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Nasalization and Voiceless Obstruents in Yoloxóchitl Mixtec: An Aerodynamic Analysis

Nasal harmony “comes about when an underlyingly nasal segment, such as a phonemic nasal stop or vowel, triggers the nasalization of an adjacent string of segments in a predictable and phonologized way” (Walker 2000: 3). In most languages that manifest nasal harmony, voiceless obstruents are opaque to this process, meaning that they block nasal spreading. However, some Mixtec languages are unusual in that their voiceless obstruents are reportedly transparent to nasal harmony (Ocotepéc) or can become nasalized in nasal harmonic spans (Coatzacoapan Mixtec) (Walker 2000: 64–65). For Ocotepéc, Marlett (1992), based on data from a personal communication, claims that [+nasal] is applied to entire CVCV lexemes regardless of the nature of the consonants. However, he asserts that “there would be no phonetic interpretation of [the nasal feature] when it combines with obstruents” (p. 431). For Coatzacoapan Mixtec, Gerfen (2001) has used aerodynamic evidence to argue that nasalization is realized on voiceless fricatives (though not on other voiceless obstruents) in nasal harmonic spans (even though the fricatives are phonologically opaque to nasal harmony (i.e., the vowel to the left is not nasalized). Gerfen’s findings challenge the phonetic theorem of Ohala & Ohala (1993) who state that “the velic valve must be closed (i.e., the soft palate must be elevated) for an obstruent articulated further forward than the point where the velic valve joins the nasal cavity and the oral cavity” (227). Modeling by Shosted (2006) explored how nasalization might debilitate the acoustic characteristics of fricatives. Some of his predictions have been corroborated by Demolin (2011) for Guarani, another language in which voiceless obstruents are transparent to nasal harmony.

We continue research on the phonetic realization of nasal harmony in Mixtec by examining a large corpus of aerodynamic data from speakers of Yoloxóchitl Mixtec. Eight speakers have been recorded producing 341 test items embedded in carrier phrases, repeated three times (8,184 tokens). Data were gathered using a split-flow air mask fitted with calibrated pneumotachometers. Simultaneous audio and airflow signals were gathered at a sampling frequency of 2 kHz. CVCV boundaries were annotated by hand by two research assistants. While the annotation and analysis of these data are still in progress, we are prepared to report some preliminary results.

We used a linear mixed effects model with item and speaker as random effects and nasality of V_2 as an independent variable. For monomorphemic $C_1V_1C_2V_2$ items where test items have either oral or nasal V_2 and C_2 is a voiceless obstruent, we find that nasal airflow during C_2 fails to achieve significance at $\alpha=0.05$ based on the oral/nasal quality of V_2 . As expected, the nasal airflow of V_2 is highly significant. The results suggest that at least in tautomorphemic spans, while V_2 (an ostensible nasal harmonic trigger) is clearly nasalized, there is no evidence of increased nasal airflow during C_2 , V_1 , or C_1 when C_2 is a voiceless obstruent. Analysis of the monomorphemic items provides a baseline for study of morphologically complex materials already collected and awaiting analysis: For example, we will ask whether, in polymorphemic items, voiceless obstruents are transparent to nasal harmony (as in Ocotepéc) or opaque but able to be nasalized, as in Coatzacoapan Mixtec. Data from Yoloxóchitl Mixtec do not falsify the observations of Gerfen (2001), who studied a different, albeit related, language. Rather, our findings highlight the importance and potential rarity of his observations. Among Mixtec languages, Coatzacoapan Mixtec (and perhaps Ocotepéc) may be peculiar in either allowing nasal

harmony to occur across voiceless obstruents (Ocotepéc) or permitting the nasalization of one category of voiceless obstruents (fricatives; Coatzospan Mixtec). With our relatively large-scale and systematic airflow study of Yoloxóchitl, we hope to better understand obstruent nasalization in Mixtec languages. We intend to present results of our ongoing data analysis, including the analysis of polymorphemic items, where the nasal harmonic span is heteromorphemic, by the time of the conference. We will investigate the phonological processes triggered by the application of oral and nasal vowel clitics in Yoloxóchitl Mixtec, e.g. =o⁴/e⁴ (1P.INCL), =a/e (3S.INANIM) vs. =õ⁴/ũ⁴ (2S), =ã⁴/ẽ⁴ (3S.Fem). While the nasal clitics condition leftward nasal spreading, the oral clitics condition apparent spreading of orality.

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