The Acquisition of L2 Laryngeal Features: The Processing of Robust Transitional Phonetic Cues

Dr. John Archibald, Department of Linguistics, University of Victoria

University of York Workshop on Second Language Phonology July 2012

Introduction

Wright (2004:35) defines a perceptual cue as "information in the acoustic signal that allows the listener to apprehend the existence of a phonological contrast." A number of recent studies show that L2 learners are initially more sensitive to transitional release cues than to internal cues in the acquisition of sounds which are not built on L1 features. The processing of these robust cues sets the stage for the developmental paths observed in the acquisition by delimiting the set of sounds which become intake to the processor. L2 grammars illustrate harmony as faithfulness to the intake.

L2 Grammars: Harmony-As-Faithfulness

•Following Howe & Pulleyblank (2004) optimal grammars are characterized by Harmony-As-Faithfulness. Perceptually-motivated hierarchies are best captured in this way (rather than via markedness scales). Deviations from input are optimal when perceptability is minimal. Preserve more robust contrasts.

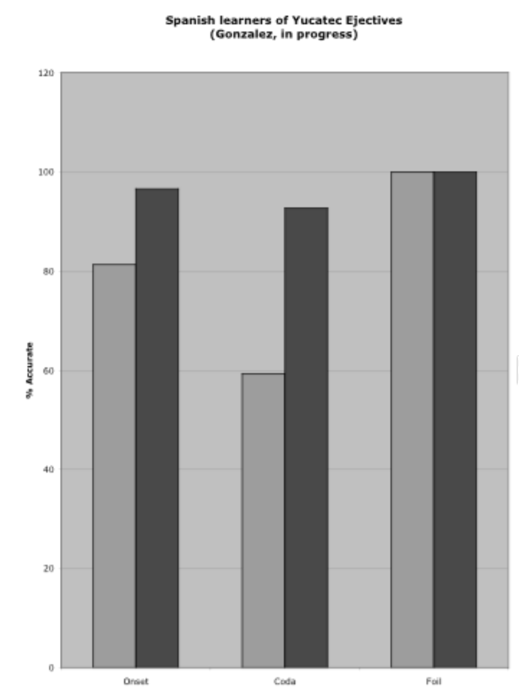
•Vanderweide (2005) proposes a family of release constraints to operationalize cue robustness in child cluster acquisition. Faithfulness constraints are based on release cues in this domain.

$\text{FAITH}(A_0/\_V) \gg \text{FAITH}(A_f/\_V)$

•Thus, pre-vocalic plosives are more harmonic than pre-vocalic fricatives. Let's explore the family of plosives in more detail.

Case #1: L2 Yucatec Mayan Ejectives

•Gonzalez (2011) shows that NS of Spanish (*[constricted glottis]) can acquire Yucatec Mayan ejectives ([constricted glottis]) via both discrimination (AX; ISI = 1000ms) and lexical selection tasks. NNS are nativelike in onsets but not in codas.



•Transitional release bursts explain the developmental paths observed within these sequences.

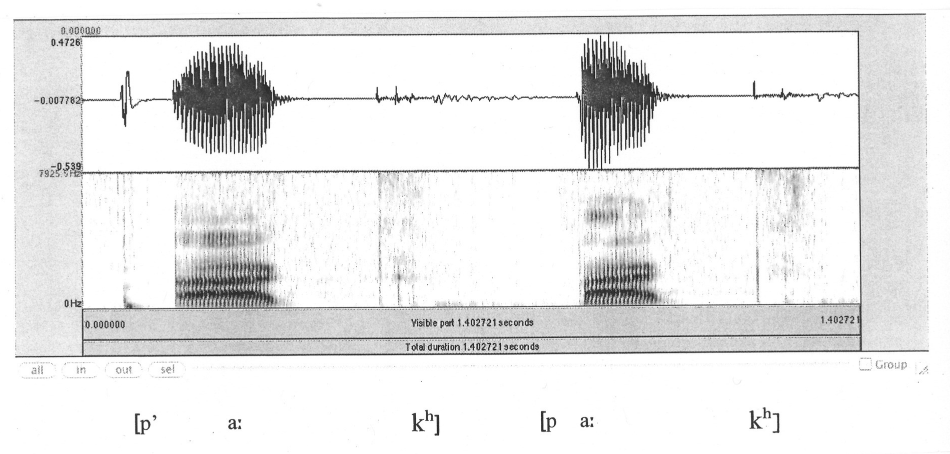
Onset: p' > k' > t', tʃ' > ts'

•$\text{FAITH}(A_0'/\_V) \gg \text{FAITH}(A_f'/\_V)$

Coda: tʃ' > ts' > k' > p' > t'

•$\text{FAITH}(A_f'/\_V) \gg \text{FAITH}(A_0'/\_V)$

•Release bursts - grounded typologically and phonetically - govern the acquisition sequence, and account for onset/coda asymmetries.



[p' a: kʰ] [p a: kʰ]

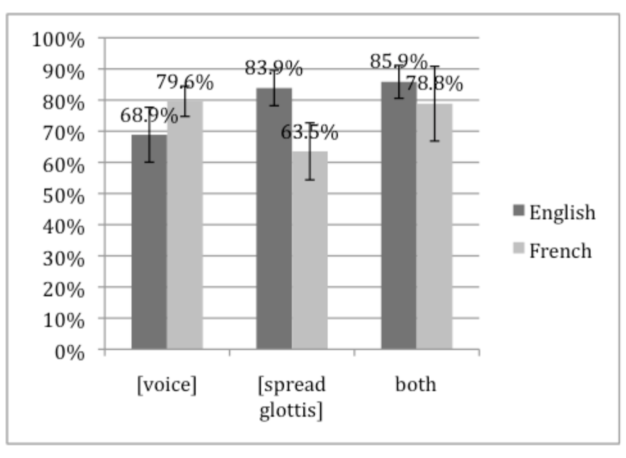
•Perceptual accuracy paves the way for grammar restructuring and the phonologicization of [constricted glottis]. *Ejective release cues the underlying feature.*

•As with Vanderweide, Gonzalez argues that perceptual saliency drives the demotion of markedness constraints. Ejectives are robust due (in part) to their dual release bursts (oral & glottal).

Case #2: L2 Hindi Voiced Aspirated Stops

•Jackson (2009) looks at the perception of Hindi murmured stops by NS of English and French.

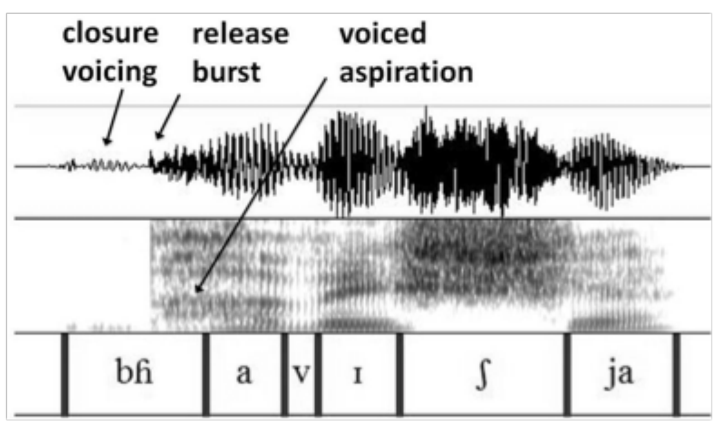
•An ABX task (ISI = 1500 ms) reveals the following accuracy scores:



•French subjects performed significantly better than English subjects on contrasts which differed by [voice] alone. English subjects performed significantly better than French subjects on contrasts which differed by [spread glottis] alone (see Iverson & Salmons, 1995).

•Both language groups, though, were unexpectedly sensitive to the properties of the voiced, aspirated stops (including the pre-vocalic component with both periodic vibration and turbulent noise, i.e. voiced aspiration).

•Jackson (2011) probes what phonetic properties might be relevant here. In a synthesized discrimination task, both the release burst and the pre-vocalic voiced aspiration (transitional cues) were attended to by the English listeners. Closure-voicing duration (an internal cue) was not attended to as accurately by the NNS, though it was an important cue for NS of Hindi.

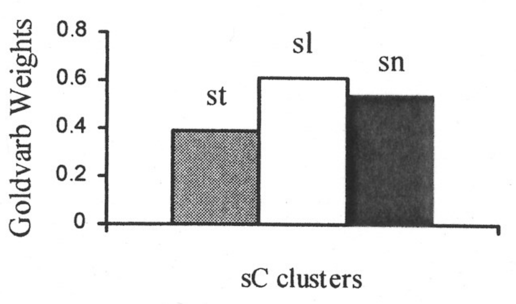


Case #3: L2 Consonantal Sequences

Release burst (a transitional cue) also accounts for the accuracy patterns described in the acquisition of consonant clusters by Brazilian Portuguese learners of English.

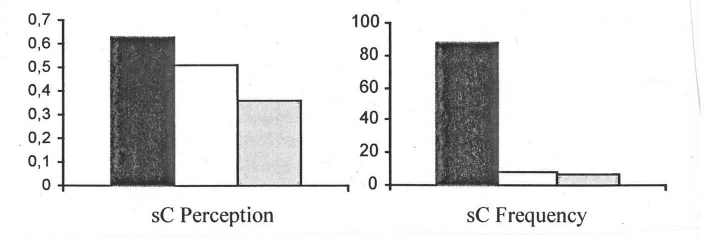
Markedness Versus Frequency Versus Release

•Cardoso (2007; 2009) in an elegant series of experiments argues that, while *markedness* best accounts for production patterns of consonant clusters, *frequency* better accounts for perceptual accuracy.



Production accuracy: sl > sn > st

Least → *Most Marked*

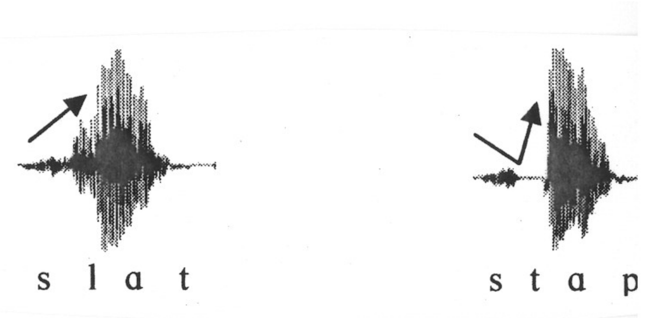


Perception accuracy: st > sl > sn

Most → *Least Frequent*

•[st] sequences, however, are not only the most frequent in the input - they also have a different transitional release pattern (which also violates the Sonority Sequencing Generalization). s+obstruent sequences are often reported to behave differently than s+sonorant sequences in First Language Acquisition, as well.

•while the [sn] and [sl] sequences rely on internal cues (fricative noise, formant structure) for recovery of the segmental sequence, the [st] sequence can be recovered via a robust release burst. It is this release burst which is responsible for the high rate of perceptual accuracy.



The Learning Algorithm: **C**ue-based **A**lgorithm for **D**emotion (CAD)

•Initial state = high-ranked Markedness of new segments:

*ConstrictedGlottis/Son >> *ConstrictedGlottis/Obs

*SpreadGlottis

•As the grammar changes, some new segments will be allowed (via markedness demotion) but not all at once.

•Release bursts determine which markedness constraints are demoted to be interleaved with Faithfulness constraints. Thus, Blame Assignment is made feasible so that grammars can converge. Landing sites for demotion are determined by universal properties

(e.g. __ V >> __ Son >> __ Obs)

•An example of an interleaved L2 grammar would look like this:

IDENT[CG]/ONS$_{\text{STOP[Periph]}}$, *[ts] >> *[CG] >> IDENT[CG]/ONS$_{\text{STOP[Cor]}}$

Conclusion

In this poster, I am arguing that it is the varied instantiation of this property of release burst which accounts for the successful acquisition of L2 contrasts which are not based on L1 properties. These phonetic properties are perceived by the listener and, hence, allow certain stimuli to become intake to the processor. Over time, these are the primary data which pave the way for the phonologization of a particular feature. These phonological features ([CG], [SG], [voice], etc.), however, are not merely read off a phonetic signal. The varied signal cues to a feature demonstrate that this is a *learning* problem, not a *noticing* problem when it comes to phonology. It is a processing issue when it comes to phonetics though.

References

Avery, P. & W.J. Idsardi (2001). Laryngeal dimensions completion and enhancement. In T. Hall, ed. *Distinctive Feature Theory.* Mouton. Pp. 41-70.

Cardoso. W. (2007. The development of sC onset clusters in interlanguage: markedness vs. frequency effects. GASLA Proceedings. Cascadilla Press.)

Cardoso, W. , P. John & L. French (2009). The variable perception of /s/ + coronal onset clusters in Brazilian Portuguese English. In M. Watkins, A. Rauber & B. Baptista, eds. *Recent Research in Second Language Phonetics/Phonology*. Cambridge Scholars Publishing. Pps. 203-233.

Gonzalez, A. (2011). *Conflict Resolution in the Spanish SLA of Yucatec Ejectives: L1, L2, and Universal Constraints*. Ph.D. dissertation. University of Calgary.

Howe, D. & D. Pulleyblank (2004). Harmonic scales as faithfulness. *Canadian Journal of Linguistics*. 49(1): 1-50.

Jackson, S. (2009). *Non-Native Perception of Laryngeal Features*. M.A. Thesis. University of Calgary.

Jackson, S. (2011). Voicing and aspiration in the production and perception of Hindi laryngeal stops. PhD candidacy paper. University of Calgary.

Iverson, G. & J. Salmons (1995). Aspiration and laryngeal features in Germanic. *Phonology* 12: 369-396.

Vanderweide, T. (2005), *Cue-Based Learning and the Acquisition of Pre-Vocalic Clusters*. Ph.D. dissertation. University of Calgary.

Wright, R. (2004). A review of perceptual cues and cue robustness. In B. Hayes et al., eds. *The Phonetic Bases of Markedness*. CUP.

Thanks to MacSingularity for the poster template. Thanks to Antonio Gonzalez and Sue Jackson for their collaboration, and to Darin Flynn, and Steve Winters for their discussion of these issues.

E-mail: johnarch@uvic.ca