Probing Escher's Problem in L2 Phonology: the Grammar of Illusory Vowels

Dr. John Archibald,
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UVic Cognitive and Brain Sciences Group

- Thanks to Marziyeh Yousefi & Amjad Alhemaid for their collaboration

Second Language Acquisition

- What is to be acquired?
- What transfers from the L1?

L1 → Interlanguage ← L2

- We treat languages as subjects
- We look for global uniformity and local variation in their behavior
- We seek *explanations* for their behavior
- We do this for interlanguage grammars too

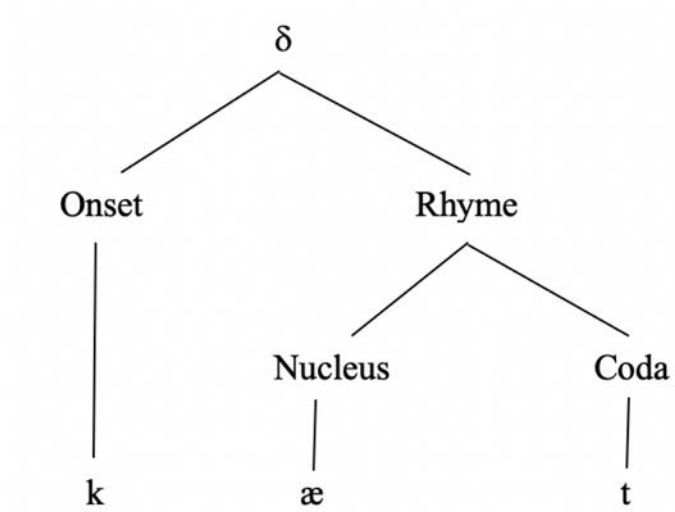
Today's Languages

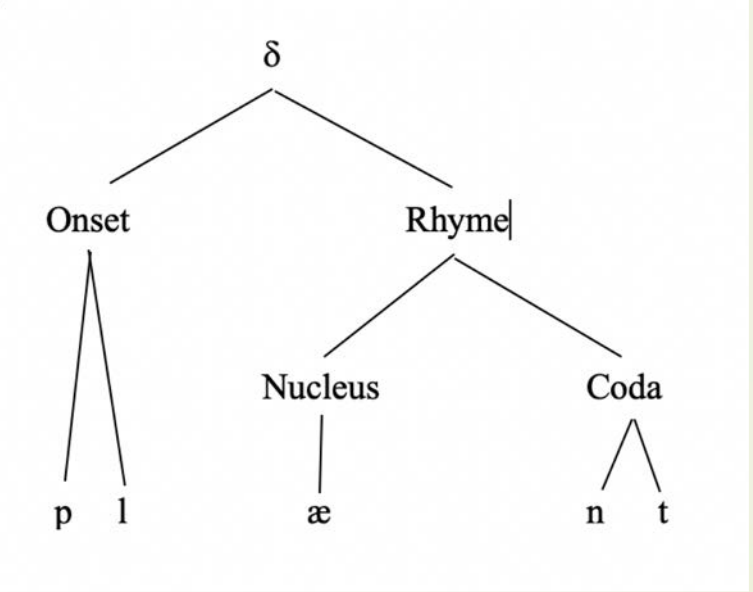
- L2 = English
- L1 = Japanese
  Thai
  Brazilian Portuguese
  Persian
  Arabic
- Which languages will group together?

Consonant Clusters in SLA

- Today, we will focus on the sequences [sl], [sn] and [st]
- This controls for place of articulation. All of these clusters involve only alveolar consonants, and this allows us to categorize them on the single dimension and avoid confounds of place of articulation

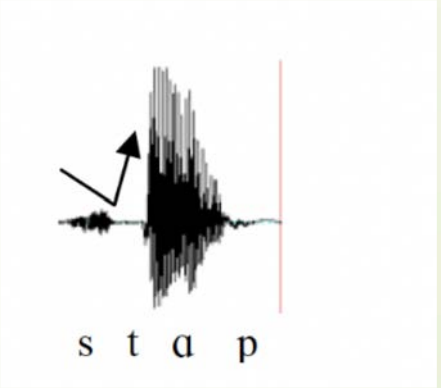
Syllable Structure





S + C Clusters

- Often behave differently than other consonant clusters
- E.g. different epenthetic patterns if the L1 does not allow consonant clusters
  - 'try' [tiraj]
  - 'sweater' [iswɛtər]
- Violate Sonority Sequencing Generalizations

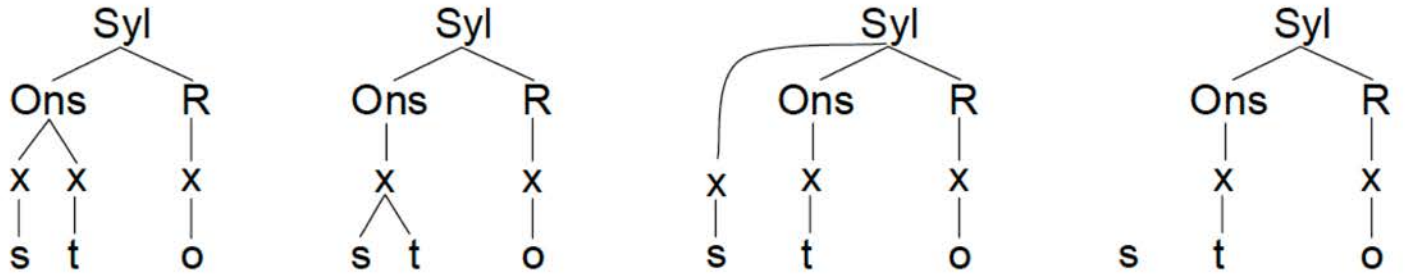


English Left-Edge Representation

From Cardoso (2007)

(7) The syllabification of onset clusters: Four analyses

a. Branching Onset b. Complex Segment c. Adjunct d. Extrasyllabic (Appendix)

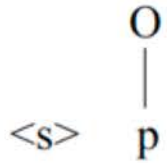


English Left-Edge

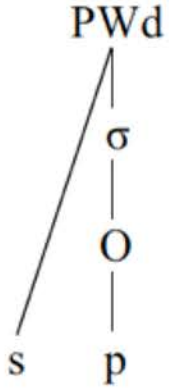
From Goad (2016)

(10) Expanded options:

a. Extraprosodic:



b. Licensed by PWd:



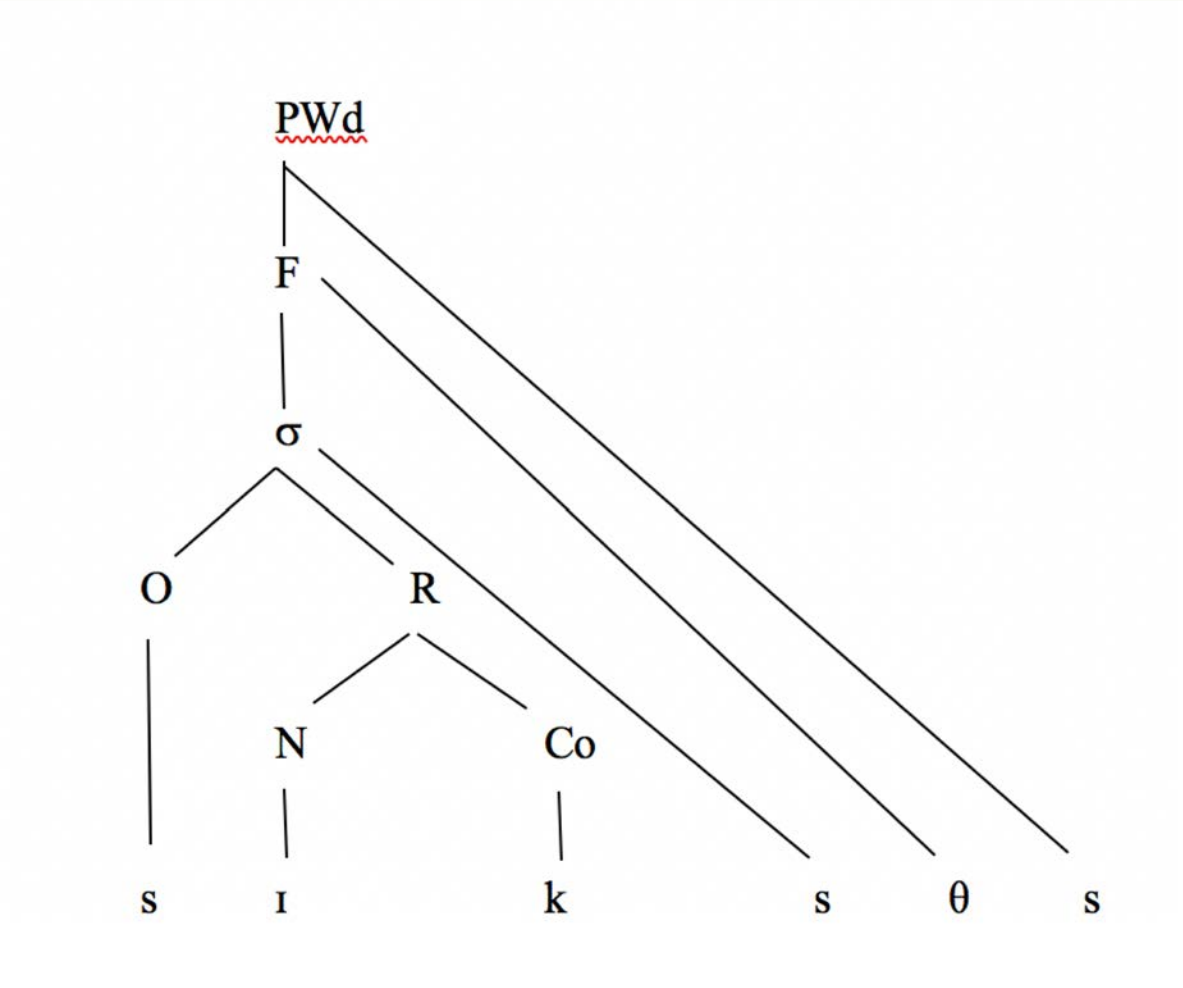
c. Licensed by σ:

d. Coda:

No Branching Codas

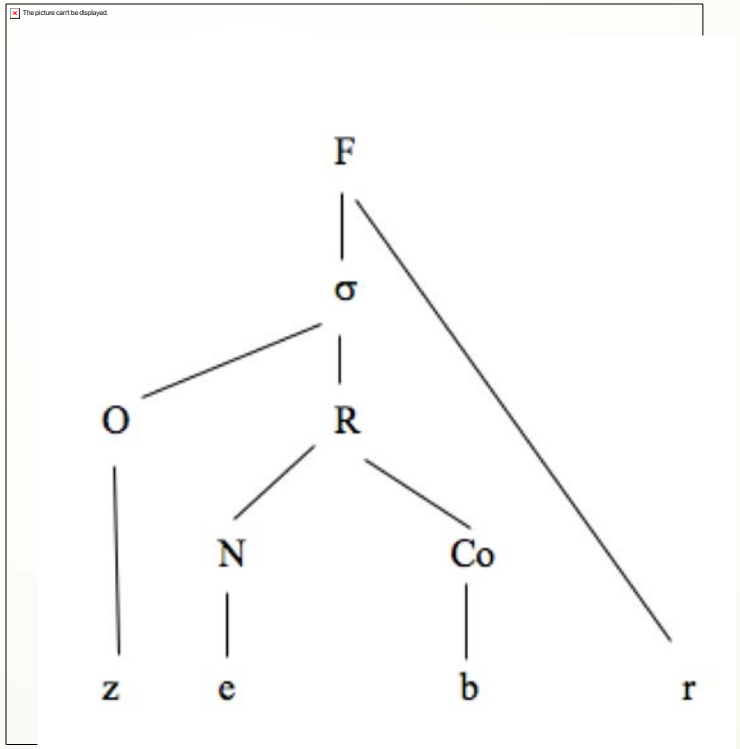
- But many phonological theories do not sanction branching codas (Golston & Kehrein (2004); Kiparsky (2002); Vaux & Wolfe (2009); Watson, J. (2007)
- So, let us explore our theoretical account

English Right-Edge Appendices

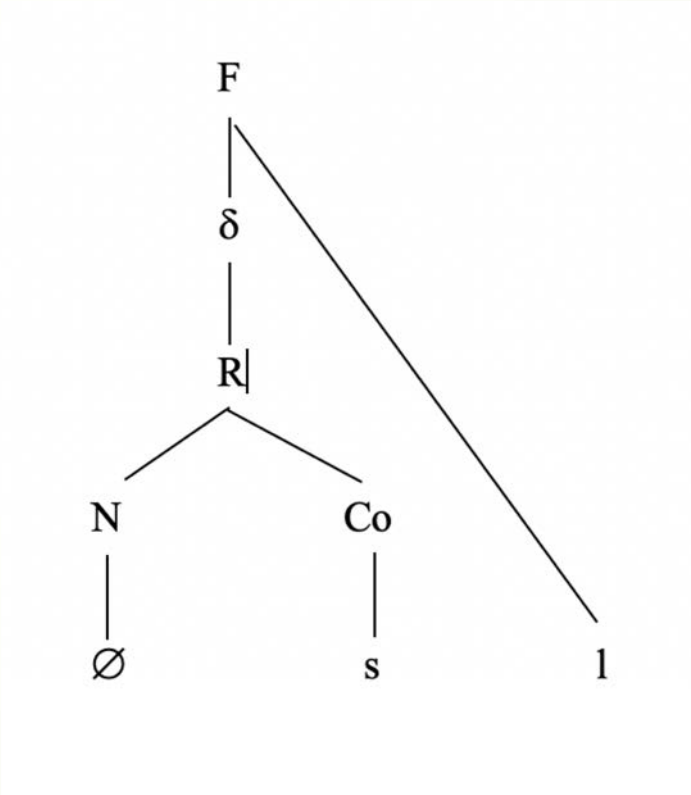


Persian Right-Edge Appendices

- Persian syllables have maximally two C's at the right edge; thus, an appendix



L2 S-Clusters Word-Initially



Illusory Vowels

- Studies from a number of L1s (**Japanese** - Dupoux; Matthews & Brown, **Korean-** Kabak & Idsardi, **Brazilian Portuguese** – Cardoso; Cabrelli Amaro) reveal perceptual illusions
- In production, subjects insert an epenthetic vowel between the obstruents
  - baseball → basubaru
  - strike → suturiku
- Japanese: does not allow obstruent consonantal sequences word medially:

  *ac.tor

- But this happens in *perception* too
- When exposed to a string like [ebzo], the Japanese subjects *hear* [ebɯzo] whether or not there is a vowel present (Dupoux, et al. 1999): **Japanese** (72% illusory vowel) versus **French** (10% illusory vowel)

- **Thai** does not allow onset clusters either
- It *does* allow medial clusters (like 'ac.tor')
- But Thai (unlike Japanese) L1 subjects (since Thai allows medial obstruent strings) do *not* hear an illusory vowel medially (Matthews & Brown)
- When they are presented with [ebzo], they hear [ebzo]
- Kabak & Idsardi (2007) show that this phenomenon of vowel epenthesis is mediated by phonological structure (specifically *Coda*) not just by linear adjacency

sC Onset Perception

- There is a cottage industry looking at sC clusters in SLA (Carlisle; Yavas & Sommeilan, 2010)
- Brazilian Portuguese (Cardoso):
  - Does not allow sC clusters
  - Allows Obsruent + Liquid clusters (e.g. [br])
  - Allows maximally single C codas
- Both production and perception studies showed definite differential accuracy effects (and no ceiling effects):
  - Production: sl > sn > st
  - Perception: st > sl > sn

- The Brazilian Portuguese L1 subjects had difficulty (performing at chance) discriminating accurately between forms which began with:
  - sC and isC

(where [i] is the BP epenthetic vowel)

- The same is true in Thai (Imsri):
  - No sC onsets
  - No branching codas
- In *production*, they epenthesize to break up the sC:
  - spa → səpa
- In *perception* the advanced learners made 60% errors on discriminating sC strings from SVC strings
  - Even when correct, there were significantly longer RTs
  - And remember, they did fine on [ebzo]
- So this is mediated by *grammar*

Our Languages

- L1 = Persian or L1 = Arabic
- L2 = English

Persian

- Data from Yousefi (2017) suggest that Persian speakers (who also lack sC onset clusters) do *not* exhibit such perceptual illusions
- Even though they have been documented to epenthesize in production (Karimi, 1987; Yarmohammadi, 1995)

The Tasks

- Perception
- Production

Perception

- Identification Task
  - a forced choice identification experiment
- Discrimination Task
  - discriminate between /s/ and /es/ word-initially via an ABX discrimination task.

Identification

- 10 [st]; 10 [est]
- 10 [sn]; 10 [esn]
- 10 [sl]; 10 [esl]

- "Does the item you will hear begin with a vowel or a consonant?"

Discrimination

- An ABX discrimination task with 800ms ISI.
- 10 [st]; 10 [sn]; 10 [sl]

- "Is the 3rd sound you hear more like the 1st or the 2nd?"

- A comparison of the two tasks showed they did not behave significantly differently (p=.232) so the scores from the two tasks were combined.

Production Tasks

- **Formal Task**
- 29 sentences in all, the target clusters /st/, /sn/, /sl/ occurred 10 times for each cluster
- *Example: Instructions:* Read aloud the following sentences, please.

  Dan slept early today

Production Tasks

- **Informal Task**
- 12 pictures consisted of 3 words for each cluster (i.e. 3 /sn/, 3 /st/, and 3/sl/) as well as three distracters
- *Example*: Pictures of the item "slippers" and 'stars" in the informal production task.

- The tasks were not significantly different (p=.133)

The Subjects

- 20 NS of Persian

Data Patterns (Perception)

L1	sC Onsets	Branching Onsets	Branching Codas	Errors
Japanese	No	No	No	72%
Thai	No	No	No	60%
Brazilian Portuguese	No	Yes	No	50%
Persian	No	No	Yes	??
NA Arabic	No	Yes	Yes	??
HA Arabic	No	No	Yes	??

L1	sC Onsets	Branching Onsets	Branching Codas	Errors
Japanese	No	No	No	72%
Thai	No	No	No	60%
Brazilian Portuguese	No	Yes	No	50%
Persian	No	No	Yes	**14%**

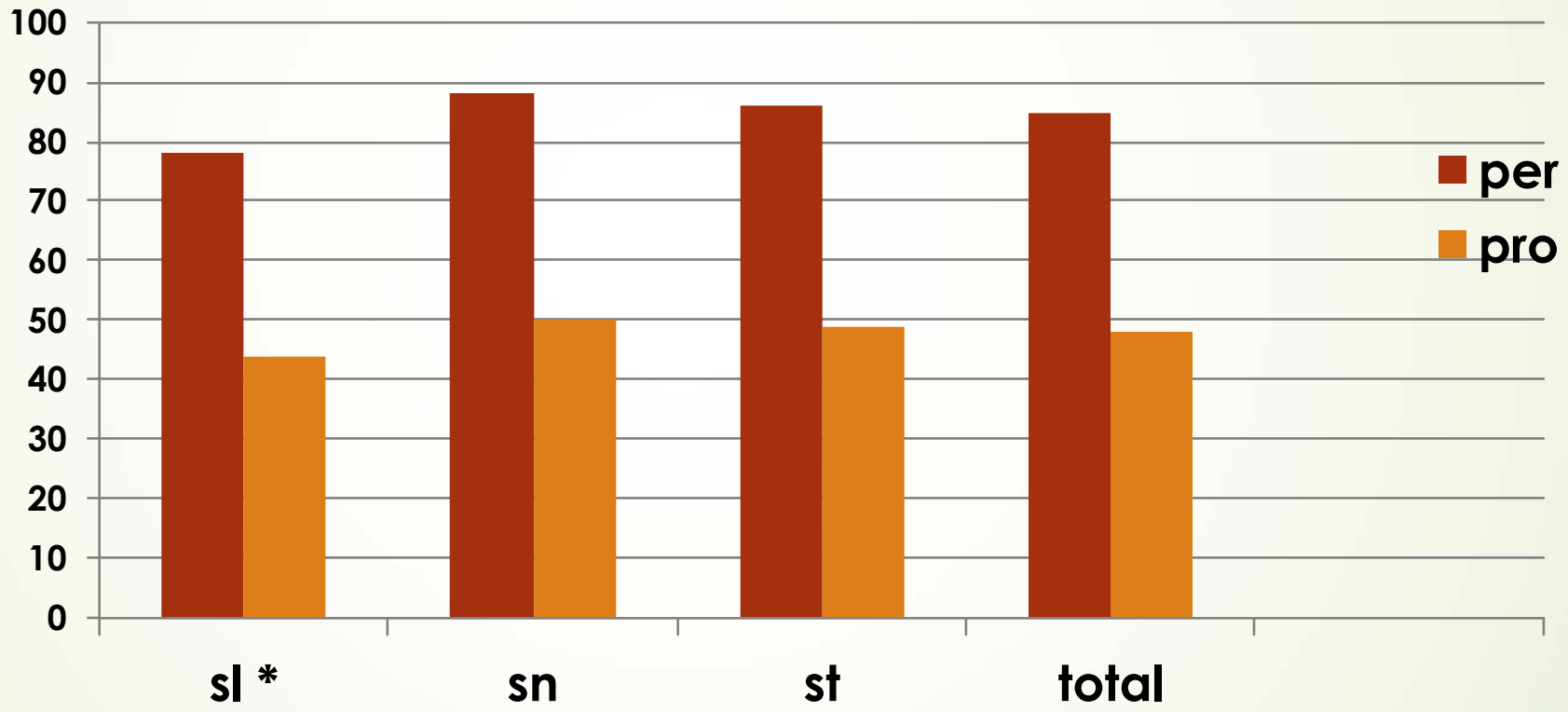
Persian

- Even the Beginner Persian students scored 75% *accuracy* (compared with Cardoso's BP Beginner's who performed at *chance*, and Matthews & Brown's (2004) Thai subjects who made 60% *errors*).
- Thus, we note that the Persian subjects are very accurate in perceiving the L2 sC onsets

Production

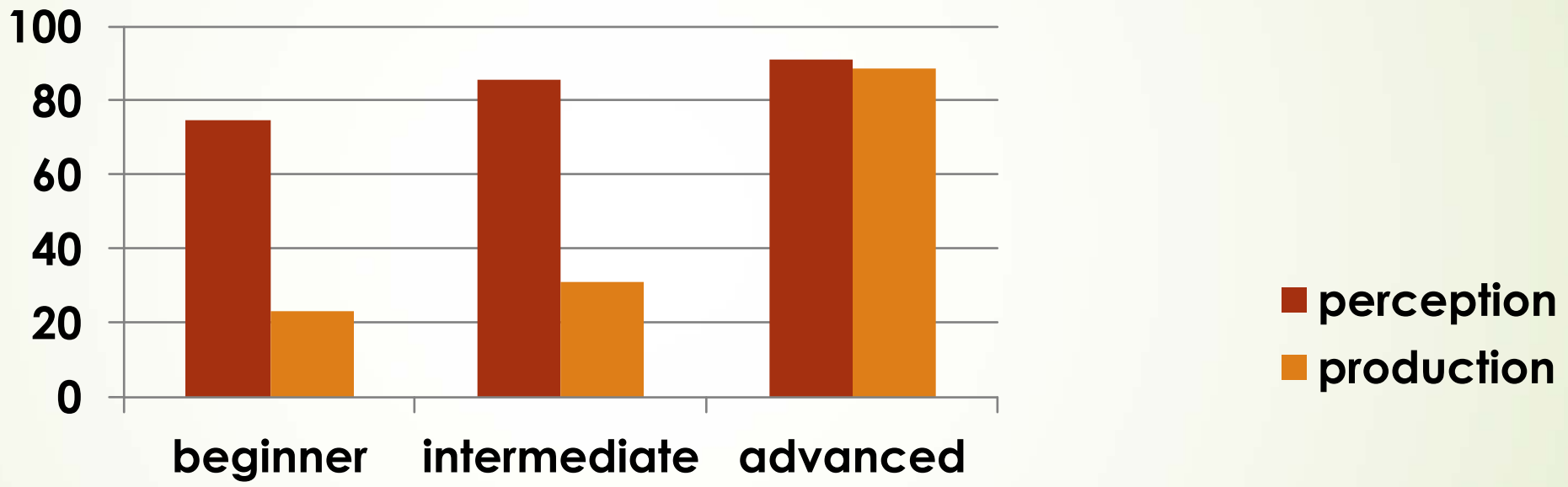
- Even though they perceive accurately, they still produce epenthetic vowels

Accuracy X Cluster Type



Note the very high accuracy rates in perception.

Accuracy X Proficiency



- Perception was significantly more accurate than production ($p=.004$), though they were correlated (Pearson $r = .536$).

Redeployment

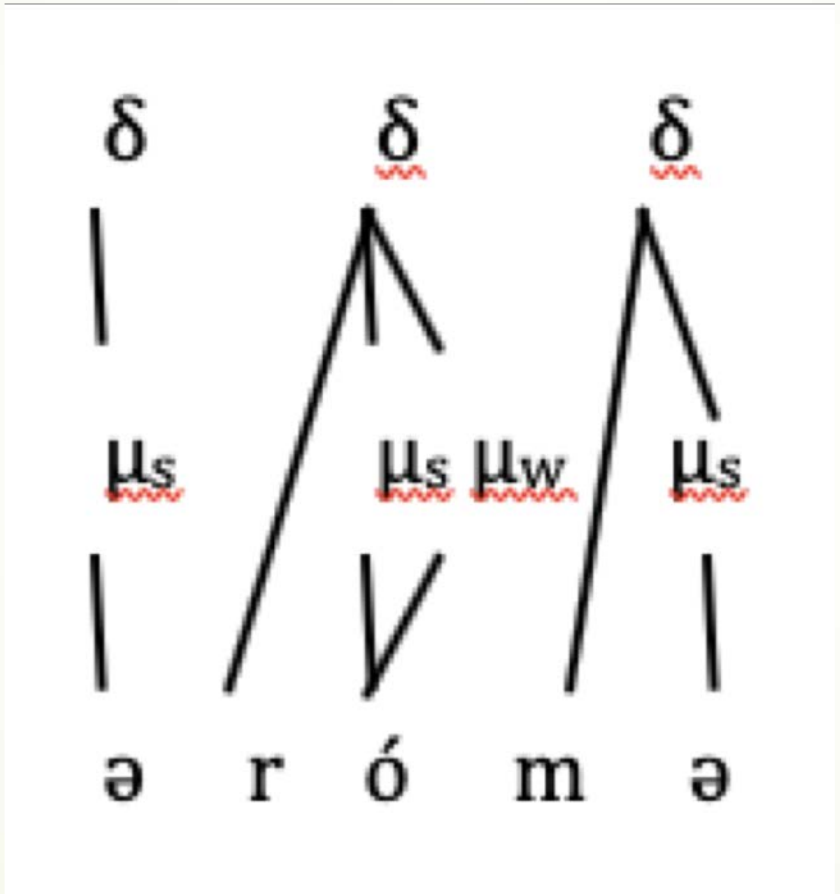
- Archibald (2005) for phonology, and Lardiere (2009) for morphosyntax demonstrate that L2ers can use L1 building blocks to assemble new L2 structures.

Redeployment

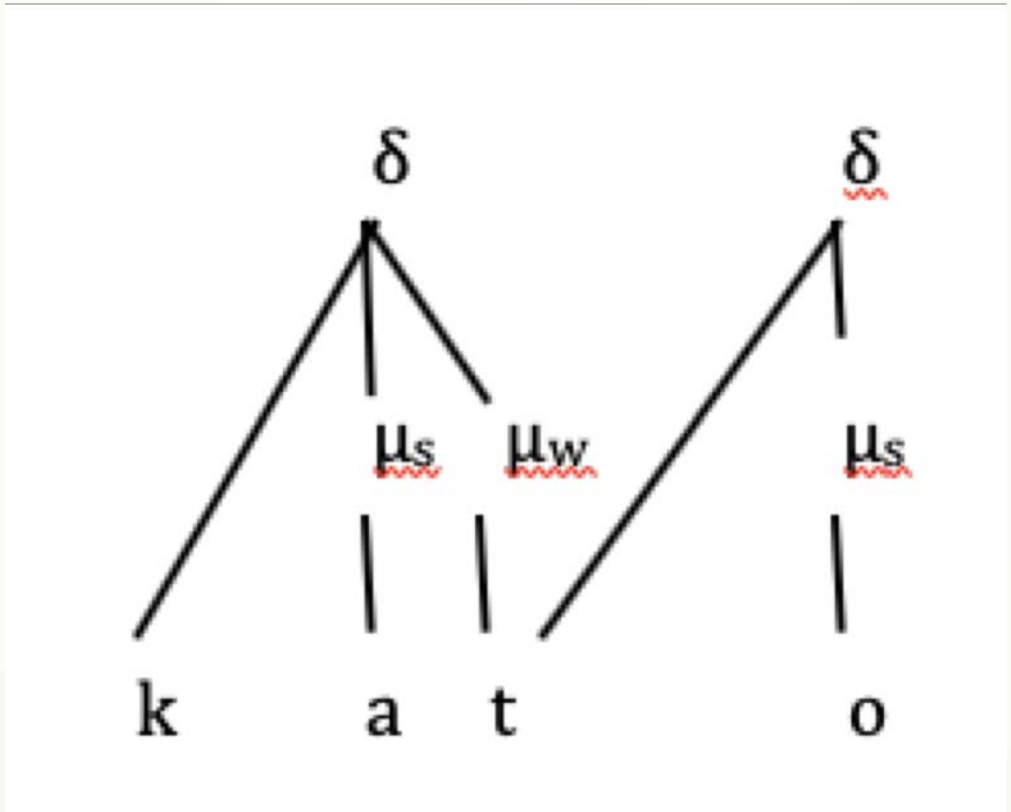
- E.g. English speakers can redeploy their L1 moraic structure used for stress, to acquire L2 Japanese geminates

- English tense vs lax vowels

English Quantity-Sensitivity



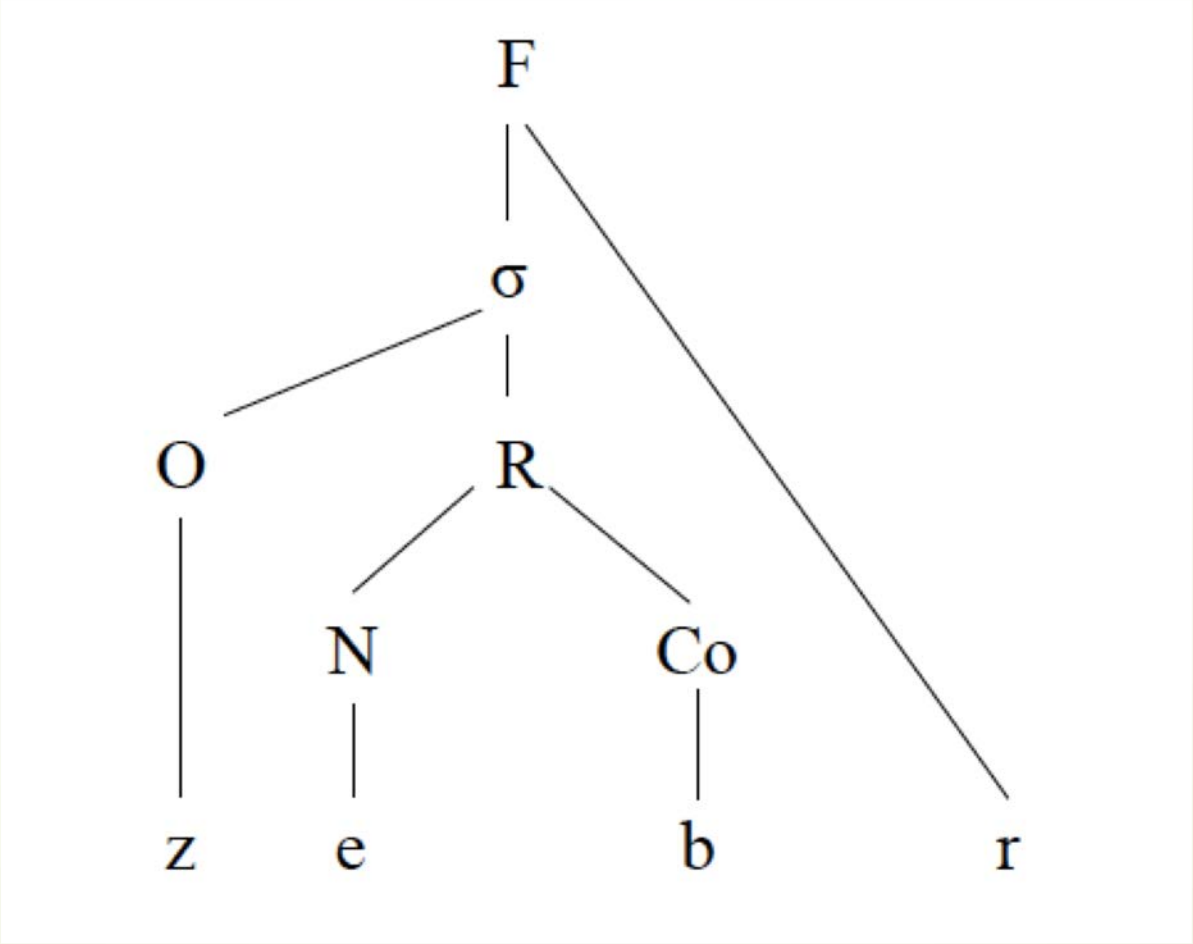
Japanese Geminates



- The Persian L1ers can redeploy their L1 right-edge appendix structure to the L2 onsets of English s+C sequences.

- Persian allows right-edge appendices which violate the Sonority Sequencing Principle (SSP) (in monosyllabic, monomorphemic forms) with *rising* sonority. Some examples are:
  - *xætm* 'funeral'
  - *qæbr* 'grave'

Persian Right-Edge Appendix



Arabic (Alhemaid, 2018)

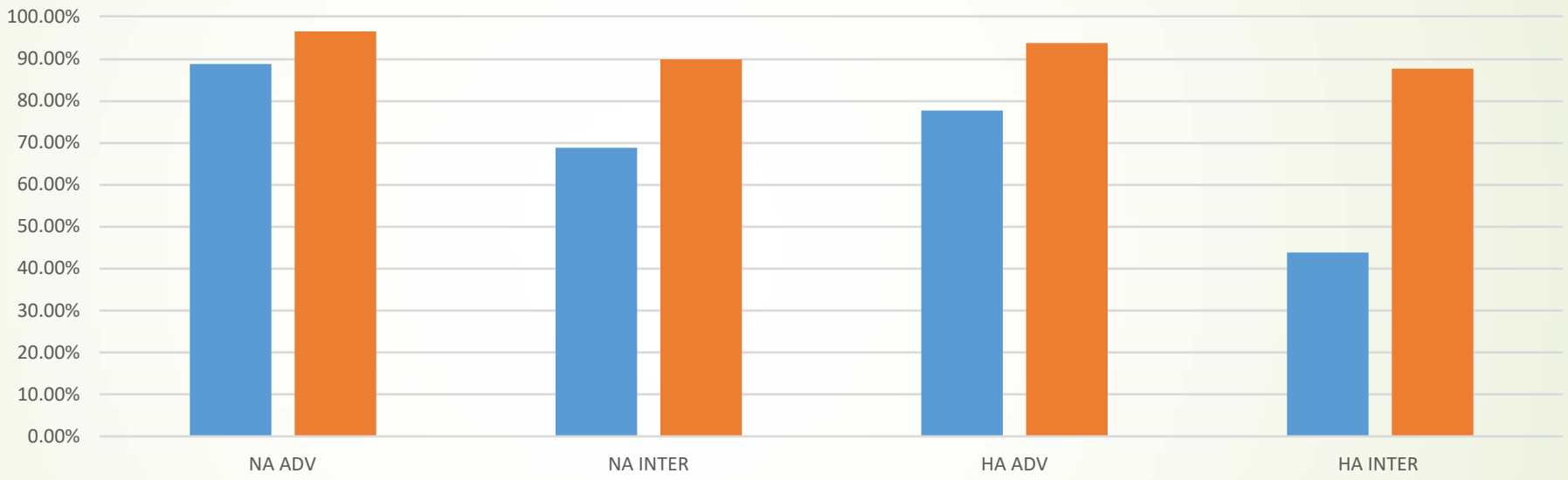
- Najdi (NA)
  - Both branching onsets and codas
    - [hm], [nt]
  - Appendices
    - [tf], [sn]
- Hijazi (HA)
  - No branching onsets
  - Branching codas
    - [nt], [lt], [nz]
  - Appendices
    - [km], [bl], [hr], etc.

- Both dialects allow right-edge clusters (branching codas –respecting SSP; and appendices – violating SSP)
- One dialect (Najdi) also allows branching onsets

Hypotheses

- If L1 branching onset transfer matters then the Najdi group should have an advantage
- If L1 appendix structure matters then the two groups should behave the same

Results



Blue = Production; Orange = Perception

- the HA group (whose L1 does *not* allow onset clusters) were not significantly different from the NA group (which does) in either production or perception.
- The results show that there is no evidence of an illusory vowel. Participants did not insert any vowel when performing the perception task.

Production

- Most interestingly, the production of participants at the advanced groups from both dialects was not statistically significant, (*U=2.50, p=. 114*).
- despite the fact that the HA group's L1 background lack branching onsets, the HA group were capable of accurately producing English onset clusters at the advanced proficiency level with high accuracy rate of (77.5%).

Data Patterns (Perception)

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Thai	No	No	No	60%
Brazilian Portuguese	No	Yes	No	50%
Persian	No	No	Yes	14%
NA Arabic	No	Yes	Yes	7%
HA Arabic	No	No	Yes	10%

'Initial' –s as Coda

- This structure explains why the sC clusters trigger prothesis while the [pl] (and all other) clusters trigger epenthesis (Fatemi et al., 2012; Fleischhacker, 2001; Karimi, 1987).
- E.g., p[e]lastic versus [e]smoke

Why the Cross-Linguistic Difference?

- the performance of all the subjects is explained, in part, via properties of their L1 appendix structure
- Japanese, Thai, BP transfer their L1 knowledge and do *not* have the building blocks (appendices) to handle sC onsets and the perceptual illusion of vowel insertion occurs;
- The illusory vowel is actually part of their stored representation

- But the Persians and Arabic subjects seem to be able to set up accurate underlying representations because of the appendix structure of their L1 grammar

- Persian and Arabic subjects *redeploy* their L1 knowledge of post-vocalic CC strings to their perception of L2 sC strings thus overcoming the perceptual illusion
- They learn *quickly* that the illusory vowels are not part of the stored representation
- They have appendices in their L1 and transfer this to the L2

Japanese/Portuguese vs Persian/Arabic

Japanese/Portuguese/Thai	Persian/Arabic
No appendices	Appendices
Epenthesis repair	Prothesis repair for [s]
	Epenthesis repair elsewhere

Japanese patterns

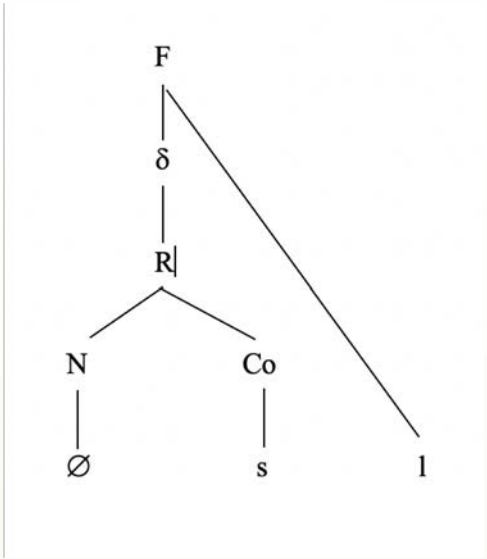
- sC = CC
  - festival -> fesutibaru
  - strike -> suturayku
- All epenthesis; no prothesis

Persian Patterns

- sC ≠ CC
  - spring -> espiring
  - smoke -> esmoke
  - floor -> filoor
- Prothesis & epenthesis

Coda [s]?

- Japanese doesn't allow [s] in codas
- Could this be what is causing the pattern?
- If they don't allow [s] in coda then they can't set up the structure:



Coda [s]

- But Brazilian Portuguese allows coda [s]
- So, that can't be the cause

- Not coda [s]
- Not branching onsets
- It's *appendices*

‘Hearing’ sC

- Who ‘hears’ sC sequences?
- L1s with appendices find English sC intelligible (Munro & Derwing, 1995)
  - Persian ≃ 85% accuracy; Arabic ≃ 95% accuracy
- L1s without appendices find them unintelligible; Japanese ≃ 28% accuracy; BP ≃ 50% accuracy
- Remember, none of them have sC sequences in the L1

Intelligibility vs Comprehensibility

- Intelligibility = accuracy
- Comprehensibility = response time

- (Munro & Derwing, 1996)

Intelligibility as *Parsability*

- Munro & Derwing refer to intelligibility of L2 speech as the property of allowing the listener to recover the target lexical item
- However, intelligibility is not a property only of the signal
- It is the result of the listener *parsing* the input

Intelligibility as *Parsability*

- we can place intelligibility within the context of lexical processing and spoken word recognition; hence *parsing*
- So, Persian and Arabic ears parsing sC strings will do different things than Japanese or BP ears parsing sC strings
- The sC strings are intelligible (i.e., parsable) to Persian/Arabic L1 subjects
- (see Archibald, 2003, 2004 for more details on phonological parsing)

Summary & Conclusions

- Even L1s with CC Onsets can have difficulty perceiving English sC sequences
- Yet L1s with right-edge appendices (and no CC initial strings) are able to accurately perceive L2 English sC initial sequences
- The accuracy is explained is the L2 target is a coda+appendix string with a null nucleus as the potential site for a prothetic vowel in production
- The construct of intelligibility can be rethought within parsing theory and models of spoken word recognition

Thank you

johnarch@uvic.ca

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Future Predictions

- Gonzalez (2004) argues that Spanish has a Foot-level appendix for [s] at the right edge.
- This predicts (for us) that Spanish PERCEPTiON of sC onsets should be good - is it?