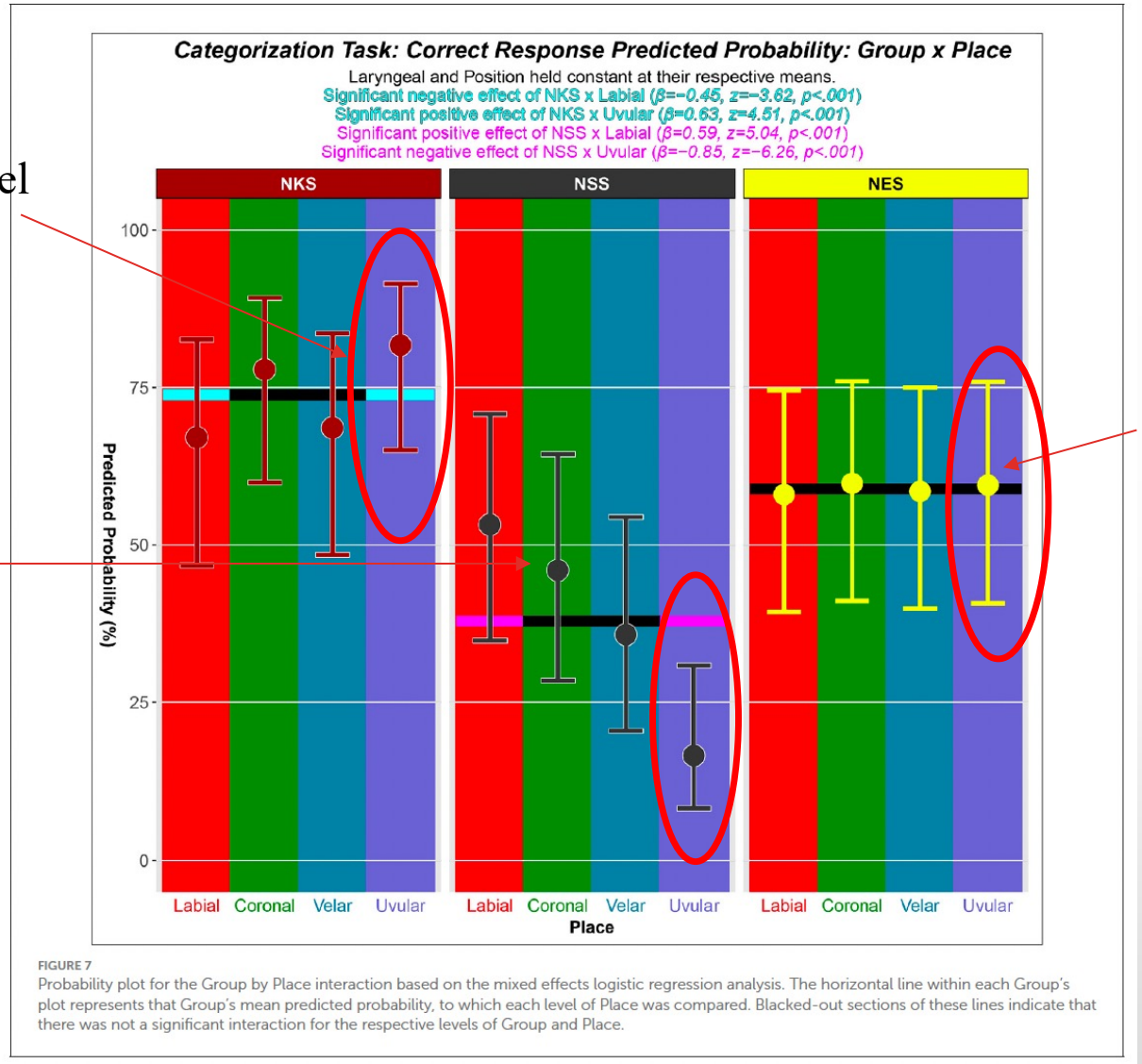


FIGURE 7
Probability plot for the Group by Place interaction based on the mixed effects logistic regression analysis. The horizontal line within each Group's plot represents that Group's mean predicted probability, to which each level of Place was compared. Blacked-out sections of these lines indicate that there was not a significant interaction for the respective levels of Group and Place.

Kaqchikel

Spanish

English



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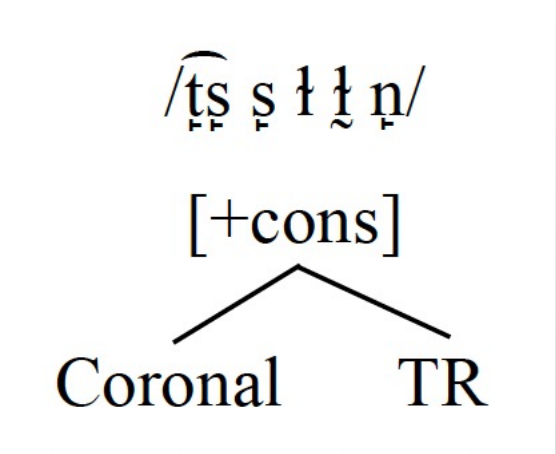
- So, why might the L1 English group be better at uvulars than the L1 Spanish group?
- They suggest it might be redeployment of L1 vocalic [RTR] applied to L3 consonantal velar/uvular contrasts

REDEPLOYMENT IN LANGUAGE CONTACT

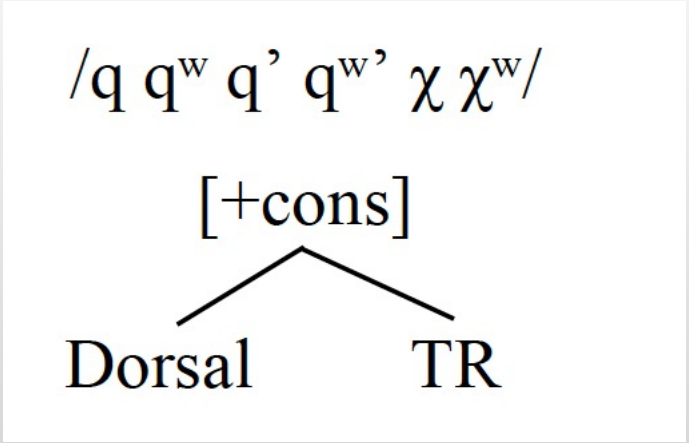
- Historical acquisition of emphatic consonants



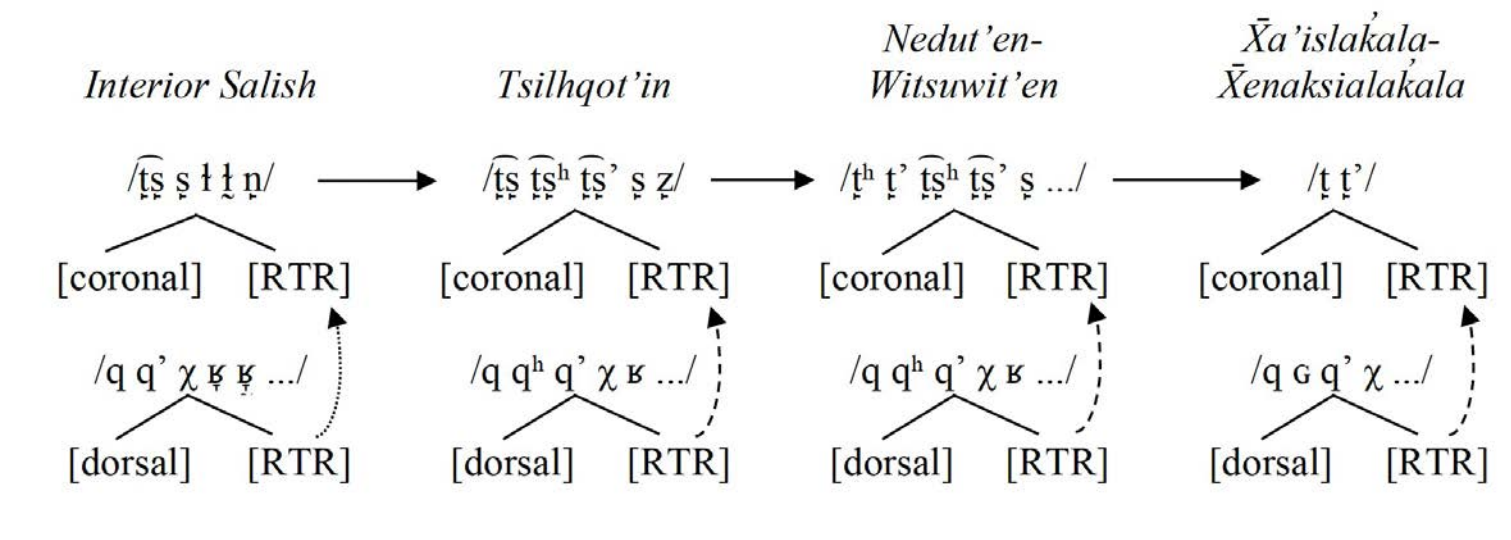
Flynn (2024)

REDEPLOYMENT IN LANGUAGE CONTACT

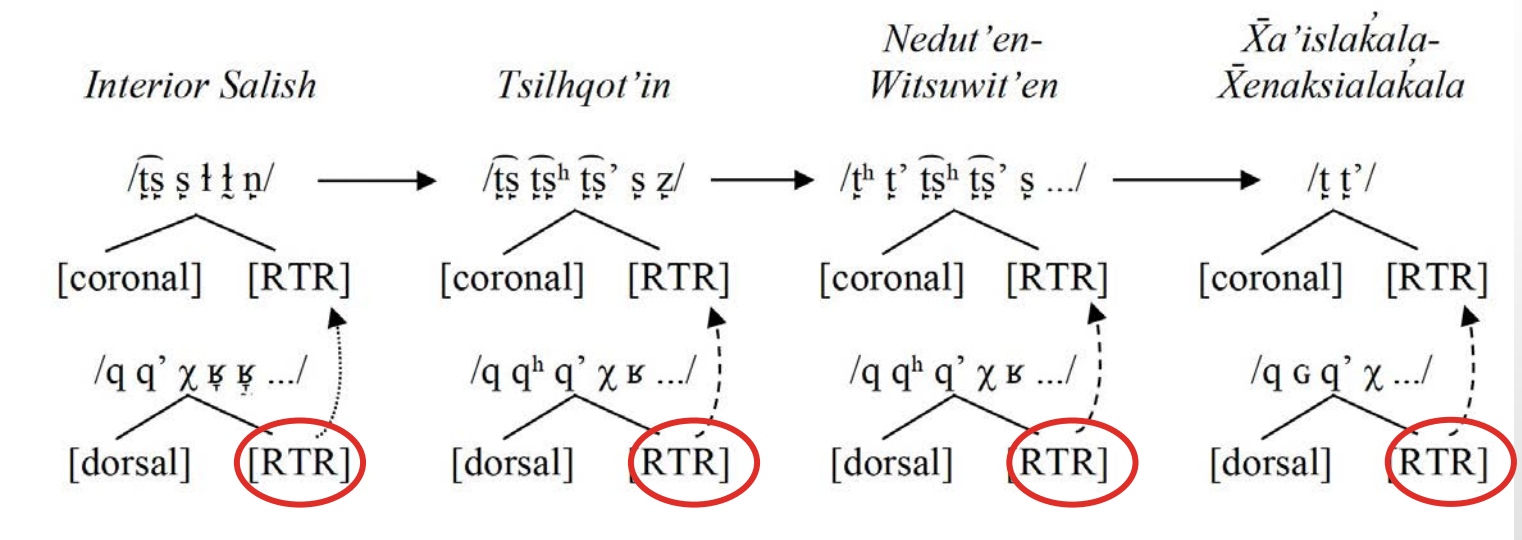
- Languages can acquire emphatics by redeploying the [RTR] feature from uvulars
- Languages which don't have uvulars (simplifying slightly) don't acquire the emphatics



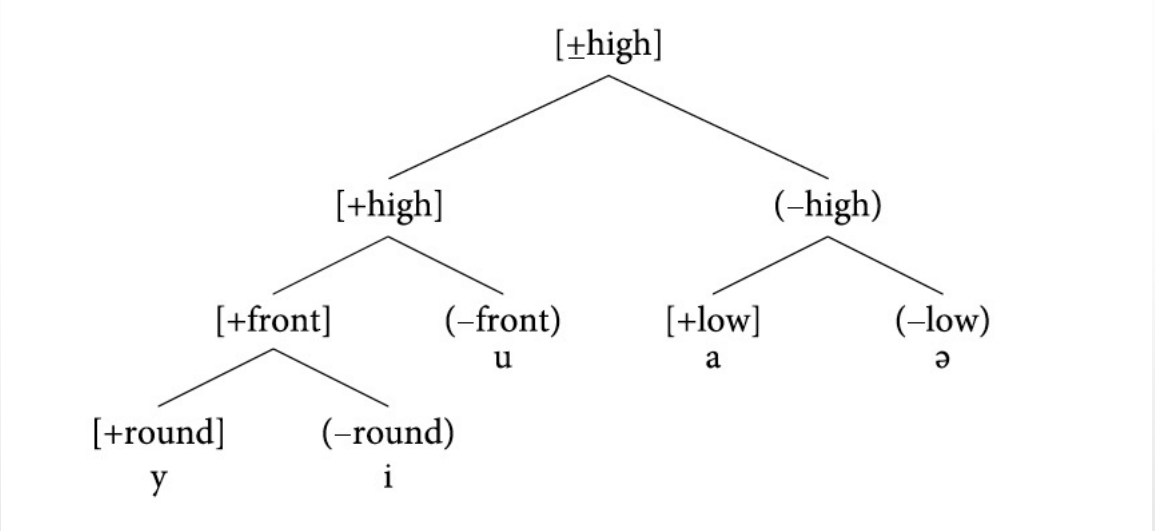
REDEPLOYMENT IN LANGUAGE CONTACT



REDEPLOYMENT IN LANGUAGE CONTACT



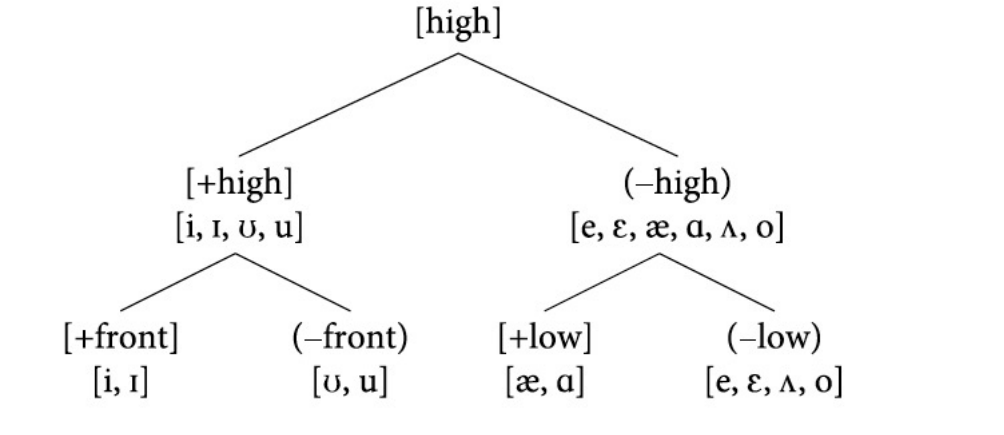
REDEPLOYMENT IN RESTRUCTURING



Mandarin vowel hierarchy (Wu, 2021)

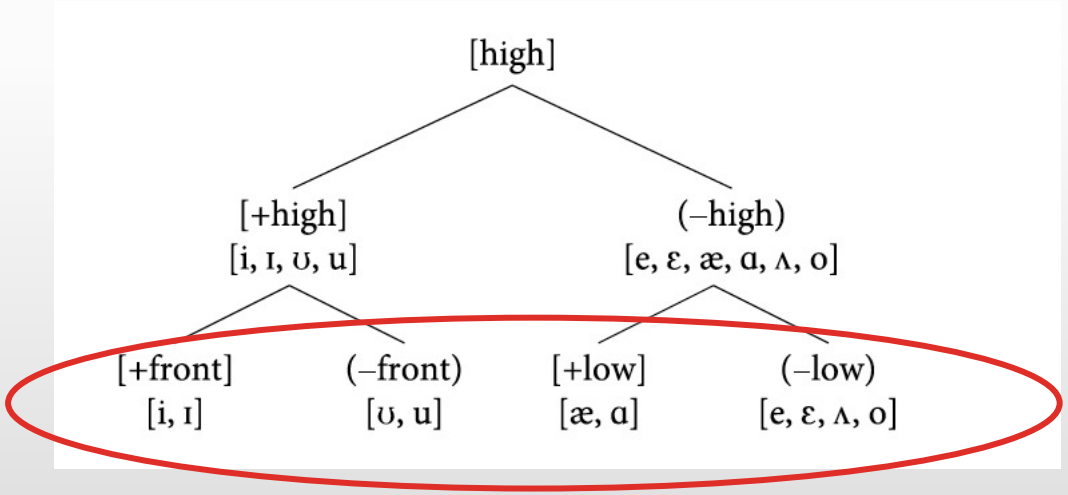
REDEPLOYMENT

This hierarchy cannot parse the English vowels



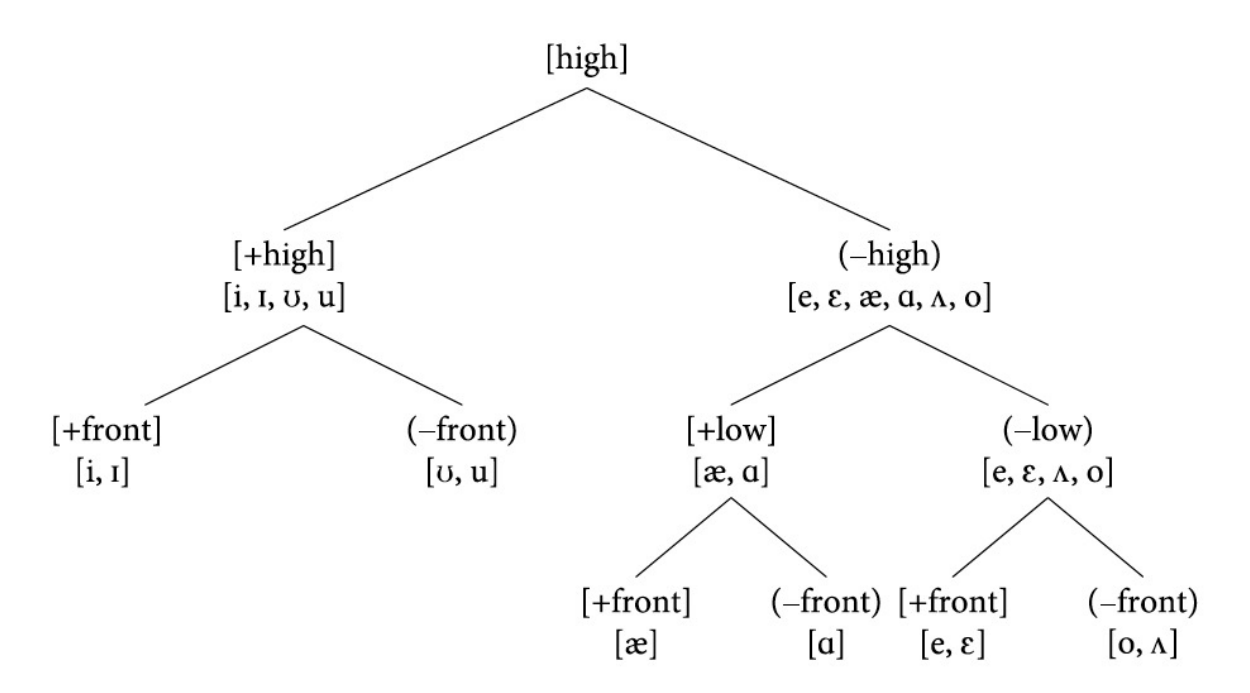
REDEPLOYMENT

This L1 hierarchy cannot parse the English vowels



REDEPLOYMENT

Possible action I: redeploy [front] from [+high] to [-high]



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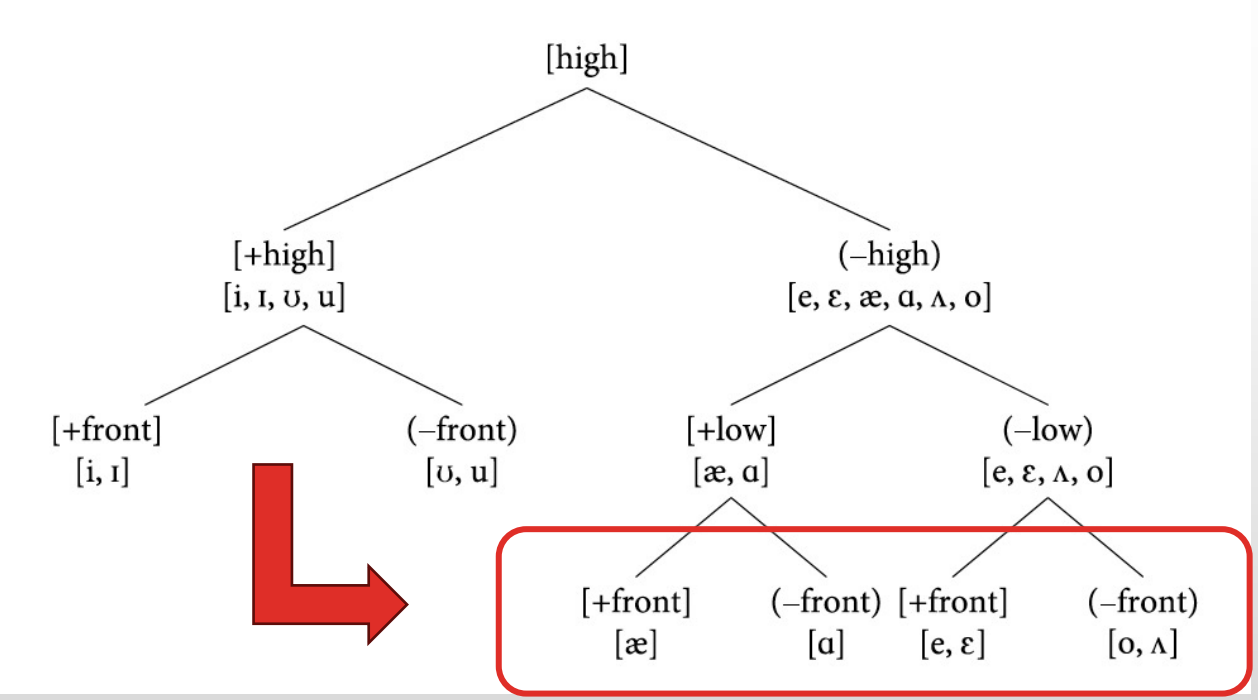
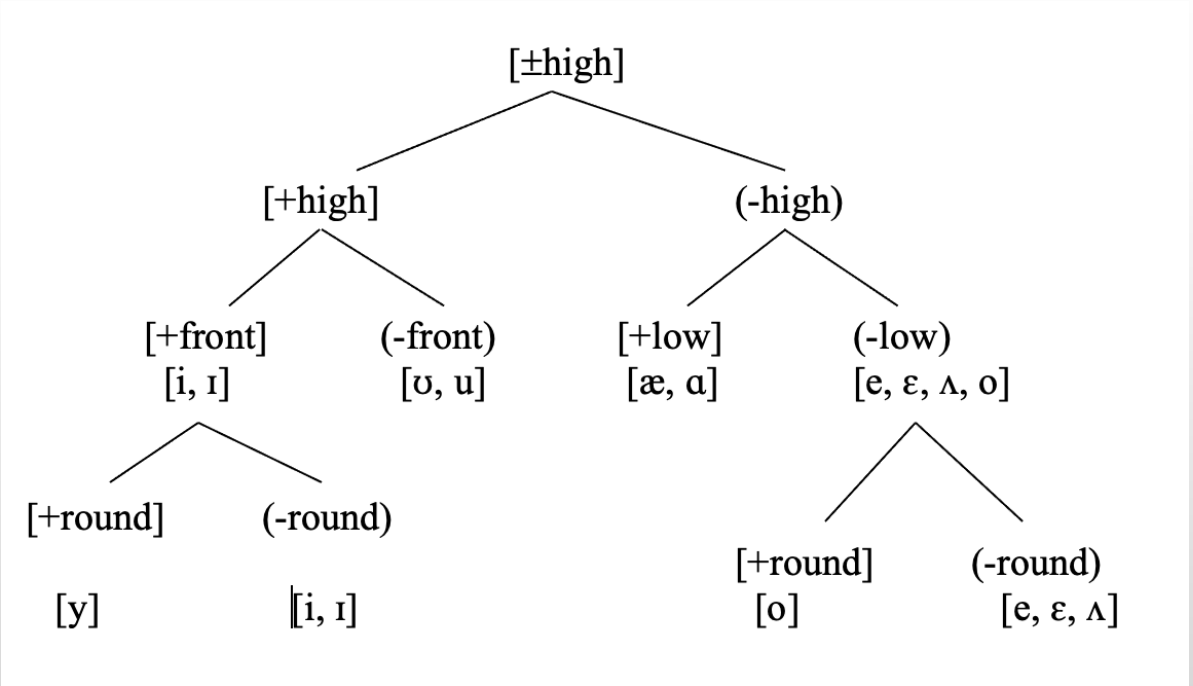


REDEPLOYMENT

Possible action II: redeploy [round] from [+high] to [-high]



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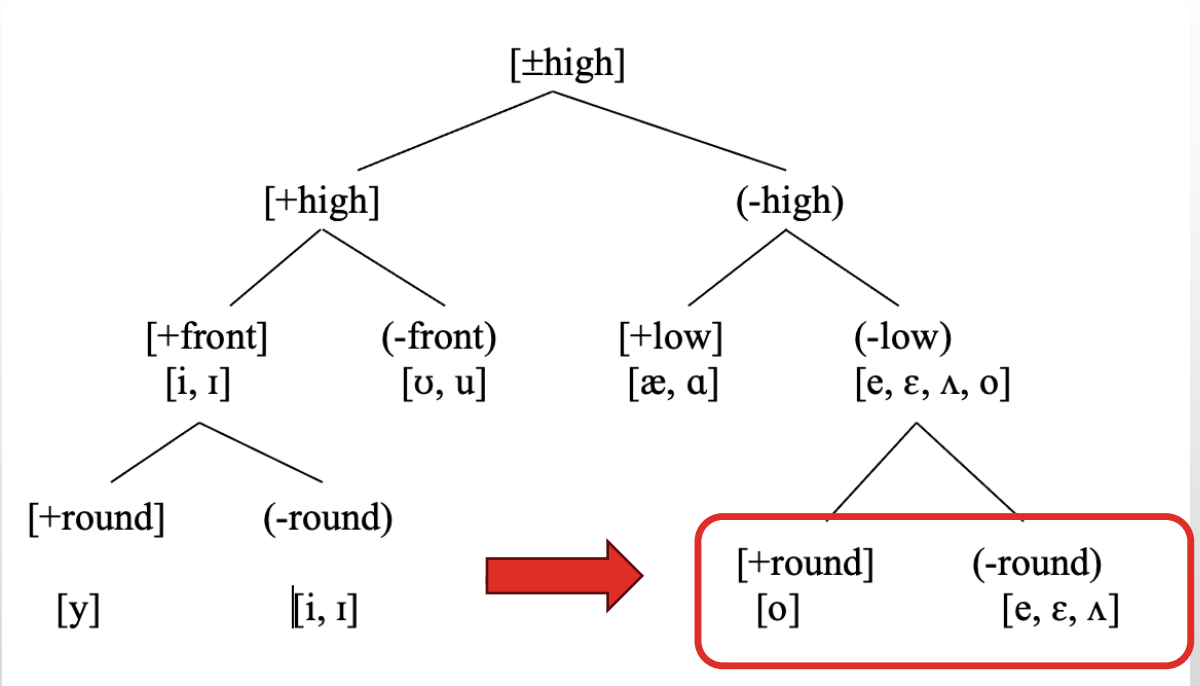


REDEPLOYMENT

- In this way individual variation can be built into an incremental, conservative largely deterministic learning theory
- Some learners pick option 1, some pick option 2

REDEPLOYMENT FROM L1 *AND* L2

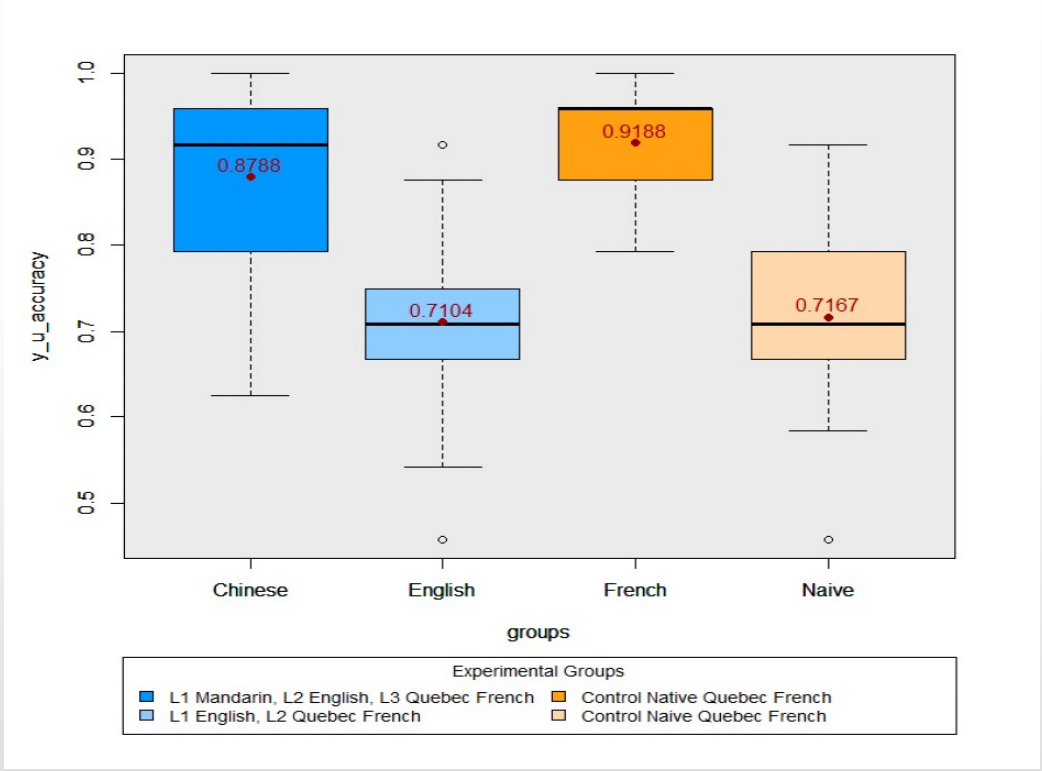
- Data from Northern Africa show that L3 English learners have redeployed features from their L1 Arabic
  - Arabic consonants to English consonants
- And from their L2 French
  - French vowels to English vowels
- Similar effects in prosody

Behrabah, 1991; Archibald, 2022a, 2022b

REDEPLOYMENT FROM L1 *AND* L2

- We also see this effect in a study of L1 Mandarin, L2 English, L3 Quebec French participants
- Wu (2024) looked at a range of vocalic contrasts and showed that there was redeployment from both the L1 *and* the L2
- The trilinguals routinely out-performed the English/French bilinguals

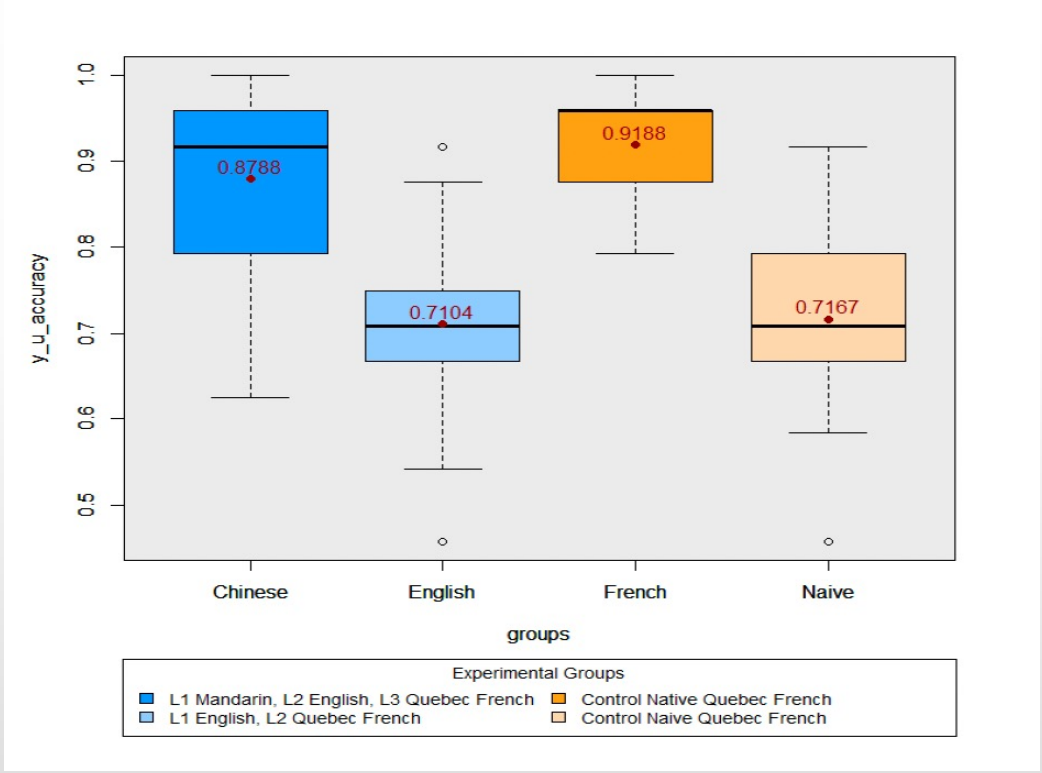
REDEPLOYMENT



[y, Y]

Wu (2024)

REDEPLOYMENT



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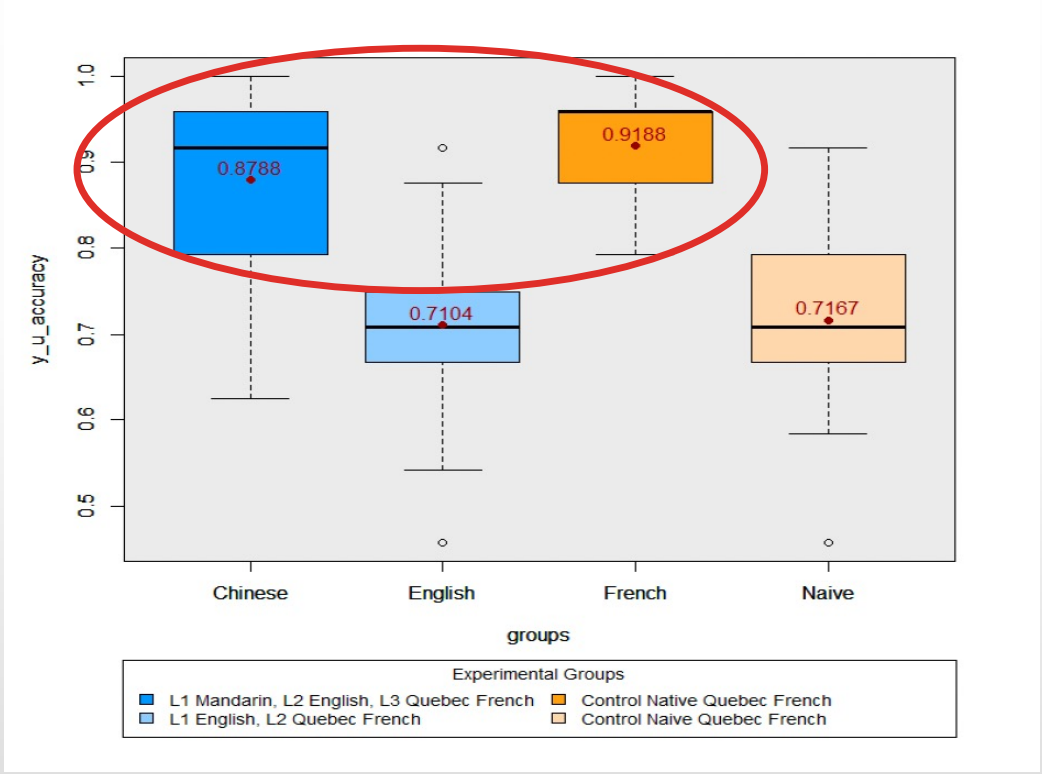
Wu (2024)

REDEPLOYMENT



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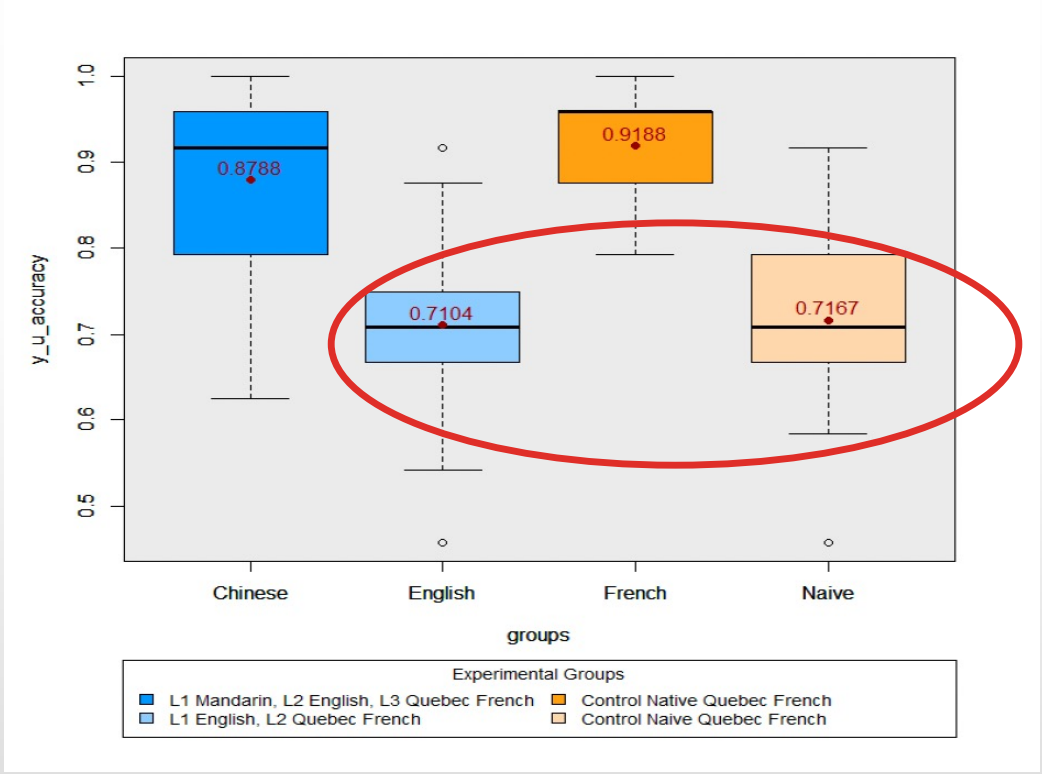
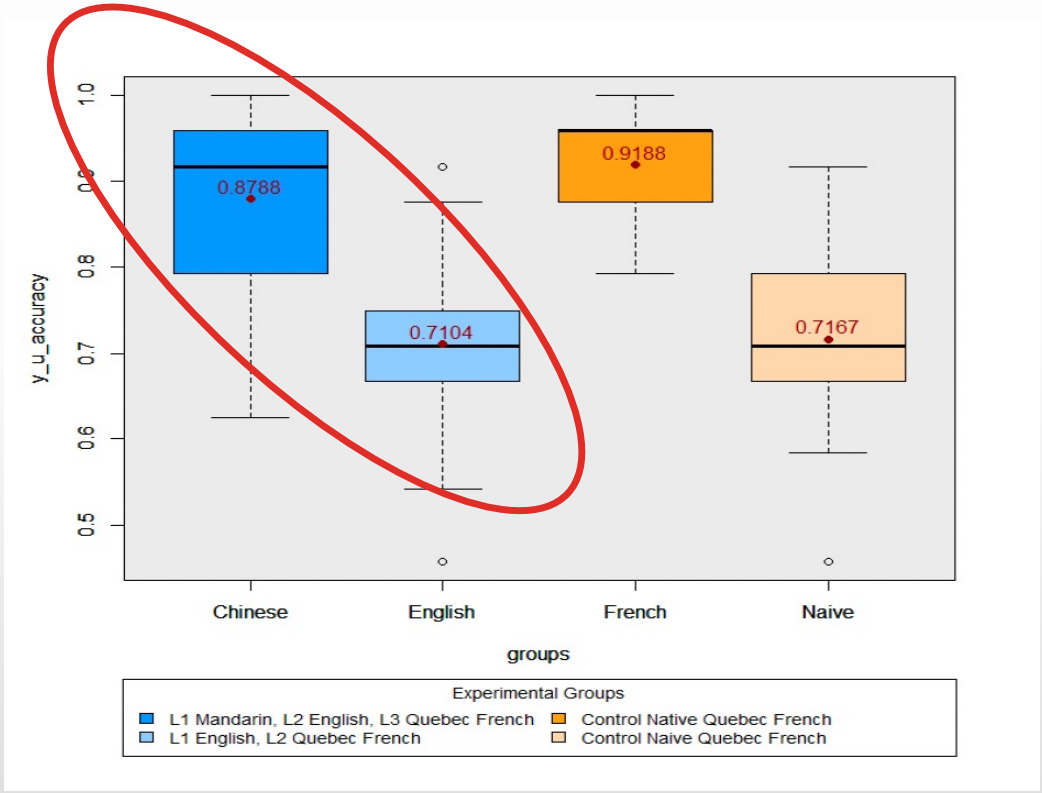
REDEPLOYMENT



[y, Y]

Wu (2024)

REDEPLOYMENT



[y, Y]

Wu (2024)

REDEPLOYMENT

- The trilinguals get [round] from Mandarin and [tense] from English which allows them to outperform the bilinguals
- A phonological instance of property-by-property transfer

EASE & DIFFICULTY

Redeployment

Triggering

Redeploying & Triggering

Easy

Difficult

From Wu (2024)

EASE & DIFFICULTY

Contrast	Action	Structure	Accuracy
/y,u/	No restructuring	[front]>[round]	88%
/œ, ɔ/	Redeployment	redeploying [front]>[round] from [+high] to [-high]	85%
[y, ʏ]	Triggering	[±tense]	76%
/e, ɛ/	Redeployment & Triggering	redeploying [±front] and triggering [±tense]	65%

L1 Mandarin/L2 English/L3 Quebec French discrimination

EASE & DIFFICULTY

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L1 Mandarin/L2 English/L3 Quebec French discrimination

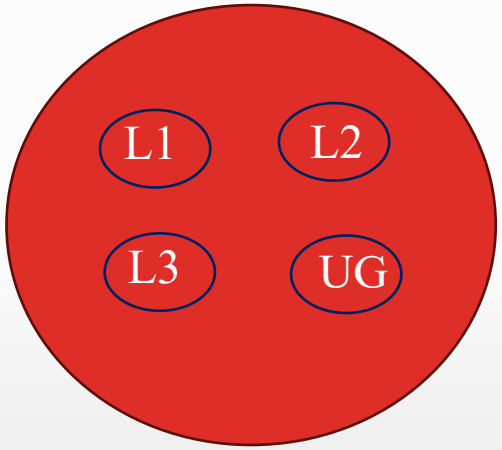
THE CONTRASTIVE HIERARCHY & A UNIFIED ACCOUNT OF GRAMMAR CHANGE

- Historical (Oxford, 2015)
- Language contact (Flynn, 2024)
- L1A (Bohn & Santos, 2018)
- Sociolinguistics (Natvig & Salmons, 2021)
- L2A (Archibald, 2023)
- L3A (Archibald, 2022a, b; Wu, 2024)

NULL THEORY

- Initially (post William of Ockham) proposed for codeswitching data, Mahootian's (1993) construct of Null Theory (i.e. no special machinery) has been extended to heritage grammars (Lohndal et al. 2019)
- See also Lohndal & Putnam (2024)
- In this vein, we don't need a special theory of L3 phonology
- We 'just' need a theory of how UG, 3rd factors and input generate hierarchical phonological representations

A LINGUISTIC REPOSITORY



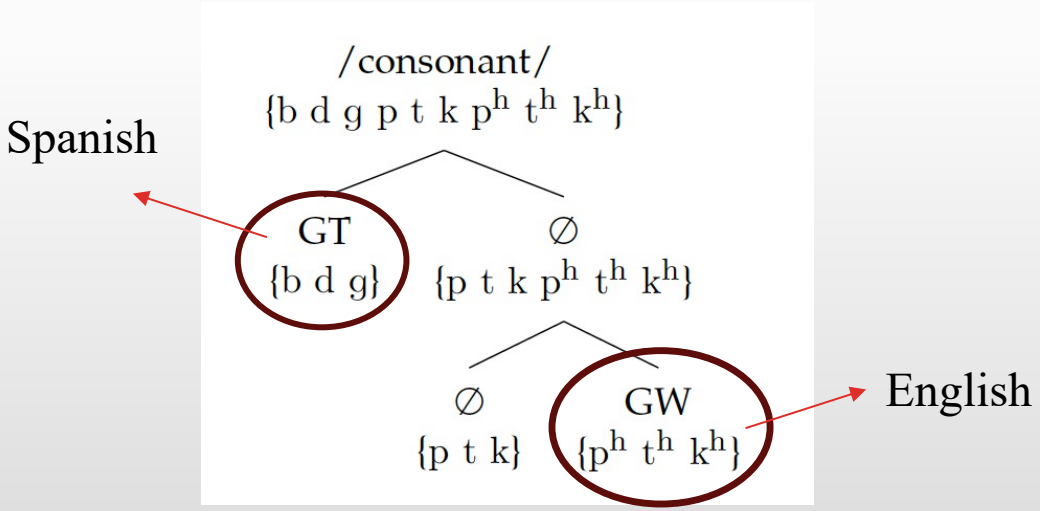
L1: Lightfoot (2020); Fodor (1998)

L2: López (2020); Natvig (2021)

L3: Westergaard (2021); Archibald (2022)

A LINGUISTIC REPOSITORY I

•an integrated feature hierarchy?



Natvig, 2021

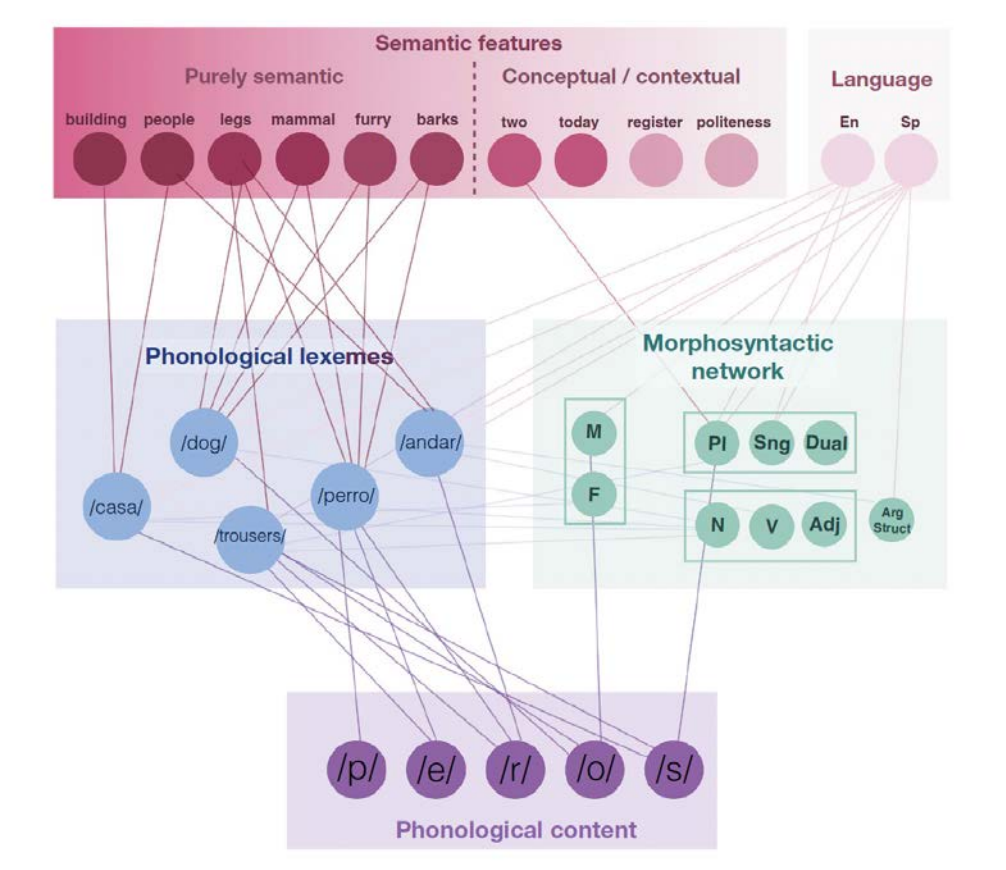
LANGUAGE TAGS

- “the nodes of the target language will receive additional activation from a Language feature, boosting their activation above those of the non-target language. …In this way, the language system’s functional architecture in bilinguals is identical in all respects to that in monolinguals ….”

Blanco-Elorrieta & Caramazza (2021)

See also Slabakova (2017)

A LINGUISTIC REPOSITORY II



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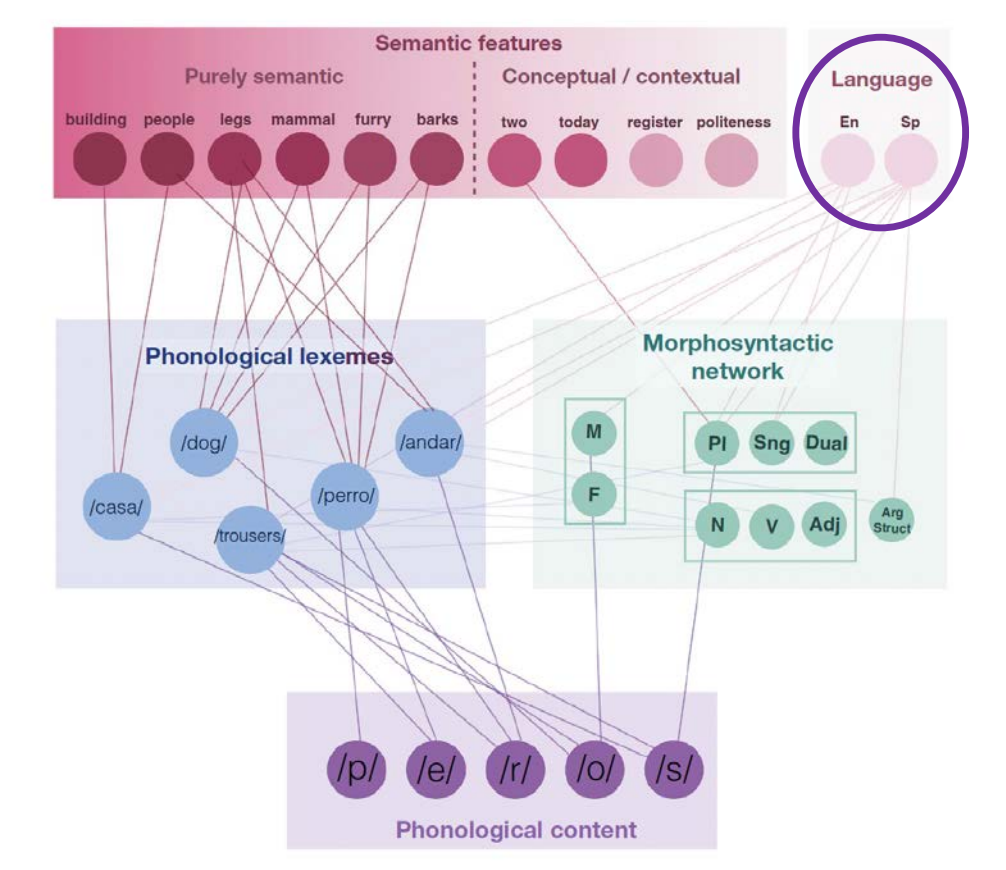


L3 ARCHITECTURE & LEARNABILITY

- This is how we can reconcile L1A = L2A = L3A without invoking wholesale transfer
  - What is accessible in L2A is the *repository*
  - What is accessible in L3A is the *repository*

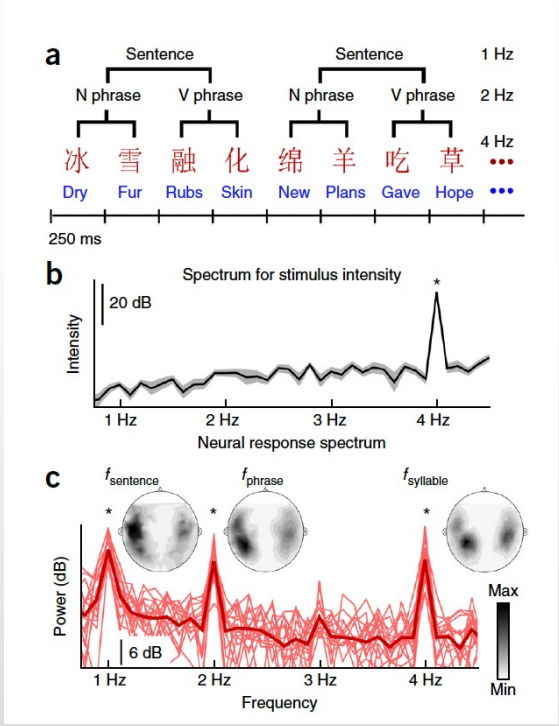
L3 PHILOSOPHY

- Let's come back to the phonology/phonetics question from a different perspective:
- The familiar mind/body problem
- As Chomsky said: the mind/body problem became intractable when Newton showed we couldn't define the 'body' so all we have left is *mind*
- But now we have 'force' particles and quantum physics so we can unify the two once again

- We don’t need to resort to dualism
- Mind can be *in* brain
- As Darwin (long ago) said: *thought is the secretion of brain*
- Can abstract phonological categories be in your multilingual brain?

CATEGORIES IN THE BRAIN

- Abstract constituents are neurologically real



Ding et al. (2015)

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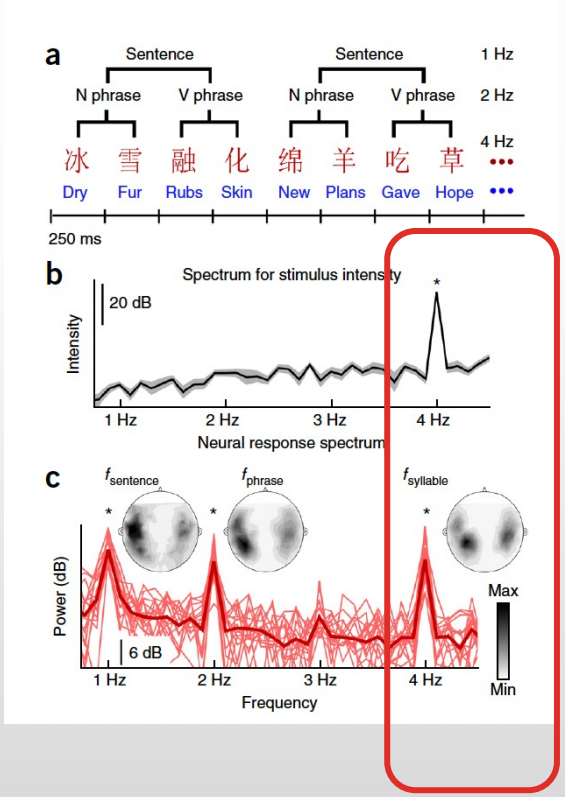
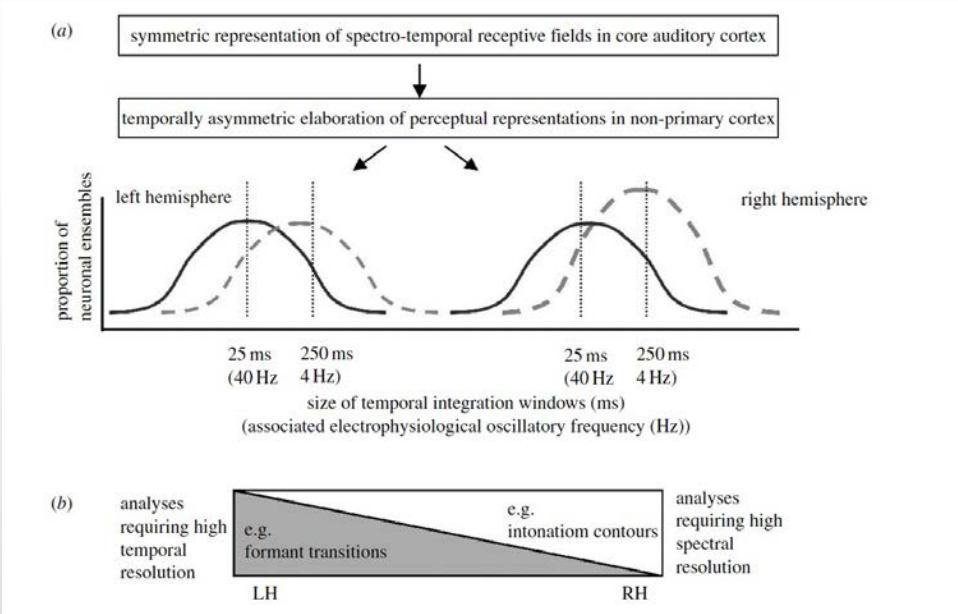


Ding et al. (2015)

CATEGORIES IN THE BRAIN

- Segments & syllables are neurologically real



Poeppel, Idsardi & Wasenhove, 2008

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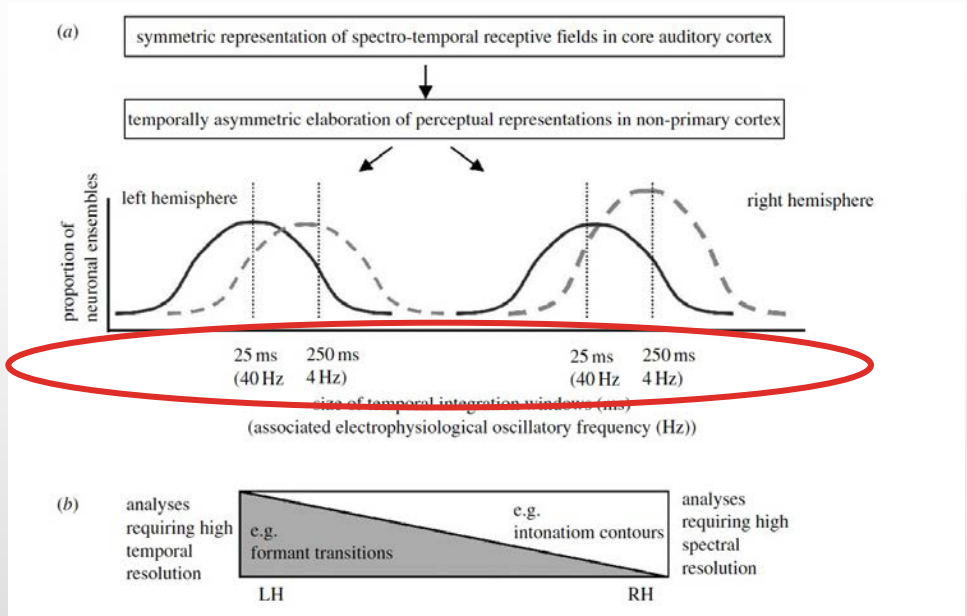

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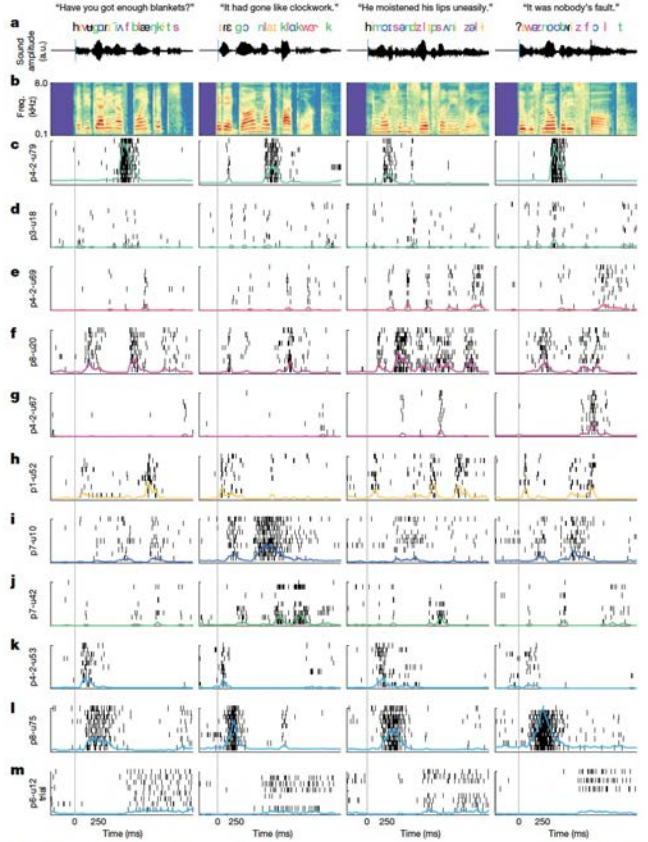
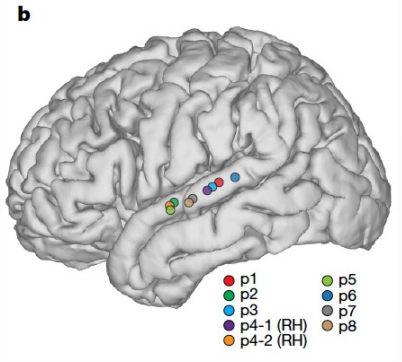
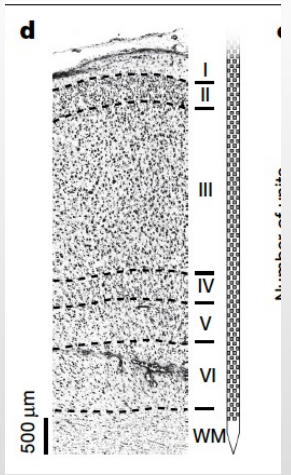
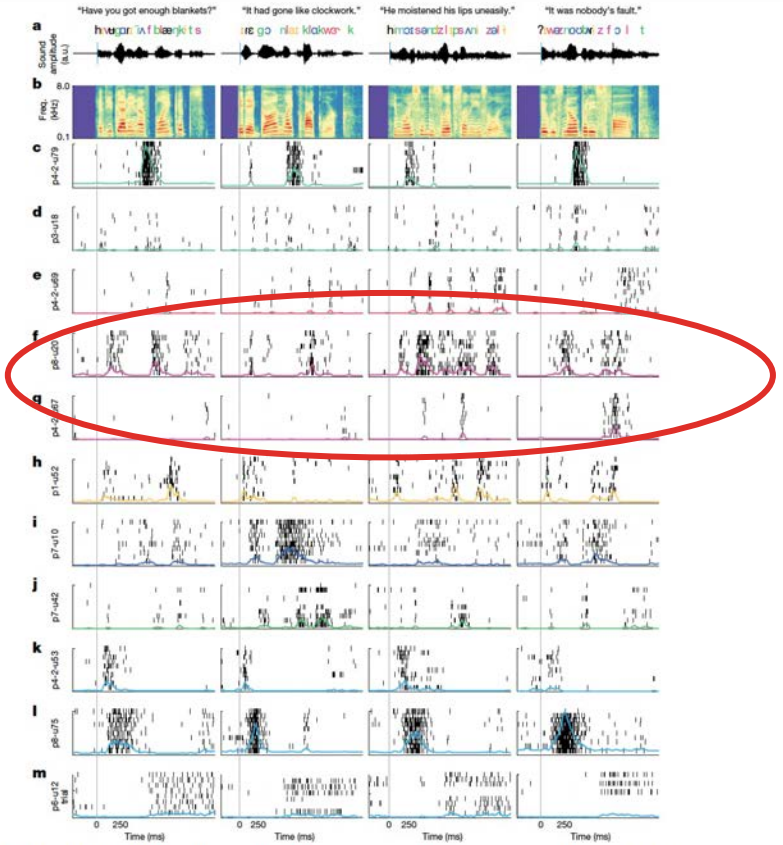


Fig. 2 | Single-trial rasters for example neurons show diversity of response types and tuning. a, Four example sentences with word- and phoneme-level transcriptions time aligned to the audio waveform. Phoneme/feature colours correspond to example units in **c**–**m**, which were labelled by hand for visualization purposes. **b**, Acoustic spectrogram of speech stimuli. Rasters for each neuron and sentence. Rows correspond to the number of repeats for that neuron and sentence. Coloured lines are the smoothed (50 ms window) PSTHs across trials. **c**,**d**, Two examples of neurons responding primarily to nasal sounds (for example, /m/, /n/). Note that even similarly tuned neurons can have very different spiking properties (for example, primarily bursting (p4-2-u79) versus sparse firing (p3-u18)). **e**, Neuron responding primarily to approximant sounds (for example, /l/, /r/, /w/). **f**,**g**, Two examples of neurons that are selectively responsive to fricatives (for example, /s/, /z/, /f/). **h**, Neuron selectively responsive to high/front vowels (for example, /i/, /ɪ/). **I**, Neuron primarily responsive to low/back vowels (for example, /a/, /ʌ/, /ɔ/). **J**, Neuron primarily responsive to plosives (for example, /b/, /d/, /g/, /p/, /t/, /k/). **k**–**m**, Neurons responsive to sentence onsets. Some units show increased firing at onset (**k**,**l**), whereas others show delayed firing (**m**). a.u., arbitrary unit.





Leonard et al. (2023)



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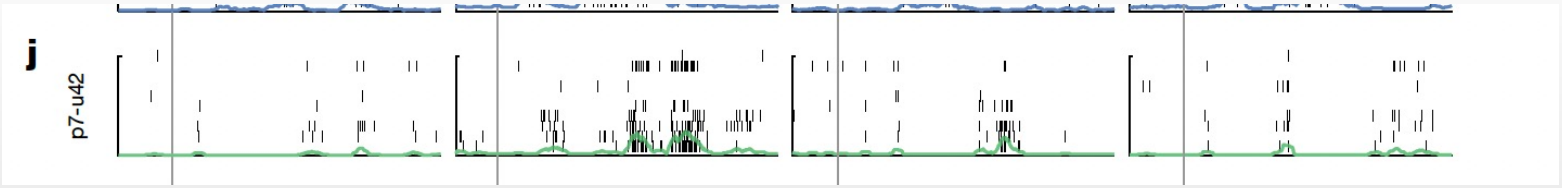
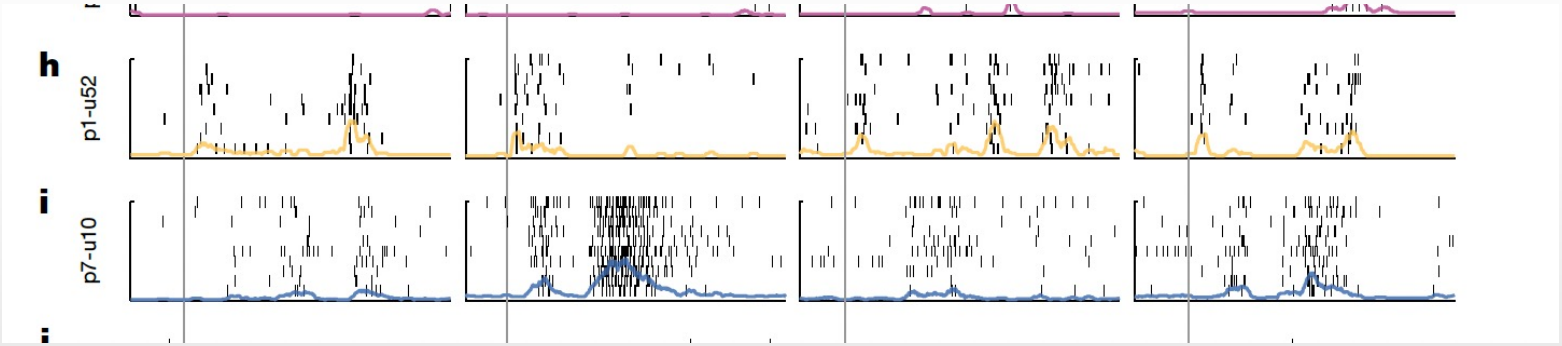
Neurons which respond to fricatives

Leonard et al. (2023)

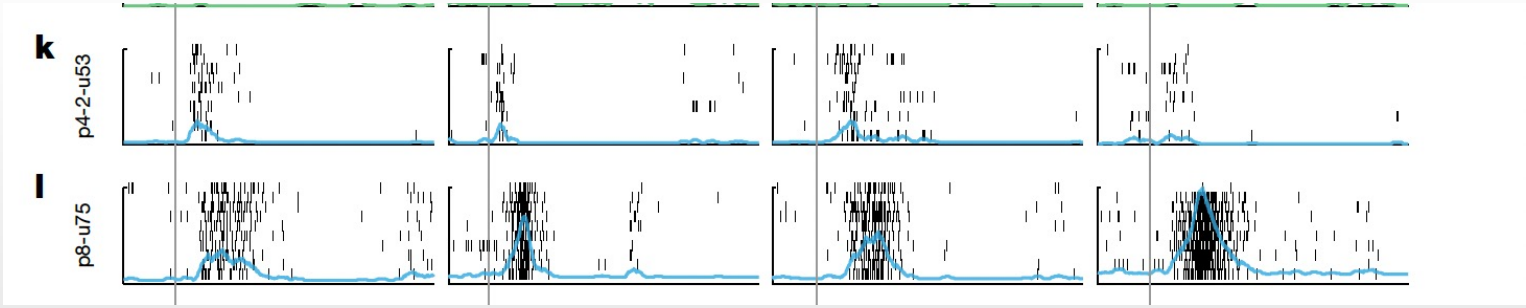
Different neurons which respond to stops



Different neurons which respond to high vs low vowels

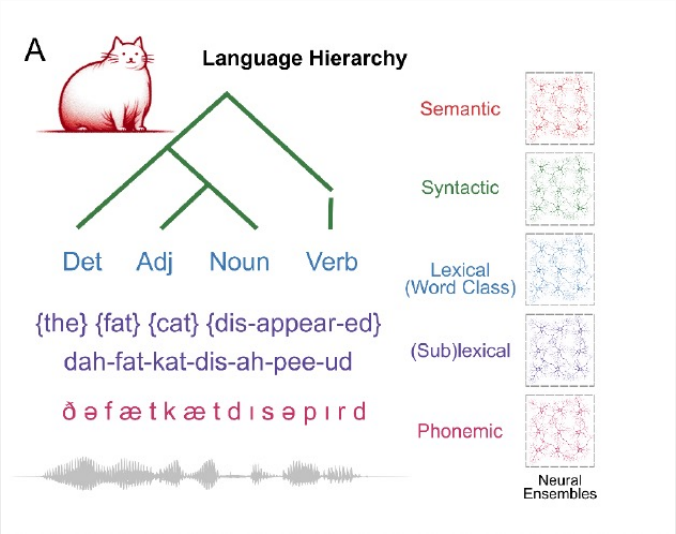


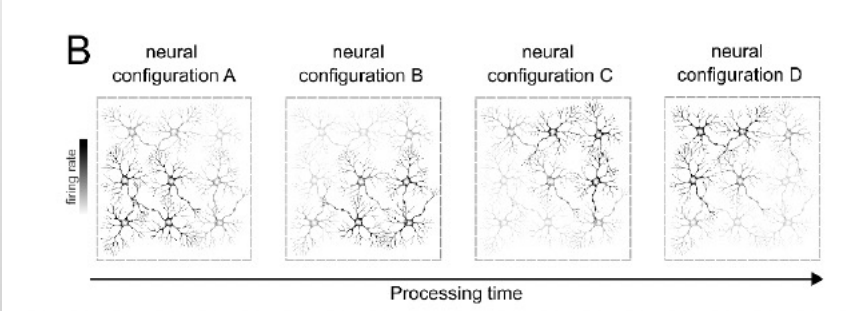
Different neurons which respond to time from stimulus onset



This is key to integrating smaller units into larger ones.

HIERARCHICAL DYNAMIC CODING





Gwilliams et al. (2024)

HIERARCHICAL DYNAMIC CODING

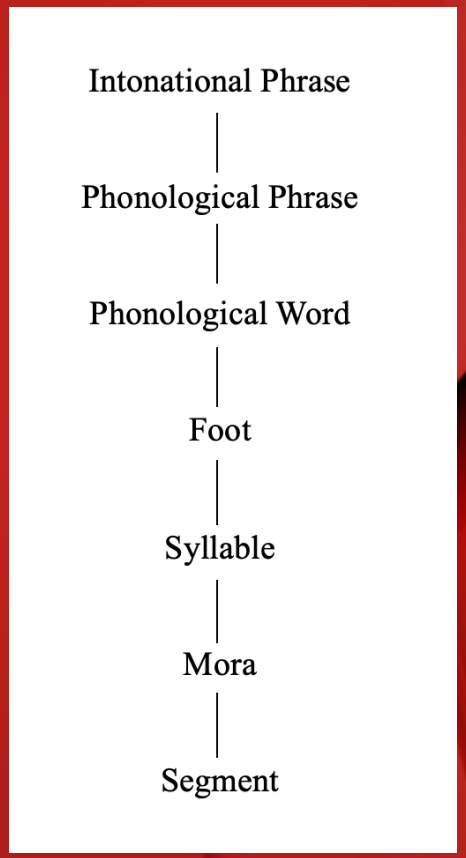
"HDC reveals how the human brain continuously builds and maintains a language hierarchy during natural speech comprehension, thereby anchoring linguistic theories to their biological implementations."

Gwilliams et al. (2024)

CONCLUSION

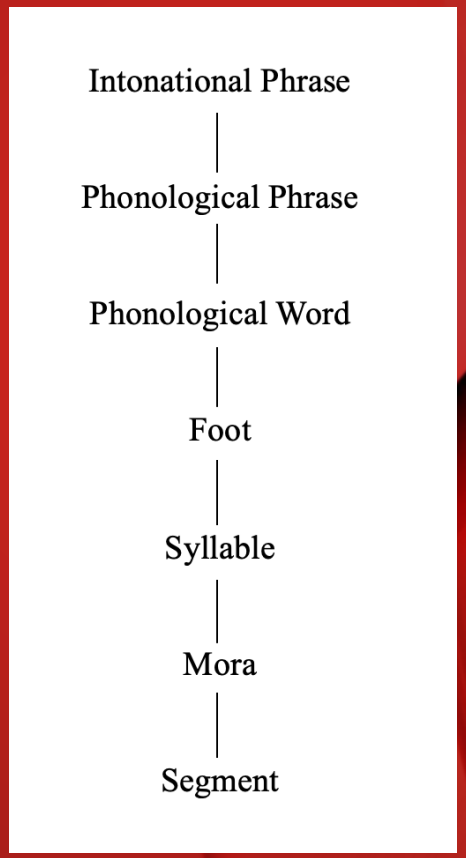
- The properties of
  - (a) phonological transfer,
  - (b) the target phonological grammar to be acquired, and
  - (c) the developmental stages,

- are abstract, hierarchical, algebraic, recursive, mental representations



CONCLUSION

- These representations:
  - Help listeners understand syntactic constituency
  - Disambiguate syntactic ambiguity
  - License syntactic properties (WH in situ)
  - Govern phonological uniformity in codeswitching
  - Guide accurate stress placement
  - Constrain novel word formation
  - Influence the perception of illusory vowels
  - Define the notion of *weight*
  - Determine the contrastive elements in minimal pairs



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  - Determine the contrastive elements in minimal pairs
- *That's* why you buy a phonology

CONCLUSION

- These representations are
  - influenced by innate, input, and domain-general factors
  - encoded in our brains to invoke contrasts in meaning which are mapped on to gesture or sound
- That's 'all' we need to explain in L3 phonology

CONCLUSION

- These representations are
  - influenced by innate, input, and domain-general factors
  - encoded in our brains to invoke contrasts in meaning mapped on to gesture or sound
- That's 'all' we need to explain in L3 phonology

- The final word goes to Hayao Miyazaki….

"Many of the things that seem impossible now will become realities tomorrow."

— "Howl's Moving Castle"

Thank you.

Come for the phonology, stay for the dinner.

johnarch@uvic.ca

https://onlineacademiccommunity.uvic.ca/johnarch/

REFERENCES

SHAMELESS PROMOTION

Formal Approaches to Multilingual Phonology

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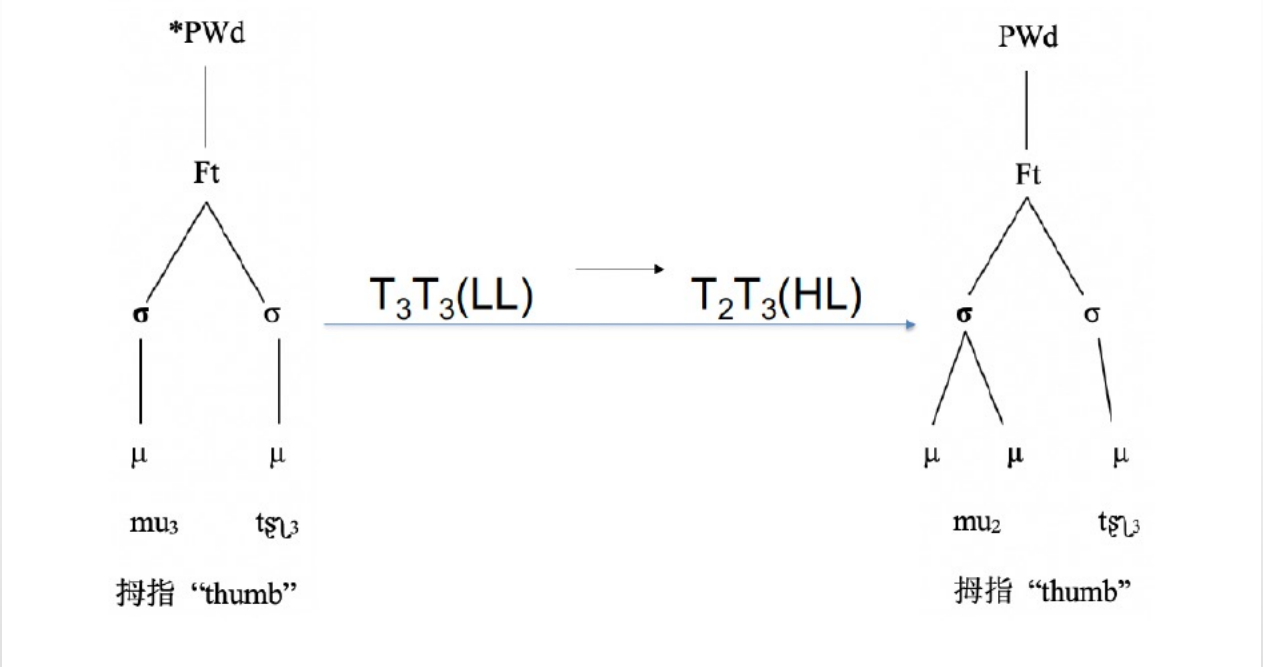
L3 TONE

- Tone sandhi (Deng & Archibald, 2023)
- When the L1 becomes the L3 (Polinsky, 2015)
- HL ‘advantage’?
- Comparing L2 Mandarin, with HL Mandarin with HL Cantonese learners on sandhi and non-sandhi words
- Cantonese lacks tone sandhi and foot structure
- Comprehensibility scores (20 raters)

L3 TONE



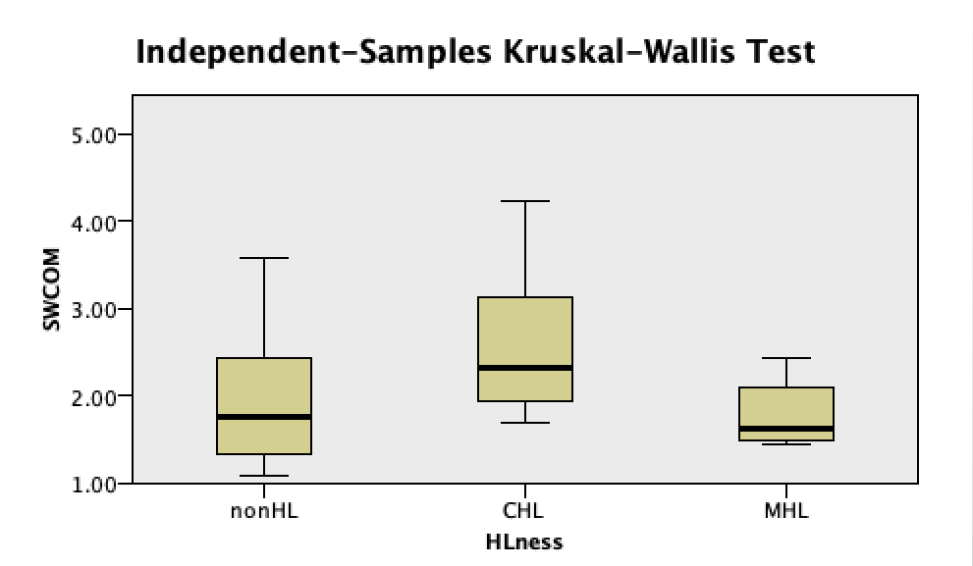
T3 tone sandhi

L3 TONE

- The three groups were equal on non-sandhi words
- But they were significantly different on sandhi words (below)

Less comprehensible

More comprehensible



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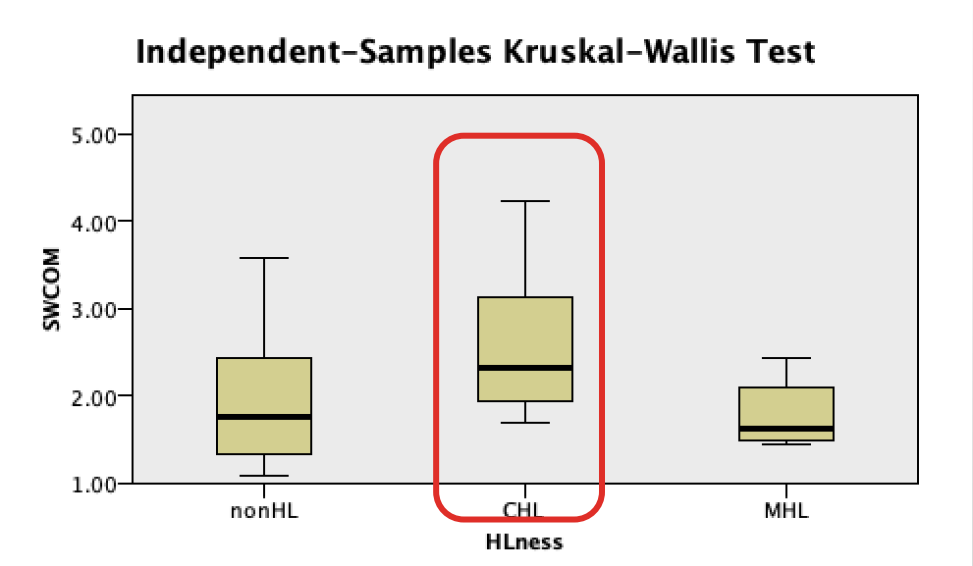


L3 TONE

- The Cantonese HLs were significantly less comprehensible than the L1 English participants
- This is a property-by-property effect not typology in that foot structure seems to trump familial relatedness

INTEGRATED PHONETIC IMPLEMENTATION

- The empirical studies on L3 rhythm provide some nice evidence that the interface is a beach (not fence or transducer)
- An integrated, property-by-property phonetic interface too

L3 RHYTHM

(1) L1 German/L2 English

(2) L1Turkish/L2German/L3 English

- German & English are both stress-timed, while Turkish is syllable-timed

- RQ: will Turkish HL rhythm adversely affect the L3 English rhythm?

Domene Moreno & Kabak (2023)
(see also Brown & Chang, 2023)

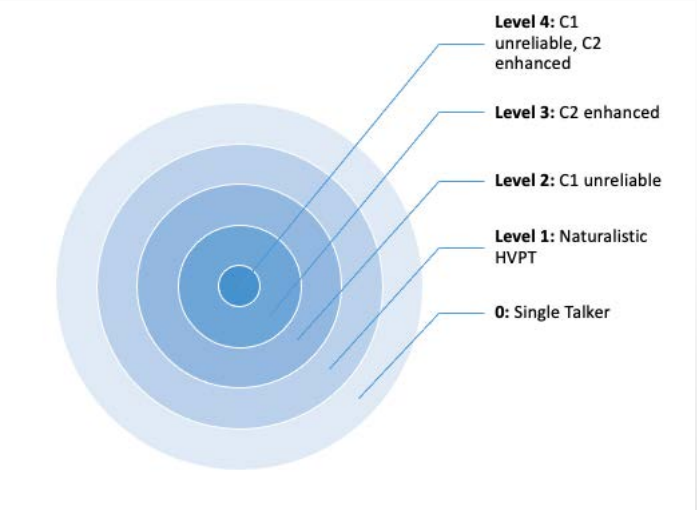
L3 RHYTHM

- in the English task, the HL bilingual group and the monolingual group differed significantly for all durational metrics but none of the pitch metrics
- “In summary, we are dealing with property-by-property …. transfer in L3 phonology wherein the source of transfer is selected due to universal as well as language-specific attributes.”
- “This gives further support to the notion of an integrated multilingual language system with interconnected linguistic subsystems.” (López, 2020)

IMPLICATIONS

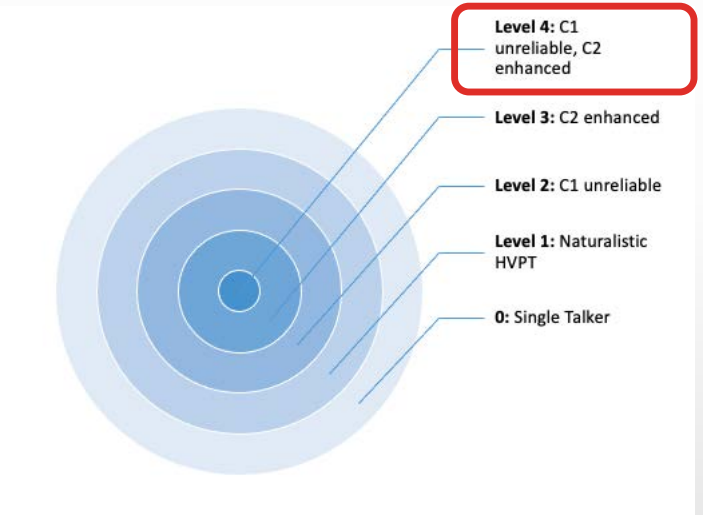
- this raises interesting questions about cue-based work (e.g., Chang, 2016; Kim & Tremblay, 2021) and how it applies to L3A
- Connects to the training literature too

CUE REWEIGHTING



Hayter & Archibald (2022); Harmon et al. (2019)

CUE REWEIGHTING



Make L1 cue unreliable and enhance L2 cue

Hayter & Archibald (2022); Harmon et al. (2019)

REDEPLOYMENT FINE-TUNED: WITHIN A DOMAIN

•redeploying phonological features different than phonetic features (Martinez et al., 2023)

REDEPLOYMENT FINE-TUNED: ACROSS DOMAINS

- Sometimes features are shared across domains
- [COR] on V-Place or C-Place (Trommer, 2021; Archibald; 2022; Özcelik & Sprouse, 2017)
- plural allomorphy & vowel harmony

REDEPLOYMENT FINE-TUNED: ACROSS DOMAINS

- Redeployment across domains is possible:
- L2 inflectional morphology (Austin et al., 2022)
- but takes more time (Martinez, Goad & Dow, 2023)

REDEPLOYMENT FINE-TUNED: ACROSS DOMAINS

•utterance-level pitch to lexical level tone (Braun, Galts & Kabak, 2014)

REDEPLOYMENT FINE-TUNED: INTEGRATED I-GRAMMAR

- L3 English German has properties of both L1 Dutch and L2 German (Simon & Leuschner, 2010)