1. Introduction

Studies of consonant gemination reveal enormous diversity crosslinguistically (Rosenthal 1995), but certain patterns have also emerged, for example that segments such as stops are among the most preferred for consonantal quantity contrasts (e.g. Thurgood 1995, Richter 2012, Kato 2007). Quantity contrasts for glides are typologically unusual, but attested in a range of language families (Maddieson 2008) and are probably more common than typological surveys reveal, e.g. in under-described linguistic regions of Africa. However, phonetic explorations of the characteristics of singleton and geminate glides are very limited.

This paper presents the results of a phonetic investigation of proposed singleton and geminate palatal and labiovelar glides in Lopit, a language of South Sudan. This study is part of a wider documentation project underway with a small community of Lopit speakers in Melbourne. Results provide supporting evidence for such a contrast; constriction duration is a major correlate, but appears to also be supported by other acoustic cues.

4. Methods and materials

Participants and experimental analysis
- For this experiment – 3 male participants (Dorik Lopit).
- Experimental materials: large set of lexical data, nouns and verbs (mostly 2 syllables, some 3 syllables). Chosen for medial (not initial) geminates, flanked by mostly non-close vowels. Range of tonal patterns on words.
- Each word recorded 5 times in isolation, following English prompt (superimposed on laptop screen).
- Recorded at 44.1kHz/16-bit in quiet room. Zoom H4N, MiXtR-E pre-amp, AudioTechnica AT892c headset mic.

901 tokens: /jː/=240, /jː/ recorded at 44.1kHz/16-bit in quiet room - Zoom H4N.

Procedures and analysis
- Segmentation and labelling in Praat – glides identified by drop in amplitude, weakened upper formants, F1-F3 structures.
- Acoustic data extracted in Emu. Querying and plotting in R (circular) measures inc. duration of C, and of preceding V (ms), F1, F2, F3 (Hz), and intensity (dB-RMS).
- Data tested with Linear Mixed Effects Models (lme4) and post-hoc tests (fixed effect: consonant/vowel, random effects: speaker, word, onset tone, preceding vowel).

5.1. Results: Duration of glides, and preceding vowels

- Results for the constriction duration (Fig. 1) show that proposed geminate glides are significantly longer than their singleton counterparts; almost twice as long on average (Table 1).
- Vowels preceding geminate glides tend to be shorter than vowels preceding singletons (Fig. 2), but this is only significant for the palatalas (Table 2).
- More speaker variation for preceding vowel duration.

5.2. Results: F1/F2 glides, intensity (glide midpoints)

- F1/F2 results show geminate glides have a significantly higher and somewhat more peripheral quality than singletons (Fig. 3). Suggests narrower constriction (perhaps more time to reach targets). F1/F2 more variable for singletons (likely greater influence of surrounding vowels).
- Results for F3 (not shown) show significant differences between /jː/ and /jː/ only.
- Geminate glides have significantly lower intensity than singleton glides.

6. Discussion and Conclusions

This study has tested the validity of proposing a contrast between singleton and geminate palatal and labiovelar glides in Lopit, and found strong evidence that the language does have two distinct classes of geminates. Longer duration values for vowels preceding geminates may provide supporting evidence for this contrast; constriction duration is a major correlate, but appears to also be supported by other acoustic cues.

These results of this experiment shed light on a typologically unusual and poorly understood class of geminates, and suggest that there are intriguing features of Eastern Nilotic consonant inventories which warrant further phonetic investigation.