ASPIRATION AND F0 IN KAM: CAUGHT AT THE BEGINNING?

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ABSTRACT

This paper presents new data from a variety of Sanjiang Kam. The data presented here deviate from standard descriptions in that the aspirated consonants, known to occur with a subset of the tones, appear to be phonologizing into a standard effect on F0: namely an initial level component (less than the maximum F0 height) in the contour. This paper discusses how this differs from previous work and how this fits into the larger picture of consonant-tone interactions more generally.

Keywords: Sanjiang Kam, tones, aspiration, consonant-vowel interaction.

1. INTRODUCTION

This study investigates the effect of aspiration on tone in a Sanjiang variety of southern Kam, spoken in Sanjiang county in the northern part of Guangxi Zhuang Autonomous Region on the border between Guizhou and Hunan provinces, China. There are several descriptions of Kam phonology, even some specifically addressing Sanjiang Kam, but they all vary significantly in the form of the tones (e.g. [1], [2], [3]). The forms in other varieties, including that which forms the basis for the standard orthography, suggest different phonological groupings with fewer distinct phonetic forms.

2. TONES IN SANJIANG KAM

Sanjiang Kam, like other varieties of Kam, has fifteen tones. These are tones, not tonemes as some have certain occurrence restrictions. An impressionistic description of these is given below using the IPA tone contours as well as Chao tone letters to represent the phonetic form of the tones.

Tone 1: [52] Tone 1 is a simple falling tone, starting at the top of the pitch range and falling just short of the bottom. E.g. [pə ˥] ‘fish’, [tə ˥] ‘eye’, [ka ˥] ‘song’.

Tone 2: [452/552] This tone has a very clear slight rise component before the fall, in stark contract with tone 1. This only occurs with aspirated onsets E.g. [pha ˦˥] ‘grey’, [tha ˦˥] ‘guide’, [kha ˦˥] ‘car’.

Tone 3: [23/12] This tone is a low tone with a slight rise, starting somewhere between 1 and 2 on the 5 point scale. E.g. [pa ˨˧] ‘touch’, [tu ˨˩] ‘an element of scales’.

Tone 4: [35/45] This is a mid-rising tone, starting around true mid and rising to the top of the pitch range. E.g. [pa ˦] ‘aunt’, [tə ˦] ‘forest’, [ka ˦] ‘wait for’.

Tone 5: [335] Tone 5 has a very clear level component before the rise commences. It starts mid range and rises to the top of the range, like Tone 4. This tone also only occurs with aspirated onsets. E.g. [phe ˧˥] [name], [the ˧˥] [name], [khe ˧˥] ‘move away’.

Tone 6: [112/212] Tone 6 is a low tone with a clear final rise, and occasionally the onset appears to be slightly higher, making it like a very slight dipping tone. E.g. [ta ˩] ‘carry’, [ka ˩] ‘Han people’.

Tone 7: [42/32] This tone starts mid range or just above and falls to almost the bottom. E.g. [pe ˩] ‘outstretch’, [ta ˩] ‘middle’, [ka ˩] [type of figure].

Tone 8: [442] Another tone with the very clear initial component. It only occurs on tones with aspirated plosive onset. E.g. [phe ˦] ‘distribute’, [pho ˦] ‘insert’, [tho ˦] ‘friction’.

Tone 9: [33/22] Tone 9 is a clear mid level tone, produced mid range or slightly below. [pa ˧] ‘chaff’, [to ˧] ‘bean’, [ko ˧] ‘open’.

Tone 10: [5] This is a short, high tone with a final plosive coda. E.g. [pak ˥] [classifier], [tak ˥] ‘break off’, [kok ˥] ‘knock someone’s head’.

Tone 11: [45] This tone again has a slight rise, making it a longer tone than tone 10. It also only occurs with aspirated onsets. E.g. [phok ˦] ‘spilled’ [that ˦] ‘seven’, [khep ˦] ‘centipede’.


Tone 13: [45/34] Tone 13 has a very clear rise component starting from mid range, or just above, and rising about one step in the five point scale. E.g. [pak ˦˥] [classifier], [tak ˦˥] ‘push down’, [kak ˦˥] ‘cut’.

Tone 14: [324/334] This tone has a mid fall initial component, followed by a very slight rise to near the top of the pitch range. Tone 14 only occurs on syllables with an aspirated onset. E.g. [phut ˦] ‘bracken’ thak ‘break some rules’, [khup ˦] ‘holding’.


To arrive at a more accurate representation of the tones in Sanjiang Kam, an acoustic study was carried out. Tokens of the form CV(C) were recorded from a female speaker. There were on average 5 tokens per tone, and each token was read out in citation twice. The recordings were made in a sound proof booth in the Phonetics Laboratory at the University of Hong Kong using a quality digital recorder (44.1Hz, 24bit). These were then analyzed using Praat.
software (Praat.org) to extract the pitch. Using the results of the pitch extraction, measurements were calculated at 10% intervals of the given tone’s duration, including 0% and 100% and additionally 5% and 95%. The F0 contours were then plotted using R. The mean F0 contours for each tone are given below in figure 1.

**Figure 1:** F0 contours for the fifteen tones in Sanjiang Kam. These are typically often conflated in phonological analyses to ~9 tones with the grouping of stopped tones with tones on open syllables.

Our claim is that tones 2, 5, 8, 11 and 14 produced with aspirated initial consonants are allotones of tones 1, 4, 7, 10 and 13 respectively. We illustrate these pairs of tones in figures 2–6 below. The solid black lines correspond to the tones on syllables with unaspirated plosive initials, the black dashed lines on those with aspirated plosive initials (the other tones are included in the plots in grey for a general reference point of the speaker’s range).

**Figure 2:** Tones 1 and 2 [+ASP]

**Figure 3:** Tones 4 and 5 [+ASP]

**Figure 4:** Tones 7 and 8 [+ASP]

**Figure 5:** Tones 10 and 11 [+ASP]
When examining the F0 contours, the effect appears to be an initial lowered component. However, it is important to see that the offset of the tones for the most part appears to be on the same target. This would seem to resonate well with the Target Approximation Model [17, 18] in that the same target is reached at the end of the syllable: the initial lowering could be an artifact of the initial consonant but that the intended target F0 is the same, supporting the conflation of these pairs of tones into single tonemes.

Tones 1 and 2 do not have the same drop in initial F0, but the tone with the aspirated C initial, tone 2, does start somewhat lower but crucially has a delayed peak, and a perceptible rise before assuming the same F0 trajectory/target.

Tones 7 and 8 are another pair of tones without the same degree of initial F0 lowering. This could be an artifact of the single-speaker data and warrants further investigation before committing to it as belonging to the same generalization or not.

One may expect aspiration to influence F0 in a local fashion, but in Kam we are starting to see the impact throughout the syllable. This effect is not limited to those syllables with reported non-modal phonation but rather may well be indicative of the beginning of change in the tonal system, where several tonal pairs may be collapsed into single tones with aspiration now a phonemic feature having predictable phonetic effects – possibly to enhance the phonemic contrasts.

3. CONSONANT-TONE INTERACTION

Consonants and tones have been known to interact in a myriad of ways. As early as the 1950s, it was established that obstruents affect the F0 at the onset of the following vowel (e.g. [4], [5]). This could be attributed to the fact that F0, voicing, aspiration and glottalization are all controlled by the muscles and physiology of the larynx ([6]). In some languages, these effects are exaggerated such that the physiological reflexes and have instead become an overt cue for distinguishing between types of consonants ([7]). Indeed, tonogenesis is typically attributed to the phonologization of these phonetic differences (e.g. [8], [9]). For other surveys of the consonant-tone interaction, see [10], [11], [12] and [6].

In her extensive study of consonant-tone interaction, Tang [6] found that aspiration interacts with tone in standard Kam. In particular, rising tones occurred after all aspired onsets, but never after voiceless unaspirated onsets. In this sense, aspiration seems to show an affinity for low/rising tone in standard Kam, counter to other findings that follow more generally expected associations of aspiration and higher tones, as in Mandarin [13].

3.1. Aspiration in Sanjiang Kam

In this variety of Sanjiang Kam aspiration appears to interact with tone, but it is not the case that one can attribute just low tones or rising tones to aspiration as Tang suggests for Kam [6], but more specifically appears to be a lowered onset with the same target contour as the unaspirated counterpart.

Given the typical association of voicelessness and high tone due to the state of the glottis, e.g. [14], this is clearly an example of something beyond a straightforward phonetic (or physiological) effect as the initial component is not as high as the onset of the original contour (e.g. [52] with an unaspirated C onset and [452] with an aspirated C). Moreover, the fact that the general effect of adding a lowered initial component is roughly the same for all four tone pairs (a lowering of ~60-70Hz on average, except before the high fall, which delays the peak as well as lowering the onset ~40Hz), further suggests that whatever inherent phonetic mechanisms that may have triggered a particular aspiration-tone association have been ‘phonologized’ to a general perceptual cue in this variety.

4. DISCUSSION

It is not yet clear if the phonologization is going to result in more tones, or perhaps collapsing the consonantal distinction. The trend in Kam languages appears to be to lose VOT features in favour of an expanded tonal inventory [2], so it is our guess that it is likely to be the case that this may result in allophonic VOT, although we seem to have caught this ‘phonologization’ at the beginning of its change – not just as the beginning of the syllable. This may well be another case of the expansion of the tonal inventory at the expense of the consonantal distinctions.

While this is the first work to present acoustic data of this kind on this variety of Sanjiang Kam, a unique variety that adds to the overall set of consonant-tone interaction phenomena, this is still a work in progress. It is of course necessary to base such claims on the speech of more than just one person. We plan a follow-up study to include data from many more Kam speakers to further examine the initial component is the same across speakers in the aspirated/unaspirated pairs of tones.

It is also necessary to thoroughly examine the tone sandhi to ensure that allotonic groupings that make sense phonetically and representationally are also confirmed with the tone sandhi data.

Moreover, there is some suggestion in the literature that non-native (i.e. Chinese loan) words may behave differently. It is yet to be investigated how their behavior may differ with regard to the tone-aspiration effect noted here.

Further, experiments with nonce words to test the productivity of the aspiration-tone association would further bolster the arguments we are making here about the phonologization of the effect.

One must also consider depressor phenomena known from other languages, including various Chinese languages (e.g. Wenzhou, [15] and Qingtian [16]). Depressor phenomena are typically analyzed as an initial lowering
corresponding to consonantal voicing as would be the phonetically transparent explanation. However, in his 2002 study of Wenzhou, [15] suggests that the lowered onset of depressed tones is not synchronically connected to the syllable onset’s voice feature due to the loss of phonological voicing in the data. Subsequent studies have also noted pitch lowering with voiceless consonants (e.g. [19]). This may well prove to be the case in Sanjiang Kam as well, an analysis that will be pursued in future work.

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6. REFERENCES