

Gestural Alignment Constraints and Vowel Devoicing in Andean Spanish

The variable, gradient process of unstressed vowel devoicing in proximity to voiceless consonants observed in a number of languages such as Korean, Montreal French, Greek and Turkish can readily be explained as the result gestural overlap within the framework of Articulatory Phonology (see Beckman 1994 for a summary). As devoicing primarily affects high vowels and is associated with fast speech in these languages, it is ascribed to a rate-based decrease in the distance between gestures that causes the glottal abductions of voiceless segments to impinge upon adjacent vowels. High vowels are most vulnerable due to their short duration. While unspecified increases in gestural overlap during fast speech account for such rate-sensitive high vowel devoicing, this approach cannot explain several features of vowel devoicing in Andean Spanish: (a) Devoicing is not rate-dependent and frequently occurs in slow speech (b) Word-internally, /e/, a mid-vowel of intermediate duration, is devoiced in a proportion similar to that of the shorter high vowels /i/ and /u/ (/e/=13% devoiced, /i/ =13%, /u/=22%) (c) In word final syllables with /s/ in coda position, which are predominantly plural morphemes, all vowels exhibit high rates of devoicing (/i/=20%, /u/=19%, /e/=20%, /o/=18%, /a/=15%).

I argue that gestural alignment constraints of the type proposed by Gafos (2002) expressing the principles of Articulatory Phonology in Optimality Theoretic terms can account for the unusual characteristics of vowel devoicing in Andean Spanish. These constraints specify a range of possible coordination relationships governing inter-segmental timing and facilitate discussion of cross-linguistic phasing differences. Gafos shows that different configurations of his constraint CC COORD effectively model the types of consonant-consonant phasing found in various languages, including those that require release of the first consonant in order to maximize recoverability and others that allow for close CC transitions (Fig 1). I propose that the consonant to vowel and vowel to consonant relationships posited in Articulatory Phonology and conceptualized as CV COORD and VC COORD by Gafos can also differ across languages and between dialects. If the CV and VC COORD constraints of Andean Spanish are assumed to allow greater overlap between vowels and consonants, the rate independence of vowel devoicing in this variety can thus be understood as following from its basic timing patterns. The gradient, variable nature of vowel devoicing is modeled by formulating these alignment constraints in terms of phase windows (Byrd 1996b) (Fig 2b) which include the canonical relationships that produce fully voiced vowels shown in Figure 2a. Following previous claims that vowel-consonant homorganicity can affect gestural overlap (Hall 2003,) the tendency to devoice /e/ but not the other non-high vowels /o/ and /a/ word-internally is attributed to the greater amount of overlap permitted between this [+coronal] vowel (Clements & Hume 1995) and the most frequently occurring voiceless consonants in Spanish which are also [+coronal]. This effect is formalized as a constraint limiting the overlap between heterorganic vowels and consonants, *OVERLAP V//C_{HET} (see Fig. 3), that outranks CV and VC COORD.

The devoicing of all vowels in word final syllables closed by /s/ is explained by extending Gafos' constraint schema to intra-segmental timing. Studies reviewed in Krakow (1999) indicate that consonants' secondary gestures tend to occur earlier in relation to their oral gestures in coda compared to onset position. I propose that, although /s/'s glottal opening gesture is normally simultaneous with its oral constriction (Silverman 1997), its laryngeal abduction is sometimes phased to anticipate oral closure in syllable final position and thus impedes voicing of the preceding vowel (Fig. 4a). Evidence supporting the explanation of high devoicing rates in this context as a result of the early occurrence of coda /s/'s glottal opening gesture rather than /s/'s status as a plural marker or word final position itself comes from a decrease in the frequency of devoicing as word final vowel-/s/ combinations are placed in the final position of progressively larger prosodic domains (intonational phrase, utterance). Presumably, this inverse relationship between devoicing rate in final position and domain size reflects the extent to which phrase final lengthening counters the syllable position effect and separates the preceding vowel from /s/'s glottal opening gesture (Fig 4b). In addition, vowels followed by an /s/ in coda rather than in onset of the following syllable are significantly more likely to devoice word internally as well as word finally. As the consequences of syllable position for intra-gestural timing may differ across languages (Kochetov 2006), the proposed "coda /s/ effect" is expressed in terms of the constraints OS COORD (default oral-secondary gesture coordination) and OG COORD_C (oral-glottal coordination, coda).

* Observations regarding Andean Spanish are based on recordings of 180 informants from Cusco, Peru

Figure 1 Consonant to Consonant Coordination Adapted from Gafos (2002)

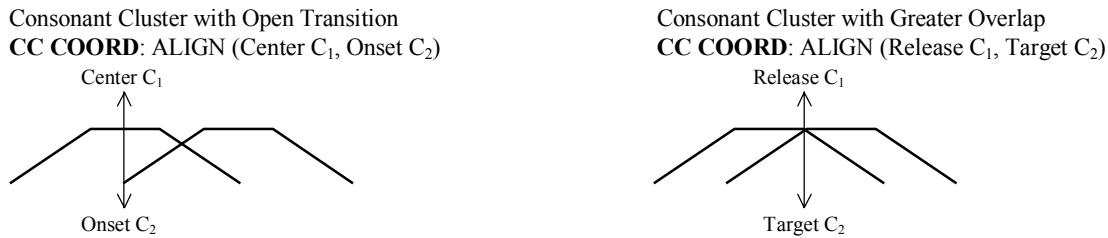


Figure 2a Canonical CV, VC Coordination with no devoicing (Browman & Goldstein 1990, Gafos 2002)

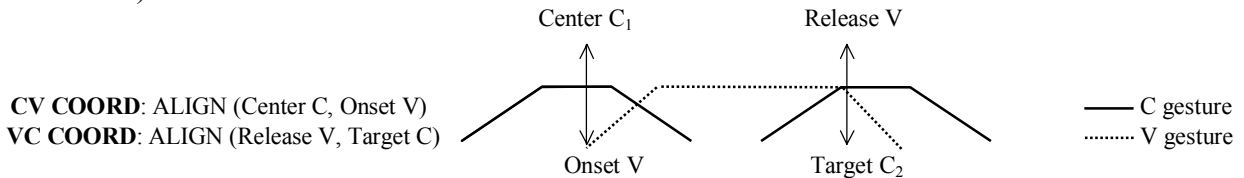
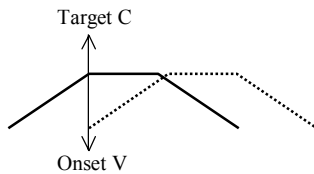


Figure 2b Proposed CV, VC Coordination in Andean Spanish, Incorporating Phase Windows:

CV COORD: ALIGN (Onset ~ Center C, Onset V) V Onset may align with any point ranging from Onset to Center in C
VC COORD: ALIGN (Target ~ Release V, Target C) C Target may align with any point ranging from Target to Release in V

Example of Devoicing in CV sequence:



Example of Devoicing in VC sequence:

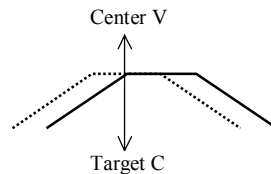


Figure 3 *OVERLAP_{V//C}HET: The plateau of a consonant may not overlap the plateau of an adjacent heterorganic vowel.

*OVERLAP_{HET} vacuously satisfied

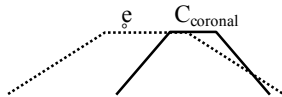


Figure 4a

Word-final (V s)

*OVERLAP_{HET} violated

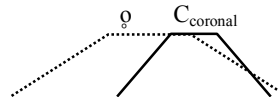
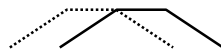


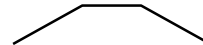
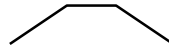
Figure 4b

Intonation Phrase Final (Vs)

Oral Gestures



Glottal Gestures



Selected References

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