AFLA 26
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A Reevaluation of the SaySiyat Vowel System

Overview—In this paper, we argue that the Formosan language SaySiyat (aka 'Saisiyat') is better described with a 4-vowel system (4VS in text) than a 6-vowel system (6VS). We provide an acoustic analysis of vowels in SaySiyat narratives to support the 4VS proposal, as well as known evidence about vowel distribution, productive alternation and typological markedness. We argue that the small number of lexical contrasts are not a robust enough pattern to favor 6VS over 4VS.

Background: 4VS vs. 6VS—SaySiyat is an indigenous Austronesian language spoken in NW Taiwan by several hundred speakers; despite its level of endangerment, it is one of the better-studied Formosan languages (see, e.g., Tsuchida 1964, Li 1978, Yeh 1991, Zeitoun and Wu 2005, Zeitoun, Chu and kaybaybaw 2015). Most descriptions of SaySiyat state that the language has six vowels [i œ ə o æ ɑ], but diverge on whether all six vowels /i œ ə o æ ɑ/ are phonemic (6VS) or [œ æ] are variants of /o a/ in a 4VS /i ə o a/. E.g., Li (1978:139) states that "Saisiyat has the following four **main** vowels /a, i, o, ə/" (emphasis ours), while Zeitoun and Wu (2005:31) have a 6VS, but /æ œ/ are "central vowels … very close" to /a o/, and "a merger … is in progress."

The existing evidence for 4VS vs. 6VS seems contradictory. 6VS is supported by a handful of lexical contrasts between [æ ɑ] (1; [ɑ] = [a] in sources) and between [œ o] (2). 4VS is supported by the near-complementary distribution between the fronter vowels [æ œ], almost always found in the environment of /ħ ʔ/, and the backer vowels [ɑ o], usually found elsewhere. This suggests that [æ œ] are allophones of /ɑ o/, as they also alternate productively: the polysemous reduplicative prefix /Cɑ-/ and the actor voice infix /-om-/ become [Cæ-] (3) and [-œm-] (4) next to /ħ ʔ/.

(1) /t**a**t**a**ʔ/ 'millet' vs. /t**æ**t**æ**ʔ/ 'to chew thoroughly' (Li 1978:139)
(2) /t**o'o**ʔ/ 'three' vs. /b**œ'œ**ʔ/ 'a species of slender bamboo' (Tsuchida 1964:49)
(3) /Cɑ-kitaʔ/ → [**kɑ**-kitaʔ] vs. /Ca-ħæŋiħ/ → [**ħæ**-hæŋɪħ]
'will be used to see' 'will be used to cry" (fieldwork)
(4) /-om-,kitaʔ] → [**k-o**m-itaʔ] 'see' vs. /-om-,ħæŋiħ/ → [**ħ-œ**m-æŋɪħ] 'cry' (fieldwork)

A SaySiyat 4VS is typologically less marked than a SaySiyat 6VS, which is unattested (Becker-Kristal 2010). The 6VS has 1 high vowel but 3 mid and 2 low vowels, against the tendency for more contrasts in the higher region of the vowel space. The 6VS also has three less common phonemes, /æ œ ə/, unexpected for a small system lacking more common phonemes like /e u/.

Hypotheses: Formant Values of [æ ɑ], [œ o]—To evaluate 4VS vs. 6VS, i.e., to determine whether the fronter [æ œ] and the backer [ɑ o] contrast, we look at the distribution of formant values of tokens of these vowel categories. We examine two hypotheses about their formant distribution, corresponding to either 4VS (5) or 6VS (6).

(5) 4VS Hypothesis: no distinct targets for fronter [æ œ] and backer vowels [ɑ o] → unbroken range of variation, considerable overlap for low [æ ɑ] and for mid [œ o]
(6) 6VS Hypothesis: four distinct acoustic targets → bimodal distribution between front low [æ] and back low [a], front mid [œ] and back mid [o], with little overlap

Methods—We used 312 vowel tokens from 90 word tokens, taken from five different narratives on SaySiyat culture that were recorded by one author from a native speaker of the northern (Taai) dialect of SaySiyat. The word and vowel transcriptions were based on the speaker's Mandarin translation, a SaySiyat-Chinese lexicon (Aboriginal Committee, 2016), and the authors' experience with the language. The vowel labels used for each token were taken from the lexicon so as to prevent any bias on the part of the authors. The formants were measured automatically using a Praat script (modified from Christian DiCanio's), and the midpoint values taken.

Results: [æ ɑ], [œ o] Overlap Extensively—The means of the formants taken at the midpoints of tokens demonstrate that [æ ɑ] overlap the same acoustic space, as do [œ o]. Figures 1-2 (from the website http://lingtools.uoregon.edu/norm/, without normalization) show the extensive overlap of the fronter [æ œ] (blue) and backer [ɑ o] (red) categories. The [æ œ] tokens are interspersed with the [ɑ o] tokens, and their ellipses (marking 1.5 standard deviations) overlap.

Figure 1. <A> (red) vs. <AE> (blue)

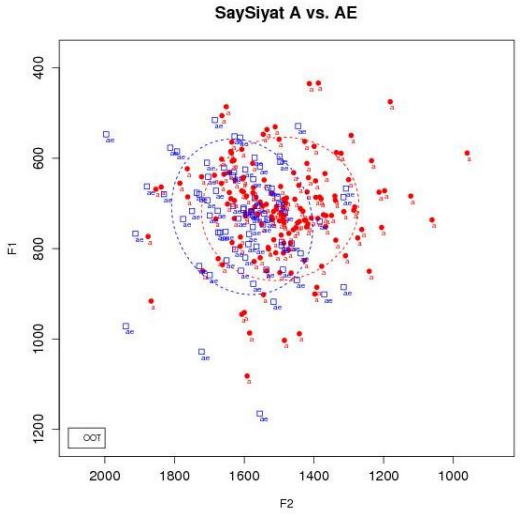
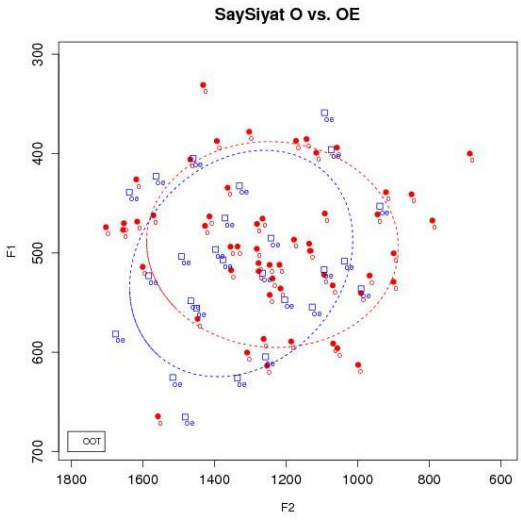


Figure 2. <O> (red) vs. <OE> (blue



Within each pair, the mean F1s are close together. While the mean F2s are slightly different (F2s of [æ œ] are 109 and 49 Hz higher than F2s of [ɑ o], respectively), the large standard deviations in F2 show that the ranges of F2 for [æ ɑ] and for [œ o] overlap extensively (Table 1), which can be clearly seen in Figures (1-2).

Table 1. Means and Standard Deviations for [æ ɑ], [œ o]

	[æ]	[ɑ]	[œ]	[o]
F1 (Mean, SD)	730 (114)	709 (112)	511 (75)	524 (138)
F2 (Mean, SD)	1606 (134)	1497 (150)	1325 (204)	1276 (269)

Discussion: Evidence *for a 4VS—The acoustic evidence above clearly shows two acoustic targets: one for [æ ɑ] and another for [œ o]. We argue that this SaySiyat speaker has a 4VS, with a single category each for a mid rounded vowel /o/ and a low unrounded vowel /a/ (in addition to /i ə/). /a o/ are not clearly specified on the F2 dimension, shown by the vowels' large F2 ranges. Instead, /a o/ spread out over a wide area of vowel space, as predicted by Adaptive Dispersion theory (Lindblom 1986) for a small inventory. The F2 values of a given vowel are heavily influenced by adjacent consonants. Following Guekguezian and Iskarous (2017), we argue [æ œ] (<ae oe> in the orthography) are /a o/ with tongue position assimilated to bunching of pharyngeal /ħ/ (and possibly epiglottal /ʔ/). We posit that the few lexical contrasts between [æ œ] and [ɑ o] are not evidence of systematic vowel contrasts, but may be due to one of two scenarios affected by extreme language endangerment (see, e.g., Dorian 2001, King 1989). Either the categories /a o/ previously had stylistic variations in F2 that were lexicalized in a few items, or an earlier system with /æ ɑ/ and /œ o/ contrasts has merged into /a o/ (as suggested by Zeitoun and Wu 2005:31fn2).

Selected References—原住民族委員會 ***(Aboriginal Committee) 2016***. *原住民族語言線上詞典 (Aboriginal Languages Online Dictionary)*. ***Li 1978***. A comparative vocabulary of Saisiyat dialects. ***Tsuchida 1964.*** Preliminary reports on Saisiyat: phonology. ***Zeitoun and Wu 2005.*** Saisiyat reduplication revisited.