

LABIAL-VELAR STOPS IN SAKATA (BANTU C34): A PRELIMINARY PHONETIC AND DIACHRONIC PHONOLOGICAL ACCOUNT

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The present contribution bears on the documentation and description of double labial-velar articulations in a few varieties of Sakata (Bantu C34) spoken in southwestern Democratic Republic of Congo. These phonemes, often considered typical of a linguistic area known as the Macro-Sudan Belt, are considerably more common in southern Central Africa than previously thought. The case of Sakata is particularly interesting due to the wide array of labial-velar articulations its varieties present. First, we provide a spectral analysis of the available data and discuss whether some of the sounds documented here should be described as labial-velar fricatives. Second, we review well-established models of sound change to test them against the newly collected data, with special focus on the Kingingele variety. We conclude by proposing that the presence of labial-velar stops in Sakata is part of a broader set of atypical (in Bantu) features present in this specific area. This might indicate that this region once hosted great linguistic diversity of which Sakata labial-velar stops may be one phonological trace.

Keywords: phonetic documentation, articulatory phonology, Bantu languages, acoustics, sound change

1. Introduction

This article is a preliminary phonetic and diachronic phonological study of newly collected fieldwork data on labial-velar consonants in a poorly known cluster of closely related Bantu language varieties from the Lower Kasai region in the Mai-Ndombe Province of the Democratic Republic of Congo (DRC), known as “Sakata” (Bantu C34).

Labial-velar consonants, such as those transcribed as <kp> and <gb>¹ in the International Phonetic Alphabet, are doubly articulated sounds produced with simultaneous occlusions at the lips and at the velum (see Connell 1994, Ladefoged & Maddieson 1996, and references cited therein). These closures are released almost simultaneously, but the velar release always seems to occur first (see Painter 1978, Connell 1987, 1991a,b, 1994, Dogil 1988, Maddieson & Ladefoged 1989, Cahill & Hajek 2001, Cahill 2018: 154). Instances of alleged labial-velar articulations with reversed release precedence in Kalanga S16, Zimbabwe, are reported in Mathangwane (1996); see also Ponelis (1974) for Zezuru S12 and Maddieson & Sands (2019: 92ff) for a counterargument; see Maselli *et al.* (2021: 10ff) for a more comprehensive review.

The presence of labial-velar stops in the phonological inventory of Sakata is striking for several reasons. First, labial-velar stops are rare in the world’s languages, occurring in but 45 of the 567 languages present in Maddieson’s (2018) sample (i.e., 8% of the total). Cahill (2008) reports that over 700 languages exhibit labial-velar stops, i.e., approximately 10% of the world’s ~7000 languages (7151 according to the Ethnologue; Eberhard *et al.* 2022). The PHOIBLE repository of cross-linguistic phonological inventory data (Moran & McCloy 2019) reports 373 languages with /kp/ and 374 with

¹ Doubly articulated sounds are better transcribed with an overarching tie bar ($\widehat{kp}$, $\widehat{gb}$, $\widehat{\eta m}$). However, as no (timing) oppositions between double articulations and clusters of individually articulated consonants are discussed in this paper, they will be consistently transcribed without a tie bar (kp, gb, ηm) for practicality reasons.

/gb/ (around 12% of their total). However, their distribution is far from even across linguistic families. According to Cahill's (2017) updated database of 848 languages with phonemic labial-velar stops, only 66 (8%) of these are spoken outside Africa (mostly in Papua-New Guinea, Oceania, South America). Within Africa, virtually all are from West Africa and northern Central Africa, i.e., north of the Congo Basin rainforest. This is far to the north of the area where Sakata is spoken.

Second, in terms of historical development, some scholars have interpreted the peculiar distribution of labial-velar stops as an areal feature – though possibly one with little diagnostic power (see Hyman 2011, Cahill 2017) – typical of an alleged macro-area known as the Macro-Sudan Belt, a stretch of land extending contiguously from the western end of the African landmass to the Ethiopian escarpment in the east (Clements & Rialland 2008; Güldemann 2008, 2018: 479–486, Idiatov & Van de Velde 2021). This linguistic macro-area would have been “shaped by geographical conditions that were fairly stable over a long time span” (Güldemann 2008: 183). As a result, shared linguistic features in this zone would be the outcome of geography rather than genealogy. Labial-velar stops have not been reconstructed to the Bantu family's putative most recent common ancestor (Meeussen 1967). Therefore, their presence in some parts of the Bantu-speaking area, especially in between the Congo and Ubangi Rivers, has been claimed to be contact-induced (see Bostoen & Donzo 2013; Cahill 2018: 156), but the exact socio-historical dynamics underpinning this transfer are still a matter of debate (Dimmendaal 1995, 2001: 377; Grégoire 2003). Their presence in Sakata, so far to the south of the major hot spots of labial-velar stops in Africa, is all the more remarkable, though not entirely unprecedented. As a matter of fact, these sounds also occur in other languages of the Lower Kasai area, most of which belong to Guthrie's Bantu B80 group (see Maselli *et al.* 2021: 3 for a recent overview); see Map 1 below. What is more, Sakata stands out amongst these other Bantu languages on the southern margin of the Congo rainforest: besides exhibiting the voiced/voiceless labial-velar oral stop pair /gb/ and /kp/ in its phonological inventory, as do the aforementioned Lower Kasai languages, it also has the labial-velar nasal stop /ɲm/.

Given the documentation state of Sakata labial-velar stops in recent surveys of these sounds which include languages of the DRC (Idiatov & Van de Velde 2021), we deemed it useful to present this exploratory phonetic and diachronic-phonological study based on new fieldwork data. In section 2, we discuss the Sakata language and people. In section 3, we present the methodology and process of data collection. In section 4, we provide as complete a spectrographic description of Sakata labial-velar stops as possible, despite some important biases, notably the limited number of consultants, the scarcity of the available data, and the lack of balance in our small corpus. In spite of these issues, the present contribution represents the first phonetically grounded report and analysis of labial-velar stops in this severely under-documented area of the African continent, arguably one of the least well-surveyed linguistic areas of the planet (Hammarström 2016). In section 5, we offer a few articulatory-phonological considerations on affricates as a substitute for labial-velar stops in Kingingele, showing how a theoretical model that has proved useful in explaining the emergence of labial-velar stops in other languages falls short of its goal in the case of this particular variety. In section 6, we set forth some historical considerations on the diagnostic power of labial-velar stops as a tool to reconstruct the heterogeneous linguistic past of the Lower Kasai region. Conclusions are in section 7.

2. Sakata people and language

The word “Sakata”² or “Saa” designates a people from the Lower Kasai area of the DRC. “Sakata”, ISO 639-3 [skt], is also the most commonly used glossonym to refer to the Bantu varieties spoken by the Sakata people (see van Bulck 1940, de Witte 1955, Matabisi 1979, Intiomale Mbonino 1986, Ikamba 1987, Mundeke 1994). In the referential classification of Bantu languages provided by Guthrie

² The prefixed form “Basakata”, plural for “Sakata person”, is how Sakata people refer to themselves in all the Sakata varieties reviewed in this article. In this article, we refer to both the people and their language as “Sakata”.

(1971), the language is inventoried with the alphanumeric code C34. In the Bantu phylogeny of Grollemund *et al.* (2015), Sakata is part of the West-Western clade, also known as West-Coastal Bantu (see Pacchiarotti *et al.* 2019). Interestingly, in the phylogeographic analysis of the Bantu family presented in Koile *et al.* (2022), Sakata is assigned to the same clade, i.e., what they identify as clade 5 (Njebe-Mbete-Teke), in the trees built solely on lexical material. However, in trees combining lexical and geographical data, Sakata is reclassified into their clade 9 (Kela-Ntomba), which is part of Central-Western Bantu. This might corroborate origin traditions pointing to a relatively recent migration into the region.

According to Vansina (1965: 129), the Sakata are part of a broader cultural and linguistic group known as Boma-Sakata which also includes South-Nunu B822, (North) Boma B82, (Boma) Nku B80x, and Mpe B821 on the one hand, and the Sakata varieties known as Saa (Sakata proper), Dza (Dia), Tow, Bai (Bayi), Tere (Eastern Saa) on the other.³ Similarly, Omasombo Tshonda *et al.* (2019) view the Sakata people as being most closely related to the Teke, Boma, and Tiene communities of Mai-Ndombe. Omasombo Tshonda *et al.* (2019) situate their origins further north, in the Ubangi region:

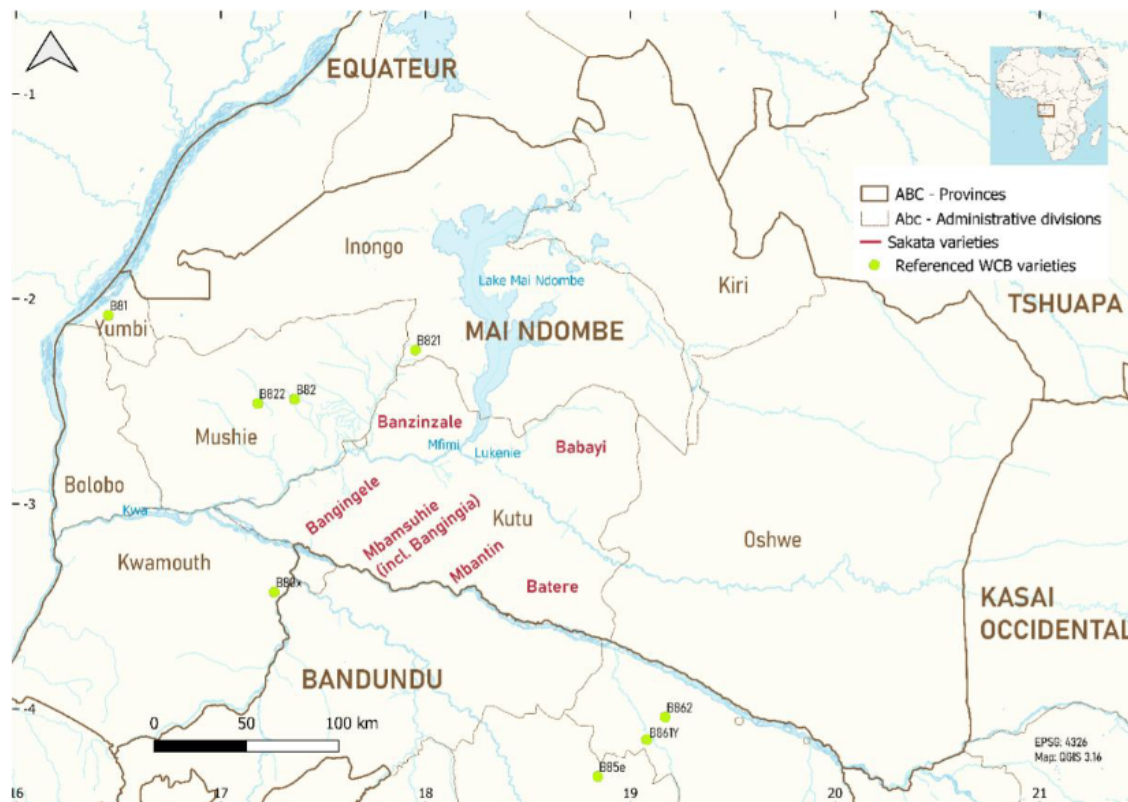
“The Sakata, to whom one might associate the Dia, the Tere and the Tow, came from the Ubangi region. They subsequently advanced along the Congo River down to Kwamouth before taking the Kasai upstream, in relatively ancient times. The migrations of the Sakata would have reached the Mfimi and Lower Lukenye around the 11th or 12th century CE. Their march would have been stopped by the advance of the Mongo” [114; our translation from the French original].

Van der Kerken (1944: 240-241) also traces their origin outside the Lower Kasai region, further west. According to him, the Sakata would have migrated in different waves, the first dating back to the 11th-12th century CE and the last to the 16th-17th century CE. He therefore considers them to be, in his words, a “complex”. This tallies with how Van Bulck (1948: 474) classifies the Sakata people, i.e., within what he calls “Western Bantu”, more specifically the so-called “Old Bantu” (i.e., “*Vieux-Bantous*”), or peoples with distinctive languages and origin traditions that can be traced back west of the Congo Basin. He clusters Sakata in a “Lake Leopold II” (today “Lake Mai-Ndombe”) subgroup together with other communities such as the Boma, Mpe, Nunu, and Tiene. Motengea (2009: 868) also considers the languages of the Sakata and Boma as the most ancient layers of western Bantu in the area which managed to preserve their cultural and linguistic autonomy in the face of external pressure from neighbouring groups.

In sum, according to the existing literature, the label “Sakata” seems to encompass considerable cultural and linguistic diversity. Based on our own fieldwork experience, Sakata is best understood as a continuum of closely related varieties spanning most of the southern borderland of the Mai-Ndombe Province of the DRC, between the Mfimi and Kasai Rivers, and further north, around the southern tip of Lake Mai-Ndombe, i.e., over a large portion of the Kutu territory (see Map 1) of the Mai-Ndombe Province. According to the speakers, different Sakata varieties are largely mutually intelligible. Our consultants never referred to each other as speakers of different languages but rather as Sakata speakers from different regiolectal areas. Even speakers from certain peripheral Sakata varieties, such as the Dia, Bayi, and Tere on the right bank of the Mfimi and Lukenye Rivers, often considered to be culturally and linguistically distinct from “core” Sakata (see Vansina 1965), still identify as Sakata. However, perceived shared ethnic affiliation may lead to an underestimation of actual linguistic heterogeneity and time depth of language divergence (see, for example, Bostoen & de Schryver 2018 with reference to the Kikongo Language Cluster further west).

³ For a discussion of glossonyms and the geographical distribution of the varieties called South-Nunu, Boma, Nku, and Mpe in Vansina (1965), see Pacchiarotti *et al.* (2019: 163-168).

Map 1 – Sakata language varieties (adapted from Bokwankon Bosonkie 1997) and neighbouring languages mentioned in this article⁴



Geographically speaking, the Sakata primarily inhabit the Kutu territory of the Mai-Ndombe Province. This territory is subdivided into five groupings (*groupements*), broadly corresponding to traditional Sakata chiefdoms as shown in Table 1.

Table 1 – Groupings, chiefdoms and Sakata varieties in the Kutu territory

SAKATA GROUPING	CHIEFDOM	SAKATA VARIETY
BADIA	Izú baDia	Kinzinzale
BATERE	Idju baTere	Kitere
KEMBA	Izú Duele	Kimbantini
LWABO	Izú baBayi	Kibayi
	Izú Mbalo	-
MFIMI	Izú Lemvia-Nord	Kingingia, Kimbantini
	Izú Lemvia-Sud	Kimbantini
	Izú Mabie	Kingingie
	Izú Mbamushie	Kəmbamushie

⁴ We asked our Sakata consultants to locate on a map where their different varieties were spoken. The geographical distribution obtained in this way overlaps with that available in Bokwankon Bosonkie (1997).

To this day, the available linguistic literature on Sakata remains scarce and the little that exists is by and large unavailable to international academia (Sundberg 1930, van der Kerken 1936, de Witte 1950, 1955, Ikamba 1987, Mpia Lefutu 1993, Mundeke 1994, Bontenge 1995, Tataa Itsutsele 1996, Nkey Iziasuma 2004, Iyekima Bonghe 2004). A small number of sources focus specifically on phonology (Matabisi 1979, Tylleskär 1987, Bokwankon Bosonkie 1997). Table 2 and Table 3 present Sakata consonant and vowel inventories as described by Bokwankon Bosonkie (1997, central Sakata), which we take as reference here. It is important to note, however, that as we mention above, significant regiolectal variation exists within the Sakata domain.

Table 2 – Sakata consonant phonemes (adapted from Bokwankon Bosonkie 1997: 20)

SAKATA CONSONANTS	BILABIAL	LABIO- DENTAL	DENTAL/ ALVEOLAR	PALATAL	VELAR	LABIAL- VELAR
STOPS	p b		t d		k ^(ŋ) g	kp gb
AFFRICATES			ts dz			
FRICATIVES		f v	s z	ʃ ʒ		
NASALS	m		n	ɲ	ŋ	ɲm
LATERALS			l			
TRILLS			r			
APPROXIMANTS				j		w

Table 3 – Sakata vowel phonemes (adapted from Bokwankon Bosonkie 1997: 20)⁵

SAKATA VOWELS	FRONT	BACK
HIGH	i	u
MID-HIGH	e	o
MID-LOW	ɛ	ɔ
LOW		a

While some phonological information on Sakata can be found in the literature, to the best of our knowledge no reliable phonetic data have ever been made available.

3. Methodology and data collection

As part of the first author's doctoral research project, the first and third authors conducted fieldwork in the Mai-Ndombe Province of the DRC from May to July 2021.⁶ We collected data in the Inongo and Kutu territories, more specifically in the cities of Inongo and Nioki. Inongo is the provincial capital and the province's most multilingual city. Nioki is the province's unofficial economic capital and its second most multilingual city. Within the Sakata area, Nioki is the most populous municipality. In Nioki, we documented six different Sakata varieties: Kinzinzale (also known as Djia, Dia, Dza, or Wadia) C34B, Kibayi C34C, Kingingia C34X, Kingingele C34Y, Kitere C34W, Kimbantin C34Z.⁷ Of

⁵ Some Sakata varieties, such as Kingingia, display phonological nasal vowels in their inventories.

⁶ For more background, see <https://www.bantufirst.ugent.be/lorenzo-maselli-and-jean-pierre-donzos-bantufirst-fieldwork-mission-in-mai-ndombe-province-drc/>.

⁷ What we documented is actually more akin to a set of "idiolects", given the limited number of speakers interviewed. This necessarily limits the possibility of inferring broad, cross-variety generalisations based solely on the data presented here. Nonetheless, it is worth mentioning that more data collection is currently underway with several speakers of central Sakata varieties, close to what is referred to here as Kingingia, and that these additional sources seem to buttress the findings reported in this preliminary venue.

these, only C34B and C34C are inventoried in Maho (2009), who also lists Sakata proper as C34A and Tuku, Ketu, Batow as C34D.⁸ We interviewed one speaker for each variety, as shown in Table 4.

Table 4 – Basic information about our Sakata consultants

SAKATA VARIETY	CONSULTANT	SEX & AGE	PLACE OF ORIGIN	GEOCOORDINATES
KINZINZALE	Frédry Bopila Mbakela	male, 52	Nioki	-2.72, 17.69
KIBAYI	Rocky Besevuku Monkaja Ila	male, 49	Tolo	-2.95, 18.57
KINGINGIA	Darius Moja Mayo Kemay	male, 52	Nioki	-2.72, 17.69
KINGINGELE	Guillaume Moke Mubata	male, 52	Mongobele	-2.79, 17.87
KITERE	Jean-Pierre Kemay	male, 58	Kilima	-3.58, 18.54
KIMBANTIN	Manuel Isee	male, 43	Motangili	-2.72, 17.69

Speakers were asked to translate a word list of approximately 800 items. Several questions to assess the sociolinguistic status of Sakata were asked by the two interviewers. The nature of these latter exchanges was informal and consisted in guided elaboration on present-day Sakata and the oral traditions concerning the history of the Sakata people. A selected subset of the labial-velar stop dataset (i.e., all words containing labial-velar stops present in the elicited data) for each of the varieties we documented during our fieldwork mission is given in Table 5. Lexical items with a labial-velar stop are reported for each variety with their equivalent in all other varieties (whenever available). A question mark means lack of data.

Recording sessions took place indoors, in a relatively quiet environment with no echo discernible in the background; recording conditions, while sub-optimal (i.e., not fully controlled for), remain the best available to us in the field. Recording sessions were interrupted during the hours of maximum traffic in the vicinity of the building. Part of the data was recorded on Roland R-26 and Zoom H-5 devices with their built-in directional microphones, and the rest on the same Roland R-26 device with an external plug-in omnidirectional microphone (Saramonic Lavalier Microphone SR-XLM1) clipped onto the speakers' clothes (sideways from the mouth). The sampling rate was kept at 44.1 kHz/s; maximum input, whenever verifiable, was set at 75%; depth was set at 24 bits; signal is stereo, and the resulting file format is .wav. The data were then imported into Praat (Boersma & Weenink 2020) for annotation and analysis.

⁸ During our fieldwork mission in Nioki and Inongo, we could identify no specific variety as “Sakata proper”, nor could we find any speakers of “Tow”. The Tow/Batow variety was also unknown to our consultants. For the conventions used in the attribution of alphanumeric codes to Bantu varieties of the region not inventoried in Guthrie (1971) and/or Maho (2009), see Pacchiarotti *et al.* (2019: 159-160).

Table 5 – Labial-velar dataset for six different varieties of Sakata

SELECTED LEXICON	KIBAYI	KINZINZALE	KINGINGIA	KINGINGELE	KITERE	KIMBANTIN
‘(kind of) stone’	ɲkú	ɲmú:	ɲmú:	ɲmú:	?	?
‘back’	?	?	?	?	ɲmwá	?
‘broom’	lèkwámò	lè:χwómò	lèmó	lèmó	lèmó	?
‘close’	?	lèkpílèkpì	lèkpílèkpì	lèpfílèpfí	lègbígbi	ò:kpókpò
‘death’	?	ì:kpá	ì:kpá	ì:kpá/ì:pfá	?	ì:kpá
‘death spirit’	mùkfi	mùkfú	ùpfí	ùpfí	?	?
‘disabled person’	ɲgbákàrà	?	ɲkpákàrà	ɲgbákà:	ɲgbá	?
‘flea’	í:ɲmè	í:kpà	í:ɲmà	í:kpà	í:ɲmà/ í:kpà	?
‘how much / many’	kpé	kpé	kpí	kfi	gbí	?
‘laugh’	?	?	?	?	?	kpánkíé
‘leg’	lè:kólò	lè:mélè	lè:kwí	lè:kwí	?	?
‘mourning’	ì:kpá	N/A	ɲkpá	mpfi	ìkpí	ì:kpá
‘myself’	múɲgbà	múɲgbà	múɲgbà	múundzà	múɲgbà	?
‘navel’	mò:túò	mù:χúmá	ù:múá	ù:kfúá	?	?
‘owner’	múɲgbà	múɲgbà	úɲgbà	úndzà	úɲgbà	?
‘pellet’	kàrikpá	kàrikpá	kàràkpá	kàràkpá	?	?
‘salt’	mùɲkpá	mùkpá	ù:kpá	ù:pfí	ùɲkpá	ɲkpá
‘short’	bò:gbé	bò:gbé	ò:kpé	ò:fí	ò:gbí	lè:kwókpò
‘termite hill’	éɲkòlò	kénmélé	káɲkùó	káɲkùó	?	?
‘to die’	òkpá	òkpá	òkpá	òpfá	ì:kpá	?
‘wreck’	?	kíɲgbàɲgbà	kíɲgbàɲgbà	kíɲgbàɲgbà	?	?
‘yam’	è:kpá	kè:kpá	kè:kpá	kèpfí	è:gbá	kè:kpá

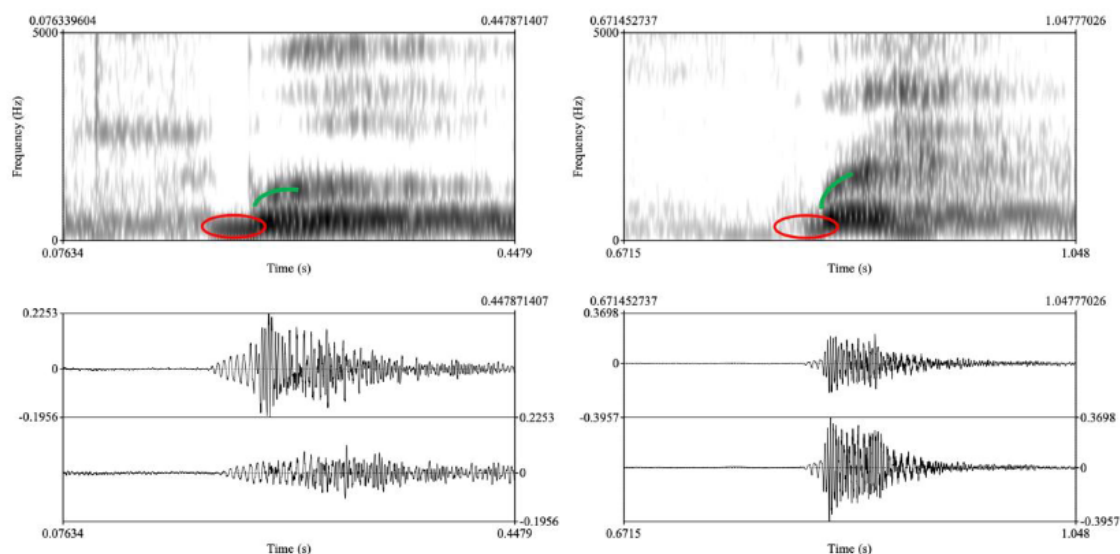
4. Sakata labial-velars

Table 5 shows that all surveyed Sakata varieties minimally contain the voiceless labial-velar stop /kp/, with five out of six also exhibiting its voiced counterpart /gb/.⁹ It is important to note, though, that the distribution of these sounds is not even across varieties. Out of 71 identified words with labial-velar consonants in our dataset, 38 display voiceless /kp/, and only 20 its voiced counterpart /gb/. If we consider possibly reduplicated lexical items (e.g., *lèkpílèkpì* ‘close by’, *kíɲgbàɲgbà* ‘abandoned object’) presenting more than one labial-velar stop, this gives us a total of 40 /kp/ and 24 /gb/ tokens in our corpus. Audio files for these items have been made public on OSF.¹⁰

Although the auditory difference between /kp/ and /gb/ is clear to the linguist’s ear, spectral cues to a voicing distinction are scarce, as shown with the Kinzinzale examples in Figure 1.

⁹ We do not have evidence of /gb/ in Kimbantin. However, our Kimbantin data are significantly less comprehensive than for the other varieties. Lack of evidence is therefore not necessarily evidence of absence.

¹⁰ https://osf.io/vz8ne/?view_only=7c1ef734f17e45a4ae3848439ee6313d.

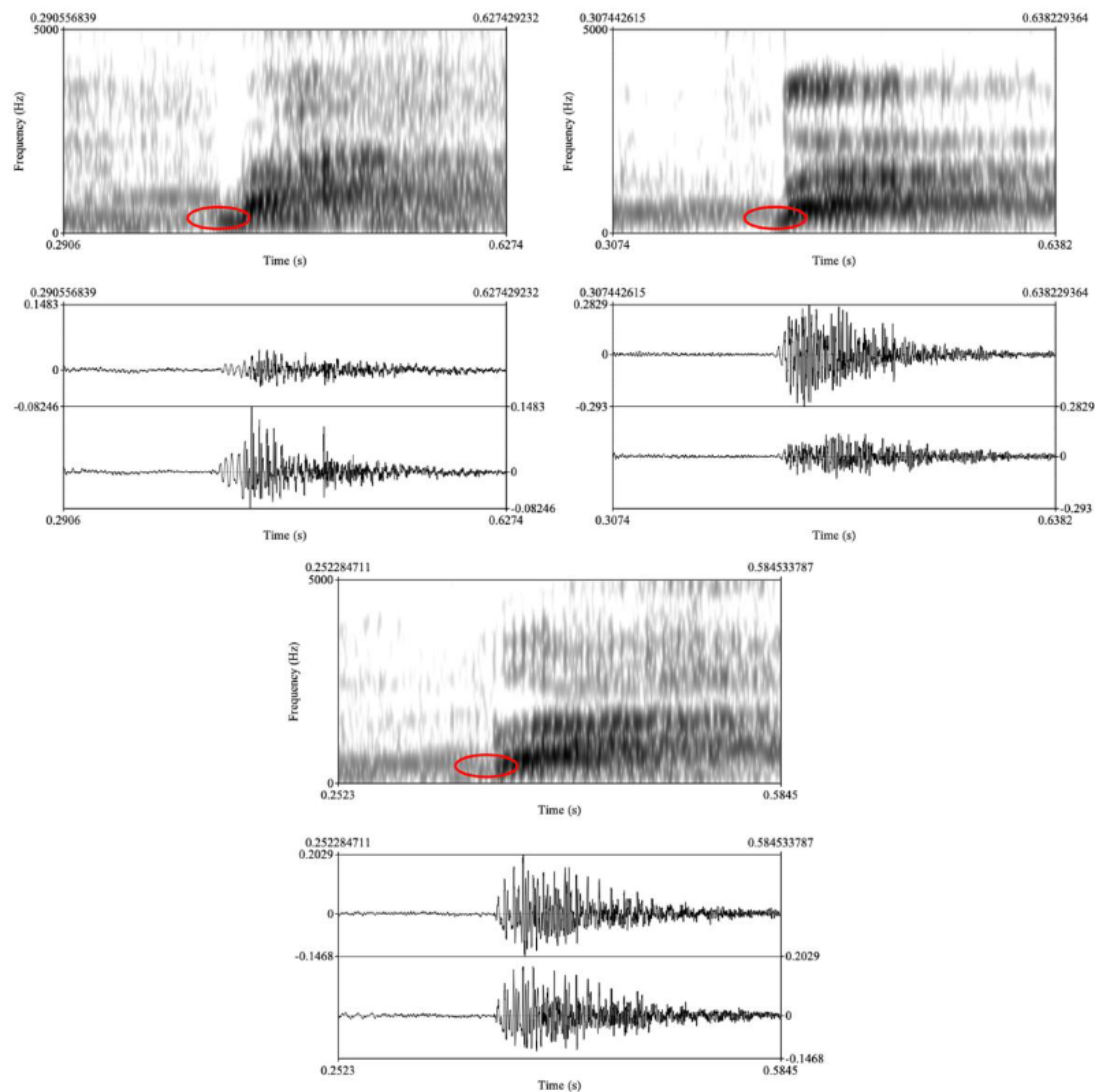
Figure 1 – Spectrograms of Kitere gbí (left) and Kinzinzale kpé (right) ‘how much/many’¹¹

F2 transitions are marked by a steep rise into the following vowel (light green line in the spectrogram), though no specific tendency for double formant loci can be identified (Ladefoged 1968a, Garnes 1975, Connell 1994). The characteristic presence of a voicing bar in the lower regions of the spectrum (circled in red) (see *infra* Ladefoged & Maddieson 1996, among others) is more clearly visible on the voiced than the voiceless counterpart, but it does not seem to distinguish the two as neatly as one might expect. This is not surprising, as labial-velar stops, regardless of their phonological specification for voicing, tend to merge (however completely) to [+ voice]. This is known to happen for several phonetic reasons (see Cahill 2008). First, voiceless labial-velar stops typically lack aspiration, even in languages that tend to prefer [+/- spread glottis] over [+/- voice] as a correlate for voicing (see Iverson & Salmons 2007). This suggests that, all other factors being equal, labial-velar stops are more easily interpreted as [+ voice] rather than [– voice], leading voiceless labial-velar stops to behave acoustically more like voiced ones. Second, labial-velar stops typically display some degree of implosivity (see Siertsema 1958, Ladefoged 1968b, Demolin 1991, 1995). Since the most common setting in larynx lowering is for the glottis not to be completely closed, the glottalic ingressive airstream is often coupled with a pulmonic egressive one. This in turn may generate voicing on both voiceless and voiced labial-velar stops (see Ladefoged 1968b: 6, Catford 1977: 75, McLaughlin 2005, Demolin & Vuillermet 2006).

This situation matches the one found in the other varieties surveyed, as can be seen in Figure 2 for voiceless labial-velar stops. Different pre-voicing spans (circled in red) can be observed during the release phase.

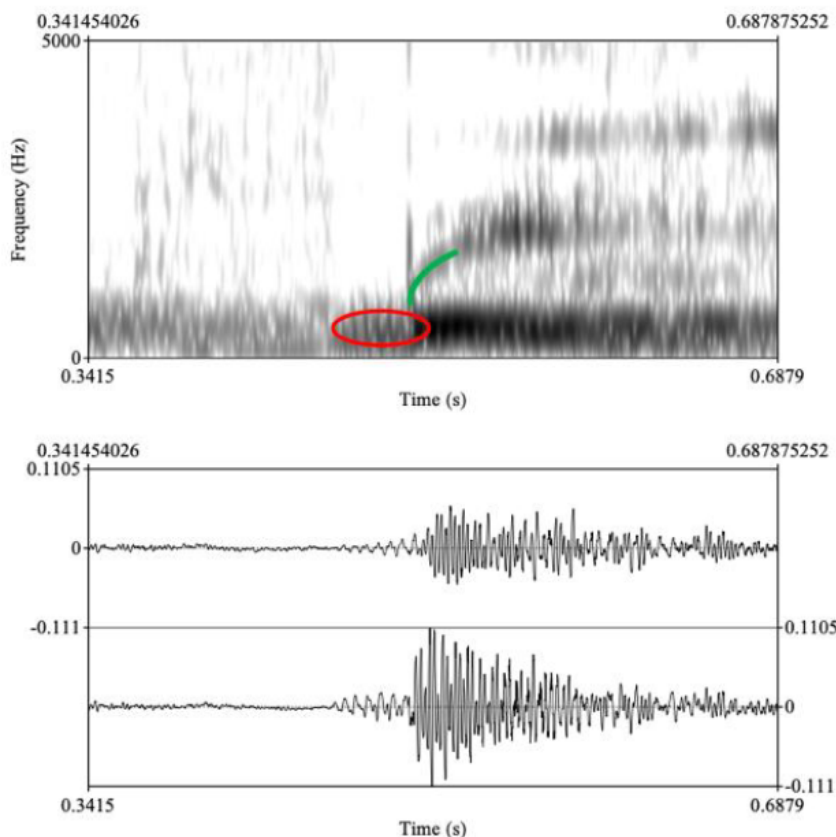
¹¹ Audio files on OSF: [kpé] Kinzinzale-combien_sak+kit_LM_20210625_NIO_03, [gbí] Kitere-combien_sak+kit_LM_20210625_NIO_03

Figure 2 – Realisations of (kàrè)kpá ‘pallet’ in Kibayi (top left), Kingingele (top right) and Kingingia (bottom)¹²



If we compare Figure 2 with Figure 3, we can observe that prevoicing (red circle) is clearer for [gb] than for [kp]. F2 rise (green line) is particularly steep for [gb].

¹² Audio files on OSF: Kibayi Kibayi-grabat_sak_LM_20210622_NIO_15_copy, Kingingele Kingingele-grabat_sak_LM_20210622_NIO_15_copy, Kingingia Kingingia-grabat_sak_LM_20210622_NIO_15_copy.

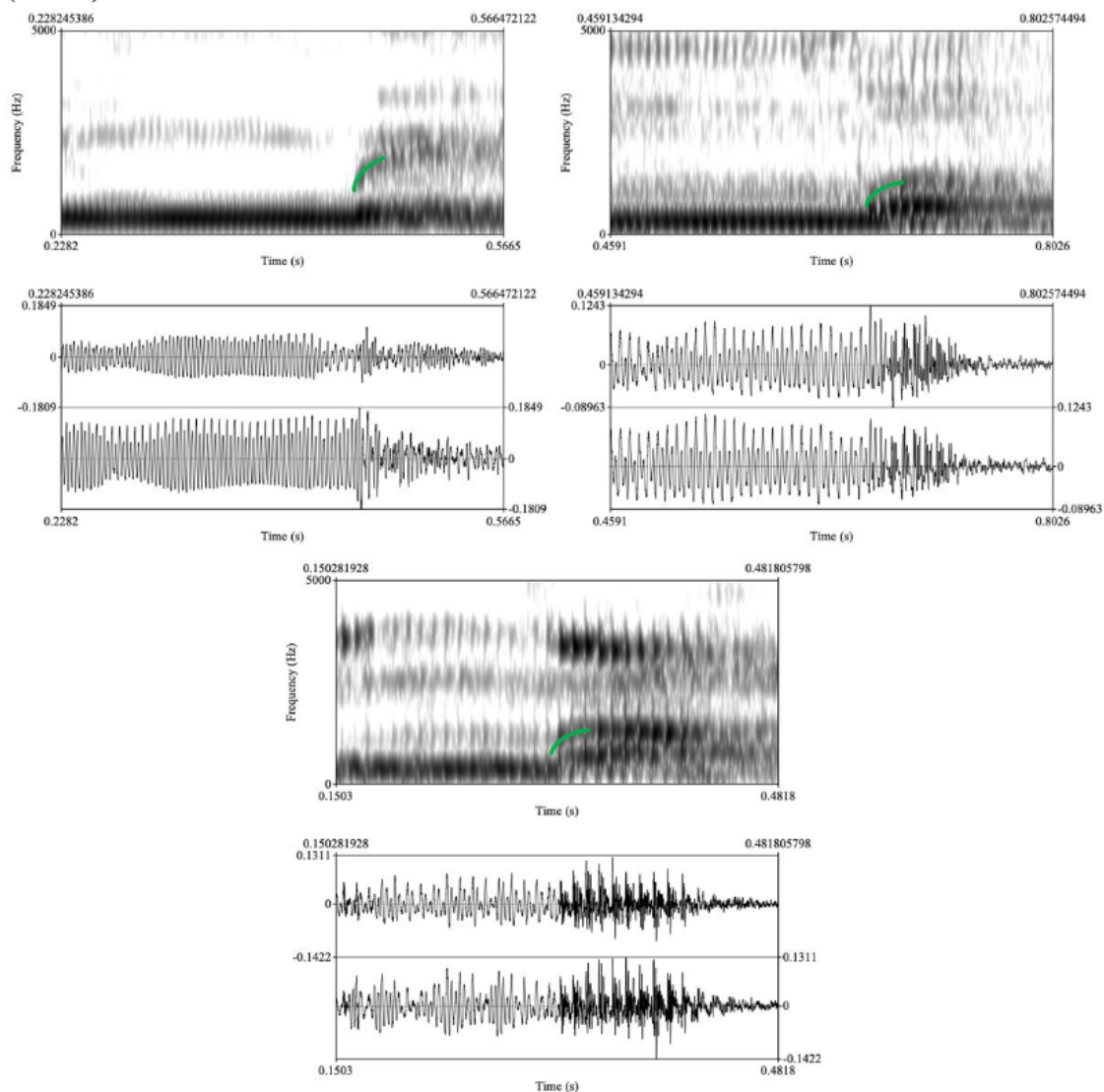
Figure 3 – Realisation of (bò)gbé ‘short’ in Kibayi¹³

As mentioned above, some varieties of Sakata (Kibayi, Kingingia, Kitere) also exhibit labial-velar nasals.¹⁴ To the best of our knowledge, labial-velar nasals have not been reported anywhere else in the region. However, they are quite common further north, in the Macro-Sudan Belt (see Idiatov & Van de Velde 2021). A few exemplary spectrograms can be seen in Figure 4.

¹³ Audio file on OSF: Kibayi-court_sak+kit_LM_20210625_NIO_03.

¹⁴ Other examples of labial-velar nasals were found in our impressionistic survey of another variety of Sakata, i.e., Kimbamushie, but we do not have recordings of those.

Figure 4 – Realisations of (i)ŋmé/(i)ŋmá ‘flea’ in Kibayi (top left), Kitere (top right) and Kingingia (bottom)¹⁵



As can be seen in Figure 4, labial-velar nasals predictably differ from their oral counterparts for the lack of a visible burst, but, to varying degrees, they all display the characteristically steep F2 rise that was observed for labial-velar oral stops (green line; more so in Kibayi, given the higher F2 of the following vowel). Effects of a nasal murmur are discernible throughout the consonant, but no spectral cues such as higher frequency damping unequivocally indicate the transition from a velar to a labial articulation.

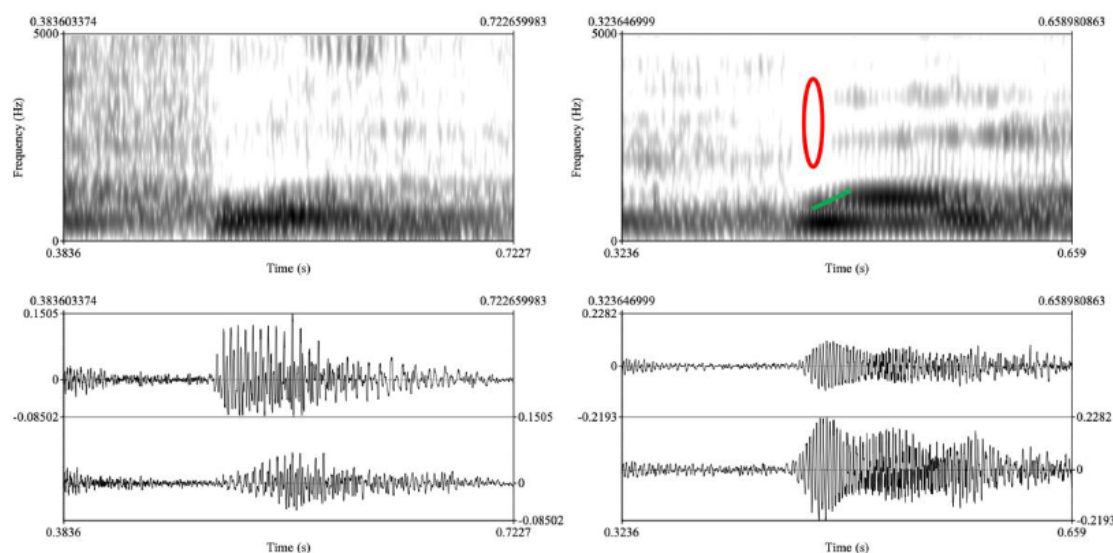
Finally, the presence of voiceless labialised velar fricatives deserves particular mention. While the very possibility of double, synchronous sources of turbulent noise in the vocal tract has long been the object of debate (Cahill 2018: 150), the notion of a voiceless labialised velar fricative / voiceless labial-velar approximant (Ladefoged & Maddieson 1996: 326) is common in the field of English dialectology, especially in reference to Scottish and American English (a few recent case studies: Schützler 2010, Bridwell 2019, Li & Gut 2022). At the moment, we lack the appropriate data to analyse the articulation

¹⁵ Audio files on OSF: Kibayi Kibayi-puce_sak+kit_LM_20210625_NIO_13_copy, Kitere Kitere-puce_kit_LM_20210626_NIO_01, Kingingia-puce_sak+kit_LM_20210625_NIO_13_copy for Kingingia.

of what we have transcribed as <ɱ> in Sakata. Whatever its exact phonetic nature might be, it is interesting to note that within the Sakata domain cognates appear to a) present /ɱ/ (and /χw/) in phonological contexts in which one would expect a labial-velar stop to arise historically (KW > KP, see *infra*), and b) differ as to the degree of labialisation of some of their fricatives as can be seen in the following examples: (i) BLR 1927 *kómbó ‘broom’ > Kibayi: *lèkwámò*; Kinzinzale: *lè:χwómò*; Kingingele / Kingingia / Kitere: *lèṃó(m)*; (ii) *kómbá ‘navel’ > Kinzinzale: *mù:χúmá*; Kingingia: *ù:múá*; Kingingele: *ù:kfúà*.¹⁶

In the case of the reflexes of BLR 1927 *kómbó ‘broom’, the Sakata varieties surveyed here are the only ones in West-Coastal Bantu to display fricativisation in root-initial position without additional voicing¹⁷ (/k/ > /χ/ in Kinzinzale).¹⁸ In turn, the back fricative + labial-velar approximant sequence appears to be subject to varying degrees of temporal compression in Kinzinzale and in Kingingele, Kingingia, and Kitere, as can be observed in Figure 5.

Figure 5 – Spectrograms of Kitere (lè)ṃó (left) and Kinzinzale (lè:)χwómò (right), ‘broom’¹⁹



In the case of [lè:χwómò], a clear F2 slope marking the passage from [w] to [o] is visible (green line), alongside a mid-to-high frequency region of lesser energy after the fricative (circled in red); in the case of [lèṃó], none of this is visible, and while the effects of possible lip-rounding are not easily identifiable without a reliable formant contour, they are unmistakable to the trained ear. Regardless of the exact phonetic nature of this sound, the reflexes of *kómbá ‘navel’ represent one step further in terms of

¹⁶ BLR stands for Bantu Lexical Reconstructions 3 (Bastin *et al.* 2002), a database of nearly 10,000 Bantu lexical protoforms with variable time depth, but widely attested in West-Coastal Bantu and beyond. The number following the BLR abbreviation refers to the unique index number of a given reconstruction in the dataset. Reconstructions without a number are not present in BLR but are posited on the basis of research on West-Coastal and Central Western Bantu languages carried out at BantUGent. For example, the root *kómbá ‘navel’ is absent from BLR but widely attested in West-Coastal Bantu and beyond.

¹⁷ Bantu B40 languages of the Kikongo Language Cluster are the only West-Coastal Bantu languages to have voiced fricative velar reflexes of Proto-West-Coastal Bantu *k, which results from the merger of Proto-Bantu *g and *k (Pacchiarotti & Bostoen 2020), in root-initial position, i.e., *k > γ. Fricative reflexes of Proto-West-Coastal Bantu *k in root-final position are more common though not widespread (Pacchiarotti & Bostoen 2022).

¹⁸ In other contexts, /k/ is the regular reflex of Proto-Bantu *k in Kinzinzale; see, e.g., *ok:ára* ‘to bite’ < *kag, *mukia* ‘tail’ < *kidà BLR 1793, *le:ké* ‘leaf’ < *kájá BLR 1736.

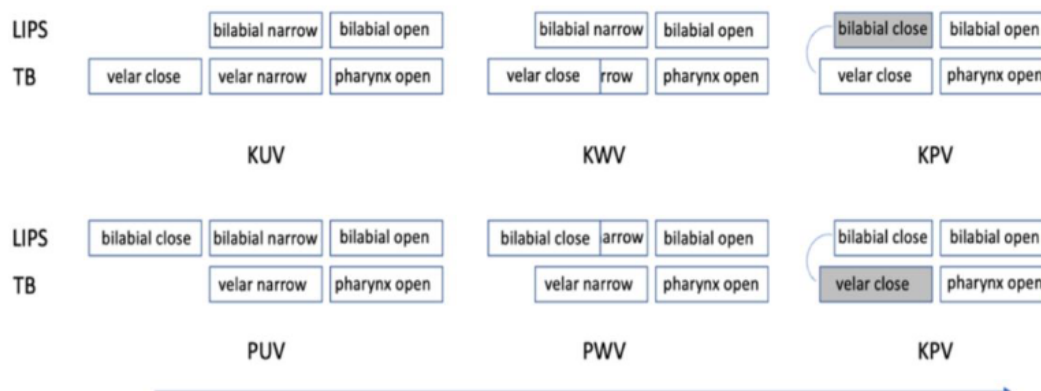
¹⁹ Audio files on OSF: Kinzinzale Kinzinzale-balai_sak+kit_LM_20210625_NIO_11, Kitere Kitere-balai_sak+kit_LM_20210625_NIO_11.

It is essential to remember that our data, and possibly the very number of lexical items with labial-velar sounds in Sakata, are too limited for conclusive phonological generalisations. This being said, it is also important to highlight that Sakata speakers consider the relatively extended presence of labial-velar consonants in their language as an identity marker distinguishing them from other Bantu speech communities of the area. Complementarily, their neighbours commonly identify Sakata speakers by their extensive use of labial-velar consonants, thereby rendering this sound class a defining linguistic mark.²⁰ Based on our own fieldwork experience, the fricatives described above align with labial-velar stops when it comes to distinctive sociolinguistic identity. In fact, to our knowledge, no other Mai-Ndombe languages display a labial-velar fricative like the one described in this section.²¹

Following the analysis of Ponelis (1974) and Connell (1998/1999: 19) as discussed in Cahill (1999), labial-velar stops are likely the outcome of a temporal compression phenomenon of the following type: KuV/KuV > KwV > KPV; PuV/PuV > PwV > KPV.

Connell's (1998/1999) approach moves from Articulatory Phonology (AP; Browman & Goldstein 1989, 1990; Recasens *et al.* 1997; Goldstein, Byrd & Saltzman 2006; Hall 2018) to challenge Mutaka & Ebobissé's (1996/1997) feature-geometrical account of the evolution of labial-velar double articulations based on data from West and East Sawabantu. According to Connell (1998/1999), the progressive overlap of the TONGUE BODY (TB) and LIPS gestures to the point of near synchrony results in a reassignment of constriction specifications (whichever articulator targets {close} spreads this specification to the other). The gestural scores for the chains of changes KuV/KuV > KwV > KPV and PuV/PuV > PwV > KPV presented by Connell (1998/1999) are reproduced in Figure 6.

²¹ The only other languages to display labial-velar stops in the Mai-Ndombe Province are Tieni B81 (see Ellington 1977), the Teke variety known as Kenkuu (recently studied by Guy Kouarata in 2021, pers. comm.) or Boma Nkuu (Nsuka Nkutsi 1990, Pacchiarotti *et al.* 2019), and the neighbouring varieties Nunu B822 and some varieties of North Boma B82 (to varying degrees; pers. data), but not the one documented by Stappers (1986).

Figure 6 – The evolution of labial-velar stops (adapted from Connell 1998/1999)

The applicability of this model is a matter of particular interest in Sakata. As mentioned above, out of 95 identified words containing labial-velar oral stops, nasal stops, or labialised velar fricatives in our set, 58 display labial-velar oral stops, of which 38 /kp/ and only 20 /gb/. Accounting for possibly reduplicated lexical items containing more than one labial-velar oral stop, this gives us a total of 40 /kp/ and 24 /gb/ tokens. For each voicing type, only 3 items could be found in Kingingele (see Table 5). In this variety, labial-velar oral stops appear to undergo a more or less regular process of affrication (which some lexical items escape, see, e.g., *kàràkpá* ‘pallet’ and *ngbákàà* ‘disabled person’), as can be seen in the examples below.

1. ‘myself’: Kibayi, Kinzinzale, Kingingia, Kitere: *múngbà* vs. Kingingele: *múndzà*
2. BLR 2096*kùà ‘death’ > Kibayi, Kinzinzale, Kingingia: *òkpá*; Kitere: *ì:kpá*; Kingingele: *òpfá*
3. *kuai ‘how many’²² > Kibayi, Kinzinzale: *kpé*; Kingingia: *kpí*; Kitere: *gbí*; Kingingele: *kfí*²³

Numerous questions can be raised concerning the Kingingele case: 1) did Kingingele not develop labial-velar oral stops in the first place, or did it substitute them with affricate variants?; 2) what are the underlying reasons for the sound changes leading to the development of affricates as substitutes of labial-velar consonants in Kingingele?; 3) why does Kingingele specifically differ from other Sakata varieties? Of course, our data do not permit a comprehensive analysis of the (extra)linguistic factors at play here, but a few hypotheses can be formulated nonetheless.

Assuming that the affricate reflex in Kingingele followed directly from a protoform like the one described in the early stages of the change summarised above, one would probably have to imagine a sound change trajectory along the following lines: KuV/KuV > KwV > KvV (> KfV/PvV) > PfV. In other words, a partial reassignment of constriction specifications, such that the LIPS’ degree of constriction be specified as {critical} rather than {close}, i.e., enough for turbulent noise to be produced. It is a well-established fact in AP that coarticulation can lead to sound change in a gradient way; see, among others, Browman & Goldstein (1992), Romero & Martín (2003). Devoicing is unsurprising, as it is also attested in Connell (1998/1999). As for the (non-systematic) velar-to-labial shift, a featural explanation might account for it in terms of assimilation ([+velar] > [+labial]/__[+labial]); an AP perspective, on the other hand, might build on the timing of the gestures

²² This root does not occur in BLR3 (Bastin *et al.* 2002) but is widespread within West-Coastal Bantu, where languages generally feature *kwa* (mostly in the Kikongo Language Cluster) or *kwε* (elsewhere). If one hypothesises the presence of a final interrogative *-i (see Meeussen 1967: 103, Idiatov 2022), *kuai seems the only possible reconstruction accounting for both present-day forms.

²³ As an anonymous reviewer notes, /kf/ is better defined as a labiodentalised velar stop (see p. 13); it does, however, occur in free variation with /pf/ (an affricate proper) in most contexts in Kingingele.

involved: the anticipated activation of the LIPS articulator covered the preceding movement of the TB, assuming its {close} specification and yielding the output below with only one articulator changing specifications (LIPS {close} to {critical}); see Browman & Goldstein 1991: 322); see the gestural score in Figure 7.²⁴

Figure 7 – Proposed gestural score for the evolution of voiceless affricates in Kingingele



This possibility supersedes all problems linked to the synchronisation of multiple articulations, effectively producing a stop with a more or less prolonged moment of turbulence after the burst (i.e., an affricate; see Berns 2014: 370). In other cases, such as $\partial:f:i$ ‘short’, it appears that the stop element of the affricate is lost altogether. It can be hypothesised that this is either a subsequent specification or an alternative development, where the {bilabial critical} specification of the LIPS simply extends backwards without assuming the {velar close} one of the TB. Now, these reflexes are by no means rare in the languages of the region: a labiodental/bilabial fricative element is found in numerous forms deriving from Proto-Bantu proto-forms structured like those visible in the early stages of the sound change in $KuV/K\partial V > KwV > KvV (> KfV/PfV) > PfV$; see, e.g., *kúà ‘death’ (BLR 2096), which exhibits reductions to [f(w)]/[pf] in 37 cases out of 47 West-Coastal Bantu attestations in our team’s comparative lexical database.

The situation for the voiced counterpart is, however, more complicated. Where the other Sakata varieties surveyed here seem to have developed the voiced labial-velar stop /gb/, Kingingele mostly exhibits the alveolar affricate /dz/; see (1). One possibility would be to hypothesise a sound change like $GuV/G\partial V > GwV > GvV (> BvV) > DzV$. However, the reasons why DzV should be the result of articulatory restructuring from BvV are unclear, as AP disfavours gestural addition as a source of sound change (in this case, the activation of the TONGUE TIP; see Goldstein 1995). There is reason to believe /dz/ may have been favoured over /bv/ for considerations other than articulation. Acoustically, a key difference between [dz] and [bv] lies in the fact that the latter is more diffuse, having no anterior resonating chamber, which makes it less perceptible. This is in line with the PHOIBLE ranking according to which occurrences of /dz/ outnumber those of /bv/ by a factor of ten in the world’s languages. This ranking does not, however, explain the sound change in question by itself, as /ts/ is also considerably more common than /pf/ (coronal affricates are generally preferred cross-linguistically; see also Berns 2014).

Therefore, a purely articulatory explanation does not appear to fully capture the sound change at play in Kingingele. This may necessitate a different explanation, bearing rather on sociophonetics. As noted above, the presence of labial-velar stops is treated as a linguistic identifier by Sakata speakers, and, within the Sakata domain, the presence of affricate allophones is clearly identified as a hallmark feature of Kingingele. Building on Labov’s (1994) remarks on sociolinguistic “change from below” (i.e., community-driven linguistic innovations that originate below the level of explicit social awareness), Thomason (2007: 45) goes on to contest the widely held assumption that deliberate

²⁴ The contribution of the teeth is left aside here; it is worth mentioning that none of the languages reported in the UCLA Phonological Segment Inventory Database (http://web.phonetik.uni-frankfurt.de/upsid_info.html) have purely bilabial affricates in their inventory.

linguistic manipulation only affects minor or trivial aspects of the grammar. In this sense, affrication can be used as a deliberate (and non-systematic, as attested by the presence of sporadic labial-velar stops in Kingingele too) tool on the part of Kingingele speakers to distance themselves from the other Sakata. Should this explanation prove valid, the reasons for this explicit distancing would need to be identified. Based on our personal fieldwork experience, the Sakata consider themselves to be distant descendants of peoples from further north. It is perhaps imaginable that different integration strategies were implemented by different Sakata groups when they immigrated into the Lower Kasai region. This, in turn, would indicate that Kingingele speakers might have adopted /pf/ to sound more like those around them who did (and do) have /pf/ as an articulatorily-grounded allophone of /kp/, and they may have opted for /dz/ in the case of /gb/ simply because it is more accessible than /bv/ (as evidenced by the fact that /dz/ is a lot more common/unmarked typologically than /bv/). In the case of the West-Coastal Bantu language Lwel B862, Maselli *et al.* (2021) observed that voiceless labial-velar stops are more stable than their voiced counterparts, which, on the other hand, tend to be realised as plain [b] (or slightly implosive versions of [b]). In other words, voiced labial-velar stops have been shown to be less stable than their voiceless counterparts in at least one of the languages of the region. If that pattern were to hold true for other languages too, it could indicate that Kingingele speakers might not even have “looked for” other regular reflexes of *gw- serving as labial-velar substitutes in the region, thus backstopping the notion that no articulatory variables came into play in the identification of their affricate allophone. More data on the acoustics and articulation of Sakata labial-velar sounds are needed to test these hypotheses. Evidence from other fields, including sociolinguistics, should also be considered.

6. Historical implications

We conclude this article with a few considerations on the phonetic and phonological uniqueness of the West-Coastal Bantu languages spoken in the Mai-Ndombe Province. Besides the existence of a full-fledged inventory of labial-velar stops including nasals in the Sakata varieties phonetically documented here for the first time, neighbouring languages such as North Boma B82 and Nunu B822 display phonemic nasal retroflexes (Stappers 1986, Maselli *et al.*: under review). What is more, they probably also have maximality constraints on verb stems similar to those described for Tieni (Ellington 1977, Hyman 2010), where co-occurrence restrictions are found that depend on the place of articulation and nasality of consonants in specific phonotactic positions within the verb stem. Maximality constraints and the sporadic presence of labial-velar stops are found elsewhere in the West-Coastal Bantu languages spoken in the homeland area (see, e.g., relevant Ding data in Ebalantshim Masuwan 1980, Maselli *et al.* 2021). On the contrary, the comprehensive inventory of labial-velar stops found in some Sakata varieties, along with the nasal retroflexes of North Boma, are, to our knowledge, unique within West-Coastal Bantu. This means that they are unique to the Mai-Ndombe area. At the same time, the West-Coastal Bantu homeland region (see Pacchiarotti *et al.* 2019) is also a hot spot of phonological diversity unlike any other in West-Coastal Bantu. Languages from this area all belong to Guthrie’s referential B80 group, which is the most diverse within West-Coastal Bantu in terms of basic vocabulary. Atypical phonological features crosscut phylogenetic subgroups and include: large vowel systems with up to 13 vowel phonemes (Ebalantshim Masuwan 1980, Koni Muluwa & Bostoen 2019, Mfum-Ekong 1979) including interior vowels (Pacchiarotti *et al.* 2021), diphthongisation, umlaut (Bostoen & Koni Muluwa 2014), phonologically unconditioned final vowel loss (Pacchiarotti & Bostoen 2021a), dorsal fricatives (Pacchiarotti & Bostoen 2022), and heterosyllabic sequences of mid and low vowels (Pacchiarotti *et al.* 2021; see also Daeleman 1977, Rottland 1977, Bostoen & Mundeke 2011a,b).

These facts invite consideration about the origins and sociolinguistic dynamics underpinning this synchronic diversity. In terms of their origin, today’s scenario suggests that the relevant languages

spoken in the Mai-Ndombe and Bandundu regions where the West-Coastal Bantu homeland area is located display traces of archaic heterogeneity (Hetzron 1976) and are therefore “fossils” of erstwhile greater linguistic diversity in the area. As argued by Nettle (1996), the social isolation model of physical barriers to explain language diversification seems to be inappropriate for West Africa and, in all likelihood, for Central Africa as well. Although precise sociolinguistic data are unavailable, the speech communities displaying the phonological inventories and features described above have a relatively small number of speakers, in the range of 2,000 to 20,000 individuals, and are in close contact with other speech communities with which they usually interact in a language of wider communication such as Lingala or Kongo ya Leta. Nevertheless, this contact situation has not led to language convergence or the loss of distinctive phonetic/phonological features such as a full set of labial-velar stops (in Sakata) and nasal retroflexes (North Boma, Nunu). Possibly, these features are attributable to conscious language manipulation as a way to create group identity (Dimmendaal & Storch 2016). At the same time, it is possible that some of these features are the result of speakers shifting to another language while preserving some phonological aspects of their original tongues. A combination of these factors cannot be excluded either. As a matter of fact, labial-velar stops are a trait of particular interest in historical terms. Unlike other distinctive phonetic features of African languages, such as clicks in southern African Khoisan and Bantu, labial-velar stops are acoustically less marked, as attested by the fact that they are known to converge to plain labial realisations in numerous languages (see Cahill 2008, Maselli *et al.* 2021: 152, and the literature cited therein). In this sense, while more acoustically marked sounds, e.g., clicks, are hardly ever transferred in situations of superficial interlinguistic contact (Gunnink *et al.* 2015, Pakendorf *et al.* 2017), labial-velar stops may have spread more easily through deliberate acquisition on the part of Bantu speakers in several areas of the Congo Basin, including southern Mai-Ndombe, possibly as a way for them to distance themselves from the neighbouring Mongo (as has been claimed to be the case for several Bantu languages spoken between the Congo and Ubangi Rivers; see Bostoen & Donzo 2013). In fact, while the phonological load of labial-velar stops appears to be established in Sakata, numerous other languages spoken in the immediate vicinity of Sakata (North Boma, Nunu) and the wider region (e.g., Lwel B862, North Boma B82, Western Ngwi B861Y) present labial-velar stops as free variants of /kw/ and /gw/ sequences (especially in fast, connected speech; pers. data).²⁵ This might indicate that some speech communities of the Lower Kasai area present labial-velar stops in their shared phonetic inventory (i.e., as a commonly accepted variant of /kw/ and /gw/, to varying degrees) before they do, individually, as full phonemes in their phonological repertoires. In this sense, the functional load of labial-velar stops in the Bantu languages of the region may be said to range from cases of major (Sakata) to minor (Nunu, North Boma) phonologisation. If so, a typology of labial-velar-containing inventories in southwestern Congo, after the model of Güldemann & Stoneking’s (2008) work on southern African clicks, would prove greatly beneficial in refining our understanding of the situation. Clearly, the unique phonological diversity of the Mai-Ndombe Province and the West-Coastal Bantu homeland area presents a promising avenue for dedicated phonetic documentation.

7. Conclusions

²⁵ While the North Boma speech varieties documented by the first and third author in 2021 feature labial-velar stops, the North Boma variety of Bopaka-Pentana (-2.49, 17.36) documented in August 2022 by the third, fourth, and last authors has [kf] and [tf] in words where other North Boma varieties might have labial-velar stops. The variety of Bopaka-Pentana appears to be virtually identical to the North Boma variety documented by Stappers (1986). Similarly, in the Eastern Ngwi spoken in Mangai (-4.02, 19.53) (Pacchiarotti & Bostoen 2021b), labial-velar stops are nowhere to be found. This is in sharp contrast with the Western Ngwi variety described by Kumpel Wossey (2001).

Labial-velar stops, a class of typologically rare sounds, occur in the consonant inventory of Sakata (Bantu C34), a cluster of closely related varieties spoken in the Mai-Ndombe Province of the DRC. This linguistic area, one of the world's least well-surveyed ones, is situated significantly to the south of Africa's major hot spot of labial-velar stops, i.e., the so-called Macro-Sudan Belt. Following our inventory of labial-velar stops in Lwel, a closely related language from the West-Coastal Bantu homeland in DRC's Kwilu Province (Maselli et al. 2021), we have provided here the first detailed spectrographic description of this category of double articulated consonants in the region, establishing the existence of both voiceless and voiced labial-velar stops and of their nasal counterparts in Sakata. While some Sakata varieties have labialised velar fricatives correspond to labial-velar stops both in terms of historical phonology and sociophonetics, Kingingele substitutes them with affricates. Unlike what happens in other African languages, the emergence of voiced affricates as a substitute for /gb/ in Kingingele eludes explanation through AP. Therefore, we contend that Kingingele speakers may have adopted a phonetically ungrounded variant to distance themselves from other Sakata speech communities in the area. Finally, when it comes to the historical-linguistic implications of Lower Kasai's great phonological diversity, labial-velar stops in Sakata may be just one trace of a now submerged past of even greater linguistic differentiation in the region. In this sense, efforts should not be spared in the future to provide a further-reaching typology of labial-velar-containing phonological inventories in southwestern Congo.

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Abbreviations

AP = Articulatory Phonology
 DRC = Democratic Republic of Congo
 TB = Tongue Body
 F2 = Second formant

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