Licensing voicelessness in Lakhota

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Obstruent voicing in Lakhota (Siouan) exhibits several typologically remarkable properties. Stops and fricatives exhibit different distributions of voicing, each interesting in its own right, and which raise further questions when combined in the same language. Phonological analyses of the typology of voiced obstruents have generally focused on constraints against voicing in various contexts. In this paper, I show that the Lakhota distributions run counter to several commonly observed restrictions on obstruent voicing. In particular, stops are required to be voiced in contexts that cross-linguistically frequently favor devoicing (in consonant clusters, and morpheme-finally), while fricatives are required to be voiceless in these same contexts. I argue that these discrepancies are due to phonetic conditions on *devoicing* segments in Lakhota–that is, on implementing voicelessness. In particular, I show that obstruents are required to be voiced in contexts where they have short duration, and where a rapid glottal abduction gesture would be required to produce voicelessness.

Stops in Lakhota contrast robustly for aspiration and ejection (*p, pʰ, p'*), but they are contextually neutralized to voiceless unaspirated stops in certain contexts, such as in clusters with other obstruents (*pt, kp, sp, xt, ks, pʃ*, etc.). However, stops are also contextually neutralized to *voiced* in certain contexts [1,2]. One such context is in clusters with sonorants: *pl, kl, km, kn, pj, kw → bl, gl, gm, gn. bj, gw* (etc.). When the sonorant is a liquid or nasal, these voiced stops are also followed by short epenthetic vocalic periods (*bᵊl, gᵊl, gᵊm, gᵊn*) [3]. Voicing before sonorants is phonetically complete, with voicing through the entire stop closure. It applies productively whenever such sequences arise through morphological concatenation: e.g., /ʃ'ak(A)+ja/ → [ʃ'agja] 'strongly'. Why do stops voice in clusters with sonorants? At first blush, this resembles regressive voicing assimilation, since it occurs before voiced consonants. However, there are several obstacles to such an analysis. First, cross-linguistically, sonorants typically do not trigger regressive voicing assimilation, but voicing is triggered by all (and only) sonorants in Lakhota. Second, voicing assimilation rarely crosses an epenthetic vowel cross-linguistically. Finally, voicing assimilation typically affects both stops and fricatives, but in Lakhota, fricatives pattern differently from stops. In what follows, I will argue that voicing in this context is not due to assimilation, but rather, to a ban on voiceless stops when they are the sole obstruent in a cluster.

Unlike stops, fricatives in Lakhota contrast for voicing and ejection (*s, z, s'*). However, in clusters, they are systematically neutralized to *voiceless*, even before sonorants (*sn, ʃn, xm, xn*, *xl*, *ʃw* etc.). This is part of a broader restriction: all fricatives in clusters must be voiceless, both in C1 (*sp, sk, ʃp , sn, xn, xl, ʃw*, etc.) and C2 position (*ps, ks, pʃ, kʃ*). Why are fricatives in clusters always voiceless, while stops vary depending on the sonority of the other member? This is not due to some general dispreference against voiced stops in the language; in fact, in certain positions of the root, fricatives must actually be voiced. Parallel to stops, this appears to be due to a special ban on voiced fricatives in clusters.

The key property that distinguishes singleton obstruents from those in clusters is duration. This can be seen by comparing the closure duration of stops in singleton CV contexts with those in CCV contexts. Singleton and cluster tokens were extracted from naturally occurring radio broadcast speech from two fluent native speakers. The ideal comparison is stop and fricative duration in controlled comparisons: *a*[t]*a* vs. *a*[t]*ka* and *ak*[t]*a*, and *a*[s]*a* vs. *a*[s]*ka* and *a*[k]*sa*. Due to limitations of recording quality, the analysis focused on stridents, which also occur more frequently. The results show that singleton fricatives are indeed longer in duration than those in clusters (mean 137ms vs. 96ms). For stops, the analysis focused on intervocalic vs. fricative-stop clusters, to avoid ambiguities of segmentation in stop-stop clusters. Here, too, the results show that singleton stops have longer duration than those in clusters (96ms vs. 64ms). These singleton durations are in line with, but overall shorter, than those reported for VCV in careful citation forms by [4]. Finally, in order to ensure that these differences reflect durational patterns of obstruents in general, and not just voiceless stops and fricatives, a small number of aspirated stops in Vk^hV vs. Vtk^hV were compared; these, too, show longer closure duration in singletons than clusters (88ms vs. 61ms).

This durational difference supports an analysis of neutralization in which the requirement to voice stops and devoice fricatives in clusters is tied to their short duration in this position. Specifically, this can be modeled with a pair of MINDIST conditions [5] demanding that laryngeal contrasts in stops be supported by adequate differences in closure or VOT duration, while contrasts in fricatives must be supported by adequate differences in frication duration. With an appropriate choice of threshold, contrasts are tolerated among singletons, but prohibited within clusters. This analysis achieves broader coverage than analyses that focus on licensing laryngeal contrasts with release cues [6], because it is able to explain why the second members of clusters neutralize, even though they are prevocalic. Finally, I hypothesize that stops undergo voicing in stop+sonorant clusters in order to avoid the rapid glottal abduction gesture needed to produce a short voiceless stop (indicated here simply as *RAPID). Voicelessness can be achieved in singleton stops, which are longer, through passive devoicing, yielding a closure that is voiceless for much of its closure duration. This is not possible for short duration stops.

/apla, ap^hla, ap'la/	MINDIST	*RAPID	IDENT	*GESTURE
a. a{b,p^h,p'}la	3!		1	4
b. apla		1!	2	1
→ c. abla			3	

/asla, azla, as'la/	MINDIST	*RAPID	IDENT	*GESTURE
a. a{s,z,s'}la	3!			5
→ b. asla			2	1
c. azla			2	2

A final benefit of this duration-based analysis is that it extends easily to another mystery of Lakhota laryngeal phonology: in morpheme-final position, stops voice, while fricatives devoice. As [4] demonstrate, morpheme-final voiced stops are very short, relative to intervocalic stops. I show that by using duration as a licensing factor, a similar neutralization can be derived as in stop+sonorant clusters.

References

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