

VOWEL QUALITY AND DURATION IN DEG XINAG

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1. INTRODUCTION

Deg Xinag, an Athabaskan language spoken in western Alaska, has been described as containing the following vowel inventory: /e a o ə u/ (Krauss 1962, Leer 1979). The vowel “/u/” is restricted in distribution in Deg Xinag, only occurring adjacent to uvulars. Deg Xinag “/u/” is a reflex of Proto-Athabaskan *u, but /u/ in Deg Xinag gives the auditory impression of being a short version of /o/. If true, then Deg Xinag would be typologically unusual in having no high vowel phonemes. This study investigated the following questions: what are the spectral properties of the Deg Xinag vowels? Which vowels are significantly different in duration?

2. METHOD

2.1 Participants

Participants are 8 adult native speakers (3 male, 5 female) of Deg Xinag, between the ages of approximately 68-76 at the time of recording. English is a second language for all speakers, but proficiency varies.

2.2 Recording materials and recording procedure

Two word lists were constructed. In a word list constructed for measuring vowel duration, words were recorded in a sentence context. Vowels were recorded in one of two consonantal contexts: surrounded by coronal stops, or preceded by a uvular stop and followed by a coronal stop. In another word list constructed for measuring vowel quality, words were recorded in isolation. The vowel quality word list recorded the vowels in several consonantal contexts: preceded and followed by coronal stops; preceded by a uvular consonant; followed by a uvular consonant.

On both the vowel quality and vowel duration word lists, words or sentences were recorded in random order (the same random order for each speaker). Four repetitions were elicited. Some speakers voluntarily produced more than four repetitions. Some repetitions were later excluded due to excess background noise or some similar reason. Because no speaker was literate in Deg Xinag, the words were elicited through a combination of translation from English and/or prompting in Deg Xinag.

Recordings were made using a professional CD recorder or compact flash recorder with an AT 4041 microphone attached. Data was recorded at 44,100 Hz and downsampled to 11,025 Hz.

2.3 Acoustic analysis

The first four formants of vowels on the vowel quality word list were measured using PRAAT (version 4.3.27), with Maximum Formant set at 5000 Hz for men and 5500 Hz for women.

Vowel duration was measured using Multi-Speech 2.5. In a first pass through all the data, tags were placed at the onset and offset of F2. In a second pass, duration was measured between tags.

2.4 Statistical analysis

The vowel duration measures were subjected to repeated measures analysis of variance, with the dependent variable being each speaker’s mean vowel duration for each vowel category. Vowel was the independent variable. Post hoc analysis was performed with Fisher’s PLSD.

3. RESULTS

3.1 Spectral properties of vowels

For vowels in the coronal context, /ə/ has higher F2 than /e/, /o/, impressionistically [ɪ]. In Figure 1, a typical plot of the contrasting vowels in this context, notice that the F1 of /ə/ is higher F1 than that of either /e/ or /o/.

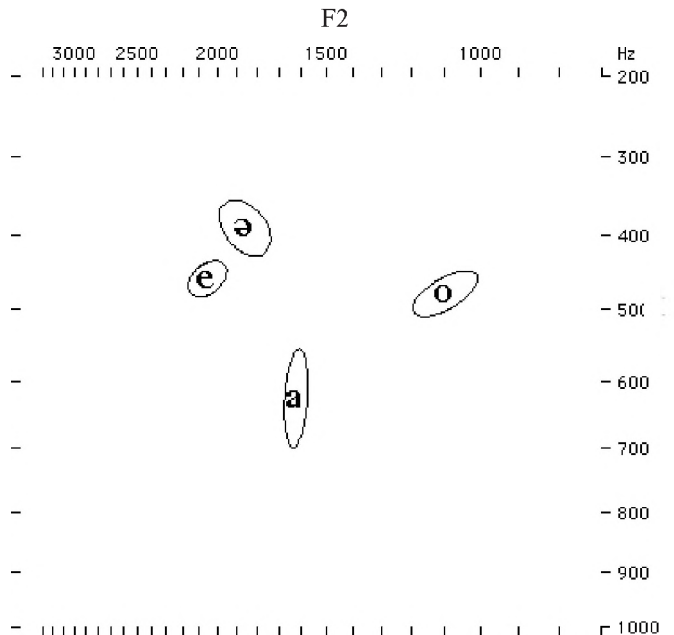


Figure 1. F1 x F2 plot of vowels in coronal context (for HM, a female speaker)

In a uvular context, /ə/ has a lower F1 than /e/ or /o/. The vowel /u/ also occurs in this context. For all speakers, there is overlap in F1 and F2 between /o/ and /u/, with greater degrees of overlap when a uvular follows. Figure 2 shows a typical vowel plot for vowels before a uvular consonant.

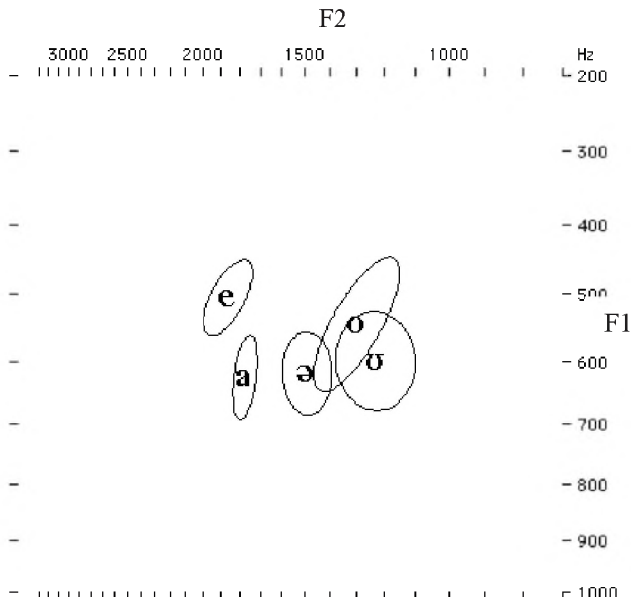


Figure 2. F1 x F2 plot of vowels following a coronal consonant and before a uvular consonant (for HM, a female speaker)

3.2 Vowel duration

Vowel duration results for the four vowels that can occur surrounded by coronal stops are shown graphically in Figure 3.

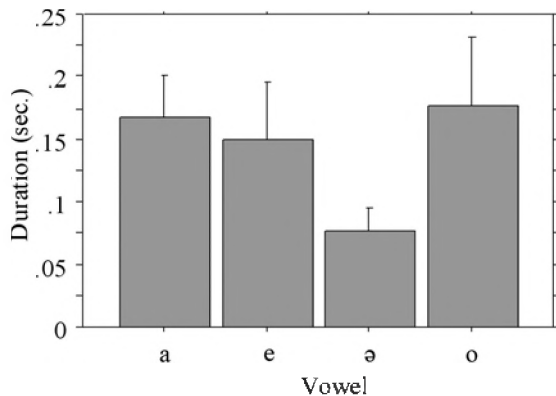


Figure 3. Bar graph showing means for /a e ə o/ preceded and followed by coronal stops. Error bars represent one standard deviation.

The vowels differ significantly in length ($F[7,21] = 21.455$, $p < .0001$). Post hoc analysis indicates that /ə/ is significantly shorter than each of /e o a/, but /e o a/ do not differ in length from each other.

Vowel duration results for the five vowels that can occur after a uvular stop are shown graphically in Figure 4.

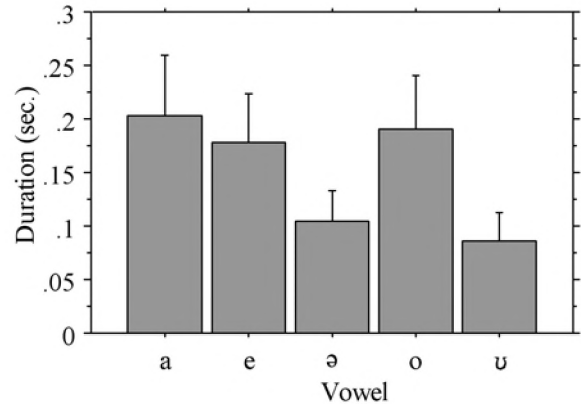


Figure 4. Bar graph showing means for /a e ə o u/ preceded and followed by coronal stops. Error bars represent one standard deviation.

The vowels differ significantly in length ($F[7,28] = 34.633$, $p < .0001$). Post hoc analysis indicates that /ə u/ are significantly shorter than each of /e o a/, but not from each other. /e o a/ do not differ in length from each other.

4. DISCUSSION

Qualitative inspection of the spectral properties of the Deg Xinag vowels indicates two points of interest: “/u/” is similar to /o/, and /ə/ has a high vowel allophone [ɪ] which occurs surrounded by coronal consonants. Thus while Deg Xinag has no high vowel phonemes, there are phonetic high vowels.

Statistical analysis indicates that the vowels of Deg Xinag can be divided into two sets, a short set consisting of /ə u/ and a long set consisting of /e o a/. Durational differences between the longer and shorter vowels of Deg Xinag are comparable to normative vowel duration data available for other Athabaskan languages (Witsuwit'en (Hargus 2007) and Tsek'ene (Hargus in preparation)), and support the reconstruction of Proto-Athabaskan as having full (*i: *e: *a: *u:) and reduced vowels (*ə *o *ʌ) (Krauss 1964).

REFERENCES

- Hargus, Sharon. 2007. *Witsuwit'en Grammar: Phonetics, Phonology and Morphology*. Vancouver: UBC Press.
- Hargus, Sharon. in preparation. Kwadacha (Fort Ware Sekani) Grammar, Seattle and Fort Ware, Ms.
- Krauss, Michael. 1962. Ingalik, Ms.
- Krauss, Michael. 1964. 'Proto-Athapaskan-Eyak and the Problem of Na-Dene I: The Phonology.' *International Journal of American Linguistics* 30:118-131.
- Leer, Jeff. 1979. *Proto-Athabaskan Verb Stem Variation: I. Phonology*. Fairbanks: Alaska Native Language Center, University of Alaska Fairbanks.

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