Labial-velar stops outside the Macro-Sudan Belt: New evidence from Lwel (West-Coastal Bantu, B862)

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Abstract

The Congo Basin rainforest is among the least well-documented linguistic regions of the world. This means that our current knowledge of Central African languages is biased by important research gaps. This is particularly true of phonetics, as sound-specific explorations and data collection in the area remain a marginal activity within language documentation. This paper offers new phonetic evidence for the presence of labial-velar stops in Lwel (West-Coastal Bantu, B862), a language spoken along the Kasai River in the Kwilu Province of the Democratic Republic of the Congo. The presence of labial-velar stops in Lwel calls into question their definition as a distinctive areal feature of the so-called Macro-Sudan Belt in northern Sub-Saharan Africa. What is more, Lwel displays a rather unusual voicing pattern, apparently at odds with the long-established notion that voiced labial-velars are cross-linguistically favored over their voiceless counterparts. We tentatively propose that substrate influence from no longer extant preBantu forest languages may have contributed to shaping the unusual phonology of Lwel and several other languages spoken in the West-Coastal Bantu homeland area.

Keywords: labial-velar stops, Bantu phonetics, historical phonology, language contact, substrate interference

Introduction

Labial-velar (LV) stops are doubly articulated sounds (see, e.g., Ladefoged 1968a, b, Ponelis 1974, Ohala & Lorentz 1977, Maddieson 1993, Connell 1994, Ladefoged & Maddieson 1996, Ladefoged 2003) produced with simultaneous occlusions at different points of the oral cavity, one around the velum and one in the labial area. These occlusions are released almost simultaneously, but the velar burst seems to always come first (see Painter 1978, Connell 1987, 1991a, 1991b, 1994, Dogil 1988, Maddieson & Ladefoged 1989, Cahill & Hajek 2001, Cahill 2018: 154). Worldwide, LV stops are most common in Africa, especially **/kp/** and **/gb/** (Cahill 2008, Maddieson 2011). They occur in three of the four main African language phyla, i.e. Afro-Asiatic (AA), NiloSaharan (NS) and Niger-Congo (N-C), more specifically in the following branches: Chadic [AA]; Moru-Mangbetu, Bongo-Bagirmi, Nilotic [NS]; Adamawa-Ubangi, Benue-Congo, Kwa, Gur, Atlantic, Mande, Ijoid, and Kru [NC] (Clements & Rialland 2008; Güldemann 2008). Several phonetically-oriented accounts of their historical development have been proposed (Ponelis 1974; Zima 1985; Kelly 1974, 1988; Connell 1991a, 1994, 1995, 1998/9; Demolin 1995, Goldstein 1995; Hyman 2011). In this respect, there is some degree of agreement in that LV stops are likely the outcome of a temporal compression phenomenon (Ponelis 1974; Connell 1998/9: 19), whereby K**u**V/K**ʊ**V > K**w**V > KPV (where K = **/k/** and **/g/**, P = **/p/** and **/b/** and V= a vowel other than **u/ʊ**). As a matter of fact, with reference to the area we are interested in, the sound shifts $C_{[+voice]}$wV > gbV and $C_{[-voice]}$wV > kpV are attested in several rainforest zone C Bantu languages spoken between the Congo and Ubangi Rivers (Bostoen & Donzo 2013). An alternative hypothesis is that LV stops might originate in labial velarization, as in the Cameroonian Grassfields Bantu languages Aghem (see Hyman 1979, Cahill 2018: 156-157). Whatever the case might be, this sound change seems to have affected different areas of the continent to different extents.

Within Africa, LV stops are seen as a distinctive feature of the so-called "Macro-Sudan Belt", a stretch of land spanning contiguously from the western end of the landmass to the Ethiopian escarpment in the east (Clements & Rialland 2008; Güldemann 2008, 2018: 479-486).[1] This linguistic macroarea in northern Sub-Saharan Africa would have been "shaped by geographical conditions that were fairly stable over a long time span" (Güldemann 2008: 183). As a result, shared linguistic in this huge zone would be the outcome of shared geography rather than shared genealogy. As for Bantu, LV stops have not been reconstructed to the family's putative most recent common ancestor (Meeussen 1967). Their presence in some parts of the Bantu-speaking area has been claimed to be contact-induced, especially through intensive interaction with languages from the Macro-Sudan Belt,

1. As an anonymous reviewer points out, labialvelars are at best a weak indicator of the Macro-Sudan Belt. As Hyman (2011) puts it: "This fact [i.e. that LV spread is still ongoing], as well as the fact that these sounds are found in only half of the languages of the MSB [Macro-Sudan Belt], suggests that the presence or absence of labialvelars will not be very useful for the purpose of reconstructing remote protolanguages". See Cahill (2008: 383) for an overview of LVs in protolanguage reconstructions across the world's families and Cahill (2017) for a critical take on the diagnostic value of LVs to delimit a linguistic area.

such as Adamawa-Ubangi languages spoken north of the Congo River (cf. Bostoen & Donzo 2013; Cahill 2018: 156). However, the social-historical dynamics underlying this transfer have been left mostly undocumented (Dimmendaal 1995, 2001: 377; Grégoire 2003). LV stops have mainly been reported in languages of the northern Bantu borderland, i.e. in Guthrie's "zones A, C, and D spoken in the equatorial forest and Congo Basin from the Atlantic in the west to Lake Albert in the east" (Clements & Rialland 2008: 43). This distribution of LV stops in Bantu does not represent a continuity zone, but rather a west-east axis where languages with a high concentration of LV stops in their lexicon alternate with languages without such phonemes in a patchwork-like fashion (Idiatov & Van de Velde 2021).

Given that LV stops are considered as a typical feature of northern Sub-Saharan Africa, i.e. the Macro-Sudan Belt, in general and the northern Bantu borderland in particular, it is remarkable that they are also reported in several languages of Guthrie's B80 group, such as Tiene B81 (Ellington 1977: 28), Nsong B85d (Dibata Mimpya 1979: 14), Mpur B85e (Kibwenge India'Ane 1985: 39-40), Nsambaan B85F (Katona Makani 2017: 16), Ding B86 (Mula 1977: 7; Munkyen Okab 1990: 208), Ngwi B861 (Nsumuki 1993: 12), Lwel B862 (Khang Levy 1977: 20, 1979: 4), Nzadi B865 (Crane *et al.* 2011: 21) and Mbuun B87 (Mundeke 2011: 29). All of these languages are spoken to the extreme south of the Congo Basin rainforest, and are therefore entirely disconnected from the northern Bantu borderland. While northern Bantu languages are supposed to have acquired LVs from languages spoken in the Ubangi Basin hotbed (Idiatov & Van de Velde 2021), the B80 languages listed above are located hundreds of kilometers further south, in the southern periphery of the rainforest, completely separated from this focal area of LV stops. Specifically, they are situated at the southern end of the so-called "Sangha River Interval", a natural corridor which might have facilitated the migration of Bantu-speaking people through the forest some 2500 years ago (Bostoen *et al*. 2015; Grollemund *et al*. 2015). B80 languages may descend from the language(s) spoken by the first Bantu speech communities settling south of the equatorial rainforest (Pacchiarotti *et al.* 2019).

All B80 languages possibly having LV stops belong to West-Coastal Bantu (WCB), a.k.a. West-Western Bantu, a major discrete clade within the Bantu phylogeny (de Schryver *et al.* 2015; Grollemund *et al.* 2015; Pacchiarotti *et al.* 2019), in which LV stops are otherwise uncommon. What is more, Guthrie's B80 group is the internally most heterogeneous one within WCB, at least as far as basic vocabulary is concerned. As shown in Map 1, these varieties are spoken within and around the putative WCB homeland, i.e. between the Kamtsha and Kasai Rivers southeast of Bandundu City in the present-day Kwilu Province of the Democratic Republic of the Congo (DRC) (Pacchiarotti *et al.* 2019: 157). This is the area of highest diversity within WCB: several of the B80 languages mentioned above belong to distinct major WCB subclades that meet there.

There might be several reasons why large-scale surveys of sounds in African languages have not reported LV stops in this specific area of the Bantu domain. To this day, several parts of the DRC, including its southern outskirts and the border with Angola, remain among the least well-documented linguistic regions of the world (Hammarström 2016). This implies that our current knowledge of Central African languages is biased by important research gaps, which impact

both synchronic typology and historical linguistics. It is worth mentioning what Clements & Rialland (2008: 44) note about their list of Bantu A, C and D languages displaying LVs in their phonological inventories:

> "This list is very likely incomplete, as information for most languages in the area is sparse. The Bantu languages in this broad zone are (or presumably have been in the not distant past) in contact with other Sudanic languages having labial-velar stops: southern Bantoid languages in the west, Adamawa-Ubangi languages in the center, and Central Sudanic languages in the east".

As a matter of fact, Clements & Rialland (2008) do not list any Bantu B languages, despite the fact that many are spoken in the area they signal as affected by the phenomenon, south of Lake Mai-Ndombe in the DRC. This is not surprising considering that: (1) the sources which describe these languages are generally rather difficult to access; (2) LVs are often a marginal phenomenon in the languages in question, i.e. they only occur in a few lexemes; (3) the existence of LV in these languages is not well established, neither phonologically nor phonetically; (4) while certain sources on a given language report them, others do not. With respect to this last point, for instance, Dibata Mimpya (1979: 14) reports **/kp/** and **/gb/** in Nsong B85d but Koni Muluwa & Bostoen (2019: 416) do not. For Ding B86, Mula (1977: 7) reports **/kp/** and Munkyen Okab (1990: 208) **/kp/**, **/ŋkp/**, and **/ŋgb/**,[2] but Mertens (1938: 14) and Mwan Mesongolo (1984: 17) do not list any of these phonemes. It is not clear whether these disparities are to be accounted foras regiolectal variation, differences in documentation methods, or simply divergent analyses of similar data. In other words, LV stops in the WCB languages of Guthrie's B80 group are still shrouded in doubt.

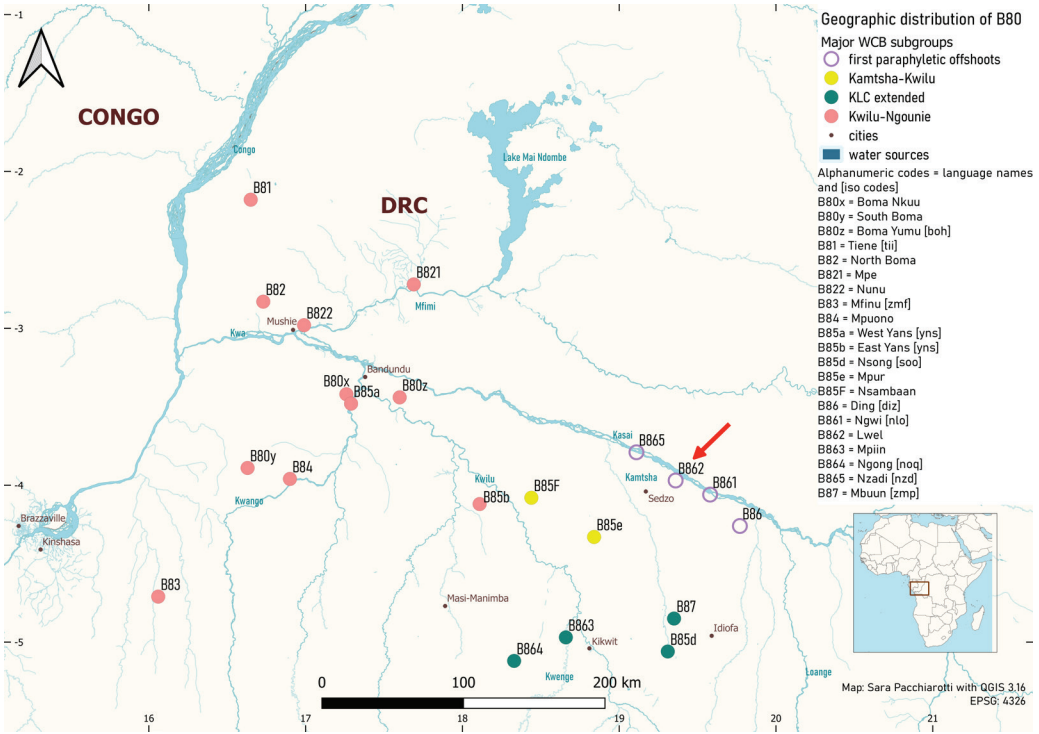
In an attempt to start resolving this uncertainty, we offer here a preliminary phonetic and phonological assessment of LV stops in Lwel B862. Starting out from the grammar sketch by Khang Levy (1979), the second and last authors recorded a number of words containing these sounds in August 2019 in Idiofa (Kwilu province, S 4°96'589'', E 19°59'151'') during a fieldwork mission within the frame of the Bantu-First project (https://www.bantufirst.ugent.be/). Unfortunately, they could only elicit reliable data from one male native speaker, Mazola Kalakwan Yolo, a 62-year-old civil servant originally from Sedzo who has been living in Idiofa since the 1980s. Mazola Kalakwan Yolo speaks Lwel in informal contexts with relatives and friends, along with Kikongo ya Leta, Lingala and French as languages of wider communication.

Lwel is a WCB language spoken in and around the collectivities of Sedzo (S 4°04'187'', E 19°17'769'') and Mateko (S 4°9'1'', E 19°5'23''), in the Idiofa territory of the Kwilu province of the DRC (Khang Levy 1979: XI). Like other languages with a Guthrie alphanumeric code of B85 and higher (Guthrie 1971, Maho 2009), Lwel is spoken west of the Loange River, south of the Kasai River and east of the Wamba River and of the lower course of the Kwango River north of its confluence with the Wamba (Pacchiarotti *et al.* 2019: 189); see Map 1. Phylogenetically, Lwel is, together with Ding (B86), Ngwi (B861) and

2. See Cahill (2018: 158-159) and the references cited therein for the problem of nasal assimilation with LVs.

Nzadi (B865), part of the paraphyly that is sister to the rest of WCB. These four languages do not have a more recent ancestor in common with each other and all other WCB languages than the one at the origin of the entire branch (Pacchiarotti *et al.* 2019: 189190). The Lwel variety concerned here is the one spoken around Sedzo (see red arrow in Map 1) and documented in Khang Levy (1977, 1979), which Pacchiarotti *et al.* (2019) refer to as East Lwel B862X, to distinguish it from the western variety spoken around Mateko (see map in Boone 1973 and Khang Levy 1979: X based on Boone 1973: 244). As far as we know, the western variety of Lwel is still undocumented. Lwel (no ISO code assigned, see Map 1) is not inventoried in the Ethnologue 24 (Eberhard *et al.* 2021). Glottolog 4.4 does include it and categorizes it as not endangered (Hammarström *et al.* 2021). The little sociolinguistic information that we gathered in Idiofa in 2019 suggests that Lwel is indeed not endangered in that there are still fluent speakers ranging from 20 to 70 years old. However, the transmission of Lwel to newer generations is doubtful, especially in the case of mixed marriages. In the area where Lwel is spoken, children born from parents speaking different WCB varieties are often raised in the main vehicular languages, namely Lingala and/or Kikongo ya Leta.

This article is structured as follows. In Section 2, we provide a concise phonetic description of LVs in Lwel pending a full-fledged acoustic and articulatory analysis for which our current data are insufficient. In Section 3, we consider LV stops in Lwel from the broader perspective of phonological typology and historical linguistics. We conclude in Section 4 by reasserting the necessity for further data collection in the region, as it is only through the analysis of all relevant variables that the exact nature of these sounds and their relevance for historical research can be satisfactorily ascertained.



Map 1. Geographic distribution of Bantu B80 languages[3]

3. Absence of an ISO code next to a language name in Map 1 means that the variety does not have one. ISO codes next to language names in Map 1 were obtained from the Glottolog 4.4 (Hammarström *et al.* 2021). For a discussion of confusion and problems around language names, alphanumeric codes (Guthrie 1971; Maho 2009), and ISO codes for some of the varieties in Map 1 see Pacchiarotti *et al.* (2019: 163-174).

1. Labial-velar stops in Lwel and their realizations

The dissertations by Khang Levy (1977, 1979) are the only descriptive studies of Lwel available to us. In these works, LV stops **/kp/** and **/gb/** are listed as part of the language's consonantal inventory, reproduced in Table 1.

	bilabial	labiodental	alveolar	postalveolar	palatal	velar	labiovelar
stop	**p b**		**t d**			**k**	**kp gb**
nasal	**m**		**n**		**ɲ**	**ŋ**	
fricative		**f v**	**s z**				
affricate		**pf bv**					
lateral			**l**				
trill			**r**				
approximant					**y**		**w**

Table 1. Lwel consonantal inventory (adapted from Khang Levy 1979: 4)

LV stops are reported in the words in (1) and (2) respectively, to which we added the notation of low tones and noun prefixes where missing. If a word can be considered as a reflex of a specific Bantu Lexical Reconstruction (BLR) (Bastin *et al.* 2002), we also added that etymon for further historical considerations below.

(1) **/kp/** in Lwel (Khang Levy 1977, 1979)

òk-pɛ́	(CL 15)	'to die'	***kú**	(BLR 2089)
Øk-pɛ́	(CL 5/6)	'death'	***kúà**	(BLR 2069)
kə̀-kpɛ́	(CL 7/8)	'yam, potato'	***kùá**	(BLR 1968)
ŋ̀-kpɛ́	(CL 3/4)	'salt'	***gúá**	(BLR 1521)
ì-kpɛ́	(CL 19)	'a bit of salt'	***gúá**	(BLR 1521)
k-pɛ̀?		'how much?'	***kʊa**[4]	
k-pɛ́		'despite'		

As can be seen in (2), all instances of **/gb/** inventoried by Khang Levy (1977, 1979) are prenasalized and the nouns in which they are found are reported as belonging to noun class pairing 9/10. We therefore mark the initial nasal as a noun class prefix, even though it might be synchronically analyzable as part of the stem.

4. This reconstruction does not occur in BLR 3 (Bastin *et al*. 2002). However, the question word **kwa** is widespread in the Kikongo Language Cluster (KLC), a discrete branch of WCB (de Schryver *et al.* 2015; Pacchiarotti *et al.* 2019), and seems cognate to Lwel **kpɛ̀,** suggesting that ***kʊa** could possibly be reconstructed to Proto-WCB (PWCB)

(2) **/gb/** in Lwel (Khang Levy 1977, 1979)

ŋ̀-gbú	(CL 9/10)	'your mother'	***gúkù**[5]
ŋ̀-gbáán	(CL 9/10)	'his/her mother'	***gúkù** +***ndɪ́** 3SG.POSS[6]
ŋ̀-gbè	(CL 9/10)	'back (body part)'	
ŋ̀-gbə̀l	(CL 9/10)	'pork'	***gùdú** (BLR 1493)

Our recordings (freely available on OSF: https://osf.io/wbaq5/) were explicitly made to determine whether the LV stops in (1) and (2) effectively occur in Lwel and whether there might be need for further sound-specific phonetic research in the region. On the basis of roughly two hours of elicited data, only the existence of voiceless **/kp/** can be unequivocally confirmed. This sound is observable in the spectrogram in Figure 1 for **ŋ̀kpɛ́** 'salt' (from the sound file nekpa.kp_labvel.1.0819_171630_1.666,493667,105.wav on OSF; dynamic range: 50 dB), where we notice the presence of a cross-frequency concentration of energy most likely associated to the bilabial burst of **/kp/**, which is arguably the more salient of the two (Cahill 2018: 152). In the spectrogram in Figure 1, the energy concentration is preceded by a few milliseconds of prevoicing (circled in red in the spectrum) and a steep F2 rise into the following vowel (dotted).[7]

5. This reconstruction does not occur in BLR 3 (Bastin *et al.* 2002). However, it occurs in several WCB languages and could go as far back as PWCB. It is not only recurrent in the Kwilu-Ngounie branch of WCB, but it is also attested in paraphyletic languages at the top of the WCB tree, such as Ding B86, i.e. in **ŋɣwa** (Koni Muluwa & Bostoen 2015), and Lwel B862. Based on reflexes like Laali B73b **ngúhò** (Bissila 1991) and Kukwa B77a **ngúkù** (Paulian 1975), we propose a CVCV reconstruction with a prenasalized ***g** in C_1 (the nasal being a CL 9/10 prefix) and PWCB ***k** in C_2, which is the merged reflex of ProtoBantu (PB) ***k** and ***g** (when not preceded by a nasal) (Pacchiarotti & Bostoen 2020).

6. Guthrie (1970: 141, 151) lists ***-nde** 'him, her' (C.S 509) and ***ndi** 'him, her' (C.S 549) as two proto-items whose reflexes are commonly attested in possessive stems. Kamba Muzenga (2003: 256) reconstructs the form ***ɪ/i-ndɪ-e** for a 3SG possessive stem of class 1, which is widespread in western Bantu. We believe it to originate in, or at least to be related to, the root ***ndí** 'other' (BLR 942 with attested reflexes in zones F and J) (Bastin *et al.* 2002).

7. As Connell (1994: 459) argues about burst spectra: "[…] the energy in the spectrum at release appears primarily in two areas in the lower frequency range, i.e. below 1.2 kHz, and in the midrange, from 24 kHz. The lower concentration could indeed be a reflection of a labial release, and this would not be unexpected […]; on the other hand the lower end of this energy concentration is almost certainly to be associated with the strong prevoicing of the release. […] on occasion there was energy present throughout the spectrum, extending quite high in the frequency range." See Ladefoged (1968a: 12-13) and Cahill (2018: 153) for a more detailed discussion of the spectral qualities of LV stops in general.

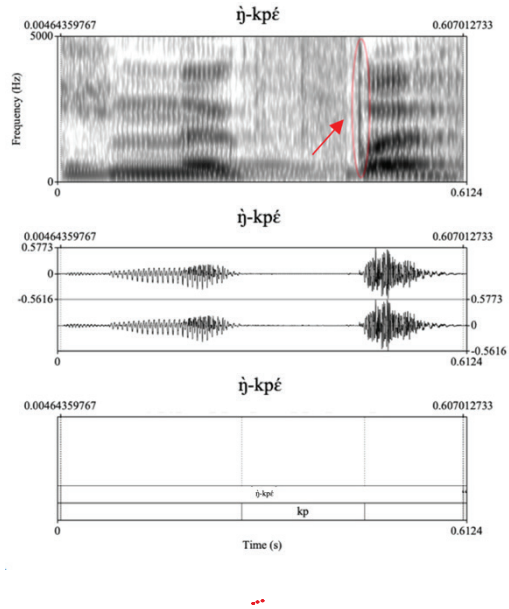


Figure 1. **/kp/** in Lwel

The presence of **/kp/** was also confirmed in the words in (3).

(3) Recorded instances of **/kp/** in Lwel (BantuFirst fieldwork 2019)

ŋ̀-kpɛ́	'salt'	***gúá**	(BLR 1521)
ò-kpə́	'die'	***kú**	(BLR 2089)
ŋ̀-kpə́ (maybe **ŋ̀gbə́**) 'person who eats after the others'			

On the other hand, the existence of **/gb/** is not unequivocal based on the available data. As shown in (4), the sound reported as **/gb/** in Khang Levy (1979) has alternative realizations across repetitions: **/gb/** can sound as **[kp]**, as a plain voiced bilabial plosive **[b]** or as a bilabial voiced implosive **[ɓ]**.

(4) Possible recorded instances of **/gb/** in Lwel (BantuFirst fieldwork 2019)

gbə́ (~**kpə́**)	'how much'	***kʊa**	
kə̀-gbà (~**ɓà**~**bà**~**kpà**)	'yam, potato'	***kʊ̀á**	(BLR 1968)

Instances of the voiced LV stop **/gb/** are harder to identify than their voiceless counterparts for two related reasons. Acoustically, they tend to display less spectrally salient cues to the velar or labial release, as can be seen in Figure 2 for ***kə̀gbà*** 'yam, potato' (from the sound file gba.gb_labvel.9.0819_181438_1.5,8606,251.wav on OSF; dynamic range: 50 dB).

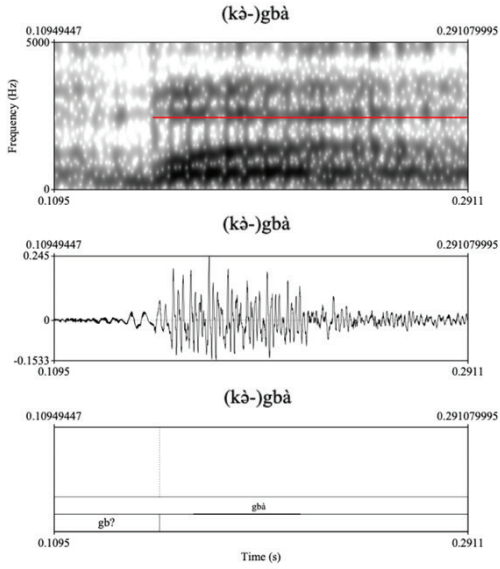


Figure 2. **/gb/** in Lwel

The rather blurry left edge of the spectrogram for **gbà** 'yam, potato' only neatly displays the abrupt start of the vowel (stricken through in red), but shows neither a clear concentration of energy across frequencies nor a visible transition signaling the presence of a consonant; additionally, the F2 does not exhibit the typical steep rise into the following vowel which we would expect in the presence of a LV. Auditorily, the spectral blurriness of the left edge makes voiced LV stops sound more like sonorants than stops.[8] These two circumstances might entail that the original voicing contrast between **/kp/** and **/gb/** is reorganized in Lwel in a way that makes it difficult to classify **/gb/** as a full (doubly articulated) stop, i.e. **/kp/** behaves more like a stop and **/gb/** behaves less like one.

There may also be articulatory reasons behind the apparent difficulty in identifying voiced LVs in Lwel. As is generally the case for LV stops, even in languages that tend to prefer [+/− spread glottis] over [+/− voice] as a correlate for voicing (see Iverson & Salmons 2007 for further references on the phenomenon of laryngeal realism), aspiration does not seem to play a relevant role in teasing **/kp/** and **/gb/** apart. This is in line with what we know about LV stops in Bantu, as they do not typically display voicing oppositions based on aspiration (Cahill 2008: 389; however, see Mathangwane 1996 for an account of aspirated doubly-articulated stops in Kalanga S16, Zimbabwe).[9] It is well known that LV stops tend to deploy

8. This is chiefly due to the fact that stops are typically associated to sharp left edges, while [+continuous] sounds, such as sonorants, are not. This may also explain why geminate/singleton asymmetries in the world's languages tend to favour the realisation of the contrast on stops rather than sonorants (Kawahara & Pangilinan 2017; Lorin & Maselli *et al.* 2020).
9. Following Mathangwane (1996), these sounds are not LVs as we have described them, but rather double articulations in which the release of the labial occlusion comes first; they

ingressive as well as regressive airstream mechanisms (Ladefoged 1968a, 1968b, Mills 1984, Vogler 1987, Demolin 1991, Connell 1995, Cahill 2008, among others). It is also known that ingressive airstreams make stops behave more like implosives than plain consonants (Simpson 2007). In turn, the necessary ingressive airstream for the production of an implosive is most commonly associated with a lowering of the larynx, which is in itself a glottalization phenomenon. Since the most common setting in moving downwards is for the glottis not to be completely closed, the glottalic ingressive airstream is frequently combined with a pulmonic egressive one, resulting in the production of voicing, which is why implosives are typically voiced (see Ladefoged 1968a: 6, Catford 1977: 75, McLaughlin 2005, Demolin & Vuillermet 2006). As a consequence, an ingressive airstream might entail some degree of glottalization in the production of Lwel LVs, where not disfavored by the phonological specification [− voice] on the voiceless stop **/kp/**.[10] This does not necessarily imply that voiced LV stops should be considered as full implosives, but rather that phonetically they do not behave as true voiced (doubly articulated) stops. In line with Ladefoged (1973: 78), we should probably describe glottalization phenomena as gradual (scalar) variations along a continuum in which ingressive elements play an important role (weakly implosive - strongly implosive). The spectrogram in Fig. 2 provides an example of what could be an implosive-like sound in Lwel, i.e. one where very few spectral cues to the presence of a true egressive burst can be detected.

2. Lwel LV stops from a typological and historical perspective

The LV voicing contrast in Lwel is blurred. While voiceless **/kp/** displays some salient spectral features, such as the presence of a clear concentration of energy associated to the burst (see Fig. 1), its voiced counterpart **/gb/** tends to behave more like a sonorant (see Fig. 2), just like implosives do (Kaye 1981; Clements 2000; Botma 2011).[11] As such, the contrast might be lost altogether. This is in line with the documented crosslinguistic preference for segmental contrasts to be licensed and maintained where they are maximally perceptible, i.e. where more perceptual

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are therefore transcribed as **/bg/** and **/pk^{h}/**. No explanation is given about the airstream mechanisms deployed when producing these sounds. Similar sounds are also reported by Ponelis (1974) for Zezuru S12, but they do not seem to be specified for aspiration in the author's account.

10. As an anonymous reviewer points out, the ingressive nature of the airstream mechanism at play here should affect both voiceless and voiced LVs, as it is generally the case in the world's languages. However, this does not seem to be the case in Lwel, or at least not to the extent one would expect. Since categorical specifications can influence the (scalar) phonetic realization of a sound (see e.g. Flemming 2001), it seems reasonable to hypothesise that **/kp/**, unlike **/gb/**, is somehow "prevented" from becoming an implosive-like sound. While we have not approached this problem from the viewpoint of Optimality Theory, we suppose that an adequate constraint ranking might shed some light on the issue.

11. In particular, Botma (2011: 19) argues: "labialvelars are sometimes produced with an ingressive airstream mechanism […]. This makes them similar to implosives, which frequently pattern as sonorants."

cues to the contrast are available at the segments' edges (Flemming 1995, 1996, Steriade 1997, Lorin & Maselli *et al.* 2020).

At the same time, a pattern whereby **/kp/** is clearly present while the existence of **/gb/** is dubious is at odds with what we know about the typology of LV stops in the world's languages. Phonological inventories with phonemic LV stops tend to have both /kp/ and **/gb/**. If only one of the two LV stops is attested, it is usually **/gb/**. This is phonetically motivated by the fact that **kp** is already partly in the "voiced camp" (Cahill 2008). This is because LVs often deploy an ingressive airstream mechanism on top of the pulmonic egressive one, so that their voicing opposition is seldom (if ever) based on [+/– spread glottis]. Additionally, they tend to display some negative VOT even when they are phonologically voiceless (see also Ohala 1979). The preference for **/gb/** is documented across several language groups throughout the world. For instance, in Senufo (NC, North Ivory Coast) ***kp** and ***gb** merged into **/gb/** (Garber 1987); in North Mande (disputably NC, throughout West Africa) ***gb** evolved into **/b/** and ***kp** into **/gb/** (Long 1971); in Ono (Trans-New Guinea, Huon peninsula) ***kp** and ***gb** merged into **/gb/** (Phinnemore 1985). Cahill (2008) reports similar mergers elsewhere in the Pacific, e.g. in Vanuatu. The few languages that favor **/kp/** over **/gb/** tend to have other phonological gaps in their sound systems (Cahill 2008). This is certainly the case for WCB. Due to the merger of PB ***k** and ***g** into **/k/** at PWCB level (Pacchiarotti & Bostoen 2020), all WCB languages lack **/g/**, except postnasally.

This apparent eccentricity raises the point of whether substrate interference played any role in shaping the phonology of the languages at hand. To this day, a number of hunter-gatherer relic groups still live scattered in small pockets across the Congo Basin rainforest. These communities commonly known as "Pygmies" – a term sometimes considered pejorative, but without an adequate alternative[12] – are commonly believed to be the descendants of the region's first modern humans. These people have a distinct ethnic identity and way of life, which usually focuses on hunting and gathering or, less commonly, on a craft, such as potmaking or blacksmithing (Schebesta 1952; Seitz 1970; Biebuyck 1973; Joiris 1994, 1996; Hewlett 1996, 2014; Mukwiza Ndahinda 2011). Linguistically, however, they are assumed to have abandoned, in times unknown to history, their ancestral languages for one of those of the many newcomer groups (Bahuchet 2012). Many hypotheses have been formulated regarding the possible influence of a "Pygmy" substrate on the existing Bantu languages. However, this can only be observed indirectly, as no original preBantu hunter-gatherer languages have survived the ravages of time in Central Africa. This situation is different from the one found in southern Africa, where several present-day Bantu languages manifest traces of past exchanges with the severely endangered, but still extant, "Khoisan" languages (Herbert 1990, Güldemann & Stoneking 2008, Bostoen & Sands 2012, Gunnink 2015, Pakendorf *et al.* 2017, Gunnink forthcoming). In Central Africa, the

12. These hunter-gatherer communities are also known as "*Batwa*". This term is also an exonym, which Bantu speakers across the continent commonly use to refer to what they consider to be autochthonous groups, not only in Central Africa, but also in Southern Africa (Schadeberg 1999). Just like "Pygmy/Pygmies", it is also not exempt of negative connotations (Lewis 2006, Woodburn 1997).

quest for traces of ancient hunter-gatherer languages has mainly focused on lexical data (Bahuchet 1993, 2006, 2012), but there might be phonetic/phonological traces worth pursuing. As suggested in Pacchiarotti & Bostoen (2020: 152, 162-166), the fortition of PB ***g*** to **/k/** and its merger with the already existing PB ***k** in PWCB could indicate the presence of a substrate reflecting the articulatory habits of shifting ancestral speakers, because this velar merger happened both in C_2 and C_1 position, while there is a strong statistical universal for phonological neutralization to target word ends over beginnings (Wedel *et al*. 2019). Albeit highly speculative, this hypothesis had already been advanced by Möhlig (1981: 270), cited in Pacchiarotti & Bostoen (2020: 26), which referred to this putative ancestral substrate as a "RainForest PreBantu stratum":

> "In most of the Forest languages, the sound shift ***g** → [– voice] (**g** → **k**) did not cause merger between ***g** and ***k**, because, at the time when ***g** became ***k**, the original ***k** had already shifted via the intermediate stages of **[x]** and **[h]** towards complete deletion. So, the sound shift ***g** → [– voice] re-introduced a sound which had previously disappeared in the phonological systems concerned. Such reversion of an inherent trend of sound shift (elimination of a voiceless velar plosive) generally indicates that language shift between nonrelated or only loosely related languages must have taken place".

While Möhlig (1981) mistakenly assumes that the devoicing of ***g** did not cause the velar merger in the first place (see Pacchiarotti & Bostoen 2020), his hypothesis that the merger itself, possibly along with the numerous, unusual vowel systems reported in the region, might betray substrate interference from no longer extant "forest" languages retains its appeal. As we showed in this article, the same tendency to devoice is observed with LV stops in Lwel.

In the search for phonological and morphosyntactic indicators of a possible substrate influence from extinct autochthonous hunter-gatherer languages, the Bantu languages spoken in the WCB homeland area may prove to be particularly promising. They manifest rather atypical features from a "typical" Bantu point of view: rare vowel harmonies, umlaut effects, final vowel loss, systems of 9 + vowels, fusion of verb suffixes producing abnormal verbal bases and rare polysemies such as causative/applicative syncretism, absence of passive morphology, etc. (Daeleman 1977; Rottland 1977; Bostoen & Mundeke 2011a, b; Koni Muluwa & Bostoen 2011, 2012; Pacchiarotti & Bostoen 2021, forthcoming). Substrate influence from non-Bantu languages is certainly a factor to be considered when trying to account for the development of the distinctive linguistic profile of these languages, which are relatively isolated in the transition zone between the equatorial rainforest and the southern savannas (in the ecoregion known as the southern Congolian forest-savanna mosaic; see White 1983). If the merger of PB ***k** and ***g** in PWCB is indeed diagnostic of a "Rain Forest PreBantu stratum", the impact of autochthonous hunter-gatherer languages on WCB may be as old as the first Bantu speech communities south of the forest. Moreover, if the presence of velar and uvular fricatives as reflexes of PWCB ***k** also resulted from such substrate interference, as Pacchiarotti & Bostoen (forthcoming) moot, linguistic interaction with local hunter-gatherer communities in the WCB homeland area may have happened repeatedly at distinct stages in the region's past.

The very presence of LV stops in Lwel and other languages in the WCB homeland area is likely to be the outcome of substrate influence. As discussed in Section 1, Lwel is not an isolated instance of a language with LV stops south of the west-east demarcation line. LV stops in the lower Kasai region occur in many languages spoken in the vicinity of the WCB homeland area, and are often free variants of velar stop + labial-velar glide sequences, in line with the general historical evolution pattern of LV stops (see Section 1). For instance, in certain varieties of Ngwi B861, **/kw/** has **[kp]** as a free variant (see Nsumuki 1993: 12 as opposed to the ideolect of Frédéric Empenge Itobola living in Idiofa, the main Ngwi consultant of the BantuFirst project team which has **/kw/**). In the Idiofa variety of Mbuun B87, **[gb]** and **[kp]** are reported as free variants of **/gw/** and **/kw/** respectively (Mundeke 2011: 29). As the Bantu reconstructions linked to Lwel words containing LV stops in (1) suggest, **/kp/** in Lwel may have also started out as a sequence of ***k**/***g** followed by the labialvelar glide *w*, the reflex of either ***u** or ***ʊ** when followed by another vowel.[13]

As mentioned in Section 1, the presence of LV stops in the Bantu languages of the northern DRC has been ascribed to long-lasting exchanges (and a high degree of admixture) with speakers of Ubangi languages on both sides of the Ubangi River (Bostoen & Donzo 2013).[14] This far south, the presence of LV stops cannot be attributed to Ubangi interference, let alone be seen as a geographic feature of the Macro-Sudan Belt. In a recent study on the lexical distribution of LV stops in northern Sub-Saharan Africa, Idiatov & Van de Velde (2021) claim that the presence of these sounds in Niger-Congo and Central-Sudanic languages is attributable to shift-induced substrate interference from now extinct languages. As for WCB, Idiatov & Van de Velde (2021: 100101) argue that LVs in this Bantu branch were brought by speakers of ancestral North-Western Bantu A80 and A90 languages already having LV stops as the result of substrate interference. These groups would have moved southwards into the rainforest and then shifted to one or more WCB languages. While this hypothesis seems plausible, we believe it is also possible that WCB varieties currently found in the homeland area developed LV stops via independent contact with autochthonous hunter-gatherers present in the area at some point in history. Because LVs are absent in many low node WCB subgroups (such as the KLC), this contact is likely to have happened in the lower Kasai region after the initial dispersal of WCB from their homeland area.

Further documentation and dedicated studies are pivotal to make sense of the phonological inventory of WCB varieties. For example, the possibility that Lwel **/gb/** exhibits some degree of implosivity might call for a more comprehensive review of similarly glottalized sounds in the area. Their presence in the wider region is not entirely atypical (Clements & Rialland 2008), and has been recently reported in Gyeli (A801), a Bantu language spoken by hunter-gatherers in southern Cameroon

13. As shown in (2), however, this is less straightforward for **/(n)gb/**, which seems to be a reflex of ***gʊ** preceded by a homorganic nasal but with no vowel following.

14. A similar contact-based account is reported by Andreas *et al.* (2009: 25) for Nyam, Chadic, spoken in Nigeria. This explanation should not be taken as an alternative to the phonetically-grounded account outlined in Section 1, whereby **Ku/ʊV** > **KwV** > **KPV**. Contact patterns may have played a role in spreading this sound change, which is not always regular in every language with LVs (e.g. it is not in Lwel), see Cahill (2018: 156).

(Grimm 2019). What is more, the status of glottalized sounds as free variants / phonetic realizations of LV stops has not been investigated for languages that are reported to have both **/kp/** and **/gb/**. The question is whether an implosive-like realization of **/gb/** could further point in the direction of a merger of **/kp/** and **/gb/**, or rather signal a general reorganization of voicing (a)symmetries in the Lwel phonological inventory. However, phonetic analyses of implosives in the southern Congo Basin are extremely rare, the one notable exception being Nagano-Madsen & Thornell (2012) for Mpiemo (A86c).[15]

Conclusions

In this paper, we showed that LV stops are part of the phonological inventory of Lwel B862. This calls into question the earlier areal definition of these sounds as a distinctive feature of the Macro-Sudan Belt in northern Sub-Saharan Africa (Clements & Rialland 2008; Güldemann 2008, 2018). Lwel exhibits an uncommon crosslinguistic pattern within the LV class, where voiceless **/kp/** is favored over voiced **/gb/**. This situation could possibly evolve into a merger of **/kp/** and **/gb/** to **/kp/** (a merger which crosslinguistically tends to have **/gb/** as an outcome), or a neutralization, with **/kp/** being the only LV stop in the language and **/gb/** being realized as either a regular plosive or an implosive, given the well-attested tendency for LV stops to be produced with an at least partly ingressive airstream mechanism. In support of the neutralization scenario, our preliminary exploration of the data collected in 2019 indeed suggests that some degree of glottalization may be detected on some of the allegedly voiced LV stops in Lwel. While more data are needed to make any further claims, this possibility makes Lwel and other WCB languages with LV stops a valuable case study for both historical phonology and phonetic typology.

Of course, all the hypotheses presented in this paper cannot successfully be tested until further evidence is gathered through phonetic documentation in the region. We still know very little about the phonetic characteristics of the languages of the southern Congo Basin. This makes them of great importance for linguistic inquiry. For one thing, crosslinguistically rare sounds are often found in underdescribed languages, and this is particularly true in Africa (Miyaoka 2001; Bhaskararao 2004; Maddieson 2018). What is more, some of these sounds seem to correlate strongly with several environmental variables. For instance, the distribution of implosives in the world's languages seems to be linked to their proximity to the equator. This outstanding relation has been neglected in the literature compared to other linguistic variables (Axelsen & Manrubia 2014; Gavin & Stepp 2014), one notable exception being Idiatov & Van de Velde (2021). Phonetic research in this area could shed light both on the diachrony of language change and contact in Africa and on linguistic evolution in broader terms. Additionally, it could help us better integrate phonetic

15. As an anonymous reviewer pointed out, it would also be worth determining whether bilabial implosives are attested in cognate forms in neighbouring languages. The reviewer reports that such as an alternation is found in Igbo, where some dialects have a labial-velar stop corresponding to velarized implosive bilabial stops in others.

knowledge and linguistic typology in a very poorly studied area of the world. The result will be a clearer picture of a region that is all too often underrepresented in crosslinguistic surveys.

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Abbreviations

AA	Afro-Asiatic
BLR	Bantu Lexical Reconstructions
CL	noun class prefix/pairing
KLC	Kikongo Language Cluster
LV	labialvelar
NC	Niger-Congo
NS	Nilo-Saharan
PB	Proto-Bantu
PWCB	Proto-WestCoastal Bantu
SING	singular
VOT	Voice Onset Time
WCB	West-Coastal Bantu

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