**Why labial-velar stops merge to ɡb**

ABSTRACT

Most languages with labial-velar stops (k̪p and ɡb) have both the voiced and voiceless versions, but a significant number of languages have only k̪p or only ɡb. Examination of the total stop inventories of such languages reveals that in languages which have only k̪p, there are always other gaps in the stop inventory, but languages which have only ɡb usually have a full set of other stops, showing that there must be a different historical mechanism involved. Also, the “ɡb-only” languages are more common than the “k̪p-only” languages, in spite of the cross-linguistic tendency to favor voiceless stops. Comparative studies show that “ɡb-only” languages are often a result of a merger of *ɡb and *k̪p into ɡb. I propose that this merger is a result of three common phonetic characteristics of the phonologically voiceless k̪p, qualities generally attributed to voiced obstruents. Since it already is partly in the “voiced camp,” it is natural for hearers to interpret it as voiced.

1 Introduction

Labial-velar stops k̪p and ɡb occur in over 650 languages of the world, mostly in central and west Africa, but also several dozen in Papua New Guinea and Vanuatu and a very few elsewhere (personal database). While complete data is lacking for many of these, every sampling so far suggests that in the vast majority of these languages, both the voiced and voiceless counterparts are contrastively present. However, some languages have only /k̪p/, and others have only /ɡb/. The reasons for these language-specific asymmetries vary. In this paper, I will focus on the /ɡb/-only cases in more detail than the /k̪p/-only cases. The languages with only /k̪p/ also have other gaps in the segmental inventory, while the languages with only /ɡb/ have no such gaps. I will propose that many, perhaps most, of the languages with only /ɡb/ became that way through a merger of *k̪p and *ɡb to present-day /ɡb/,

* Acknowledgments.
and that there are systematic phonetic factors that have consistently driven the merger in the direction of the voiced stop.

Cross-linguistically, it is not uncommon for a language to have only voiceless stops. In Maddieson’s recent sample of 566 languages, 17% of the total sample lacked voiced stops of any kind (Maddieson 2005). Examples include Mandarin, Nahuatl, and Maori, to list just a few. What is highly unusual in languages of the world is to have only voiced stops present in the phonological inventory. Maddieson (1984) lists only two examples of this pattern out of 317 languages: the Australian languages Alawa and Bandjalang.¹

Stated differently, as a general rule of thumb in sound inventories of languages, a voiced stop implies the presence of a voiceless one (in the original 1984 UPSID database 91.8% of languages had a plain voiceless stop series, while only 66.9% had a plain voiced stop series); so languages which have /d/, for example, will almost certainly have /t/ (Maddieson 1984). For discussion of the phonetic basis for the bias against voiced obstruents, see Ohala (1997).

Applying this principle to labial-velar consonants, we might expect that if only one labial-velar stop of the voiced/voiceless pair is present, it would be /kʰ/. In fact, this is so only in a minority of cases. Both in Africa and Oceania, the more prevalent pattern is the presence of /g͡b/ but not /kʰ/. In the online UPSID program,² there are 35 languages with /k͡p/, and 39 with /g͡b/. 34 languages have both /k͡p/ and /g͡b/. One language is listed with only /k͡p/, while 5 have only /g͡b/. Similarly, in the online SALA,³ 107 languages have both /g͡b/ and /k͡p/, six are listed with only /k͡p/, but 11 with only /g͡b/. In Oceania, there is no language I know of with only /k͡p/, but several with only /g͡b/, as will be seen below.

Before focusing on /g͡b/-only languages, I briefly present data with discussion on /k͡p/-only languages, all occurring in Africa except the South American Bora.

¹ Even these may actually be cases of lack of contrast between voiced and voiceless stops. As Dixon (1980:125-126) remarks, a common characteristic of Australian languages is such a lack of contrast.
² Available as a DOS program at http://www.linguistics.ucla.edu/faciliti/sales/software.htm.
³ This is “Systèmes alphabétiques de langues africaines,” derived from the UNESCO/SIL publication “Alphabets des langues africaines,” a database with orthographies and phonemic inventories of approximately 200 African languages, available at http://sumale.vjf.cnrs.fr/phono/.
<table>
<thead>
<tr>
<th>Language and family</th>
<th>Other stops</th>
<th>Source of data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Balanta (Atlantic)</td>
<td>b, t/d, k</td>
<td>Wilson 1961a</td>
</tr>
<tr>
<td>2. Bora (Witotoan, Peru)</td>
<td>p, t, k</td>
<td>Thiesen &amp; Thiesen 1975</td>
</tr>
<tr>
<td>3. Bulu (Bantu A)</td>
<td>b, t/d, k</td>
<td>SALA</td>
</tr>
<tr>
<td>4. Chumburung (Guang)</td>
<td>b, t/d, k</td>
<td>Snider 1990</td>
</tr>
<tr>
<td>5. Ditammari (N. Gur)</td>
<td>p/b, t/d, k</td>
<td>SALA</td>
</tr>
<tr>
<td>6. Efik (Lower Cross)</td>
<td>b, t/d, k</td>
<td>UPSID, Cook 1969, Ward 1933</td>
</tr>
<tr>
<td>7. Ibibio (Lower Cross)</td>
<td>p/b, t/d, k</td>
<td>Essien 1990, Boys 1979</td>
</tr>
<tr>
<td>8. Kabiyyé 4 (S. Gur)</td>
<td>p, t/d, k</td>
<td>Lebikaza 1999</td>
</tr>
<tr>
<td>9. Krachi (Kwa, Guang)</td>
<td>p/b, t/d, k</td>
<td>Snider 1990</td>
</tr>
<tr>
<td>10. Kuwaa (Kru)</td>
<td>p/b, t/d, k</td>
<td>Marchese 1978</td>
</tr>
<tr>
<td>11. Lama (S. Gur)</td>
<td>p, t, k</td>
<td>SALA</td>
</tr>
<tr>
<td>12. Larteh (Kwa, Guang)</td>
<td>p/b, t/d, k</td>
<td>Snider 1990, Ladefoged 1968</td>
</tr>
<tr>
<td>13. Lokpa (S. Gur)</td>
<td>p, t, k</td>
<td>SALA</td>
</tr>
<tr>
<td>14. Makaa 5 (Bantu A)</td>
<td>b, t/d, k/g</td>
<td>Heath 2003</td>
</tr>
<tr>
<td>15. Nateni (N. Gur)</td>
<td>p/b, t/d, k</td>
<td>Neukom 1995</td>
</tr>
<tr>
<td>16. Nkonya (Kwa, Guang)</td>
<td>p/b, t/d, k</td>
<td>Lear and Peacock (ms)</td>
</tr>
<tr>
<td>17. Sekpele (Kwa, Lelemi)</td>
<td>p/b, t, k</td>
<td>Andrew Ring pc</td>
</tr>
<tr>
<td>18. Waama (N. Gur)</td>
<td>p/b, t/d, k</td>
<td>SALA</td>
</tr>
</tbody>
</table>

These languages with only /kʰ/ are not only less common than those with only /gʰ/, but as seen in the table above, they always have other gaps in the stop inventory. Most obviously, /g/ is missing from all languages except Makaa. But beyond this generalization, all the languages except Makaa can be grouped into two categories. First, there are languages with only voiceless stops: Bora, Lama and Lokpa. Kabiyyé comes close to this, with the only voiced stop occurring in the alveolar place. A few others, Balanta, Bulu, Efik, and Sekpele, are quite similar, but

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4 The CNRS database cited above (http://sumale.vjf.cnrs.fr/phono/) lists Kabiyyé as having both kp and gb, but other sources such as Lebikaza indicate that there is no contrastive voice distinction in stops except for t/d.
5 Heath notes that the lack of /p/ is “common of many Bantu languages of southern Cameroon, especially A70 languages” (which would include Bulu above).
have /b/ rather than or in addition to /p/ in the labial place.\textsuperscript{6} The second main category is languages which have a full complement of voiced and voiceless stops in all places, with the sole exception that these are missing a /g/. Nine of the 18 languages above have this pattern.

Kisi (Childs 1983, 1992-1994) may be added as a borderline case, since synchronically /g\textsuperscript{b}/ exists in very few forms, while /kp/ is relatively common. Again, /g/ also does not exist presently, but historically merged with /k/.

Proto-languages have also been reconstructed with this pattern. Snider 1990 reconstructs proto-Guang with a similar system to Chumburung and the other Guang languages Krachi and Larteh above, having only /kp/ but no /g\textsuperscript{b}/, and also /k/ but no /g/. Also, in Connell’s (1995) reconstruction of the consonants of Proto-Lower Cross, he reconstructs *kp but not *g\textsuperscript{b}, and also *k but not *g – the same pattern that exists synchronically in a majority of languages in the table.

It thus seems that a /kp/ with no /g\textsuperscript{b}/ always correlates with a related gap in the segmental inventory, either a lack of /g/\textsuperscript{7} or more generally, a lack of voiced stops altogether.

In contrast, most of the languages with /g\textsuperscript{b}/ but no /kp/ have no such gaps, as seen below. Since languages of Papua New Guinea and other Oceanic languages are not as well known with respect to labial-velars, I will note them by “PNG” or the country name.

\textsuperscript{6} See Ohala (1997) for articulatory reasons favoring /b/ over other voiced stops.

\textsuperscript{7} The relationship between these two gaps is beyond the scope of this paper, but a possibility to be explored in more detail relates to the fact that /g\textsuperscript{b}/ historically often has its origin in *gu, that is *gu > gw > \textsuperscript{g}b (along with *ku > kw > \textsuperscript{k}p). If *g is lacking, \textsuperscript{g}b will not develop. See Maddieson (2005) for reasons why /g/ is specifically the voiced stop that is most commonly missing in various languages, and why *k and *g would merge to /k/. Cross-linguistic evidence also supports an additional scenario, where a near-simultaneous merger of *g and *k to /k/ occurred along with merger of *\textsuperscript{g}b and *kp to /kp/, basically eliminating any voiced stop involving a velar place.
(2) Languages with only /g/\textsuperscript{b}/

<table>
<thead>
<tr>
<th>Language</th>
<th>Non-g\textsuperscript{b} stop inventory</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Amele (Madang, PNG)</td>
<td>-/b, t/d, k/g</td>
<td>Roberts 1987</td>
</tr>
<tr>
<td>2. Baga Sitemu (S. Atlantic)</td>
<td>p/b, t/d, k/(g)</td>
<td>Ganong 1998</td>
</tr>
<tr>
<td>3. southern Bambara (Manding)</td>
<td>p/b, t/d, k/g\textsuperscript{a}</td>
<td>Welmers 1973:48</td>
</tr>
<tr>
<td>4. Bau (Madang, PNG)</td>
<td>p/b, t/d, k/g</td>
<td>Vander Meer 2002</td>
</tr>
<tr>
<td>5. Iai (Oceanic, New Caledonia)</td>
<td>p/b, t/d, k/g</td>
<td>UPSID, Maddieson 1984</td>
</tr>
<tr>
<td>6. Kar (Senufo)</td>
<td>p/b, t/d, k/g</td>
<td>Wichser 1994</td>
</tr>
<tr>
<td>7. Kohumono (Upper Cross)</td>
<td>p/b, t/d, k/g</td>
<td>UPSID</td>
</tr>
<tr>
<td>9. W. Central Limba (S. Atlantic)</td>
<td>p/b, t/d, k/-</td>
<td>Anderson 1976, SALA</td>
</tr>
<tr>
<td>10. Loko\textsuperscript{10} (W. Mande)</td>
<td>p/b, t/d, k/-</td>
<td>Innes 1964</td>
</tr>
<tr>
<td>11. Mandinka (W. Mande)</td>
<td>p/b, t/d, k/g</td>
<td>SALA</td>
</tr>
<tr>
<td>12. Maninka-Kan (W. Mande)</td>
<td>-/b, t/d, k/g</td>
<td>Welmers 1973:48, SALA</td>
</tr>
<tr>
<td>13. Manya (W. Mande)</td>
<td>p/b, t/d, k/g</td>
<td>Manessy 1964</td>
</tr>
<tr>
<td>14. Mahou (W. Mande)</td>
<td>(p)/b, t/d, k/g</td>
<td>Derive 1983</td>
</tr>
<tr>
<td>15. Mbato (Kwa, Potou-Tano)</td>
<td>p/b, t/d, k/g</td>
<td>Grassias &amp; Bole-Richard 1984</td>
</tr>
<tr>
<td>16. Mofu-Gudur (Chadic)</td>
<td>p/b, t/d, k/g</td>
<td>SALA</td>
</tr>
<tr>
<td>17. Ono (W. Huon, PNG)</td>
<td>p/b, t/d, k/g</td>
<td>Phinnemore 1985</td>
</tr>
<tr>
<td>18. Owa (Oceanic, Sol. Islands)</td>
<td>p, t, k</td>
<td>Greg Mellow, pc</td>
</tr>
<tr>
<td>19. Sherbro (S. Atlantic)</td>
<td>p/b, t/d, k/-</td>
<td>Anderson 1976</td>
</tr>
</tbody>
</table>

\textsuperscript{8} Isoko is also listed in the UPSID database as having only /g/\textsuperscript{b}/, but both Mafeni (1969) and Ladefoged (1968) report /k/p/ as well.

\textsuperscript{9} This stop inventory is based on reports of Bambara that do not differentiate between northern and southern. Welmers is specific that it is southern Bambara, not northern, that has only /g/b/, so there may be other differences as well.

\textsuperscript{10} This is based on Innes reporting that Dr. Pichl found only /g/\textsuperscript{b}/ with the Loko speakers he interviewed. Innes himself transcribed not only the fully voiced /g/b/, but also a partially voiced labialvelar he transcribed as [kb]. Ladefoged 1968 transcribes [kp] in one word; evidently there was much variation at the time.
<p>| | | | |</p>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>20. Sissala (S. Gur)</td>
<td>p/b, t/d, k/g</td>
<td>SALA</td>
<td></td>
</tr>
<tr>
<td>21. Western Sisaala (S. Gur)</td>
<td>p/b, t/d, k/g</td>
<td>Moran 2006</td>
<td></td>
</tr>
<tr>
<td>23. Susu(^\text{11}) (W. Mande)</td>
<td>p/b, t/d, k/g</td>
<td>Houis 1963, SALA</td>
<td></td>
</tr>
<tr>
<td>25. Tenyer (Senufo Gur)</td>
<td>p/b, t/d, k/g</td>
<td>SALA</td>
<td></td>
</tr>
<tr>
<td>26. Tepo (W. Kru)</td>
<td>p/b, t/d, k/g</td>
<td>Dawson 1975, Thalmann 1980</td>
<td></td>
</tr>
<tr>
<td>27. Toussien (Tusia Gur)</td>
<td>p/b, t/d, k/g</td>
<td>Prost 1964</td>
<td></td>
</tr>
<tr>
<td>28. Wojenakakan (=Odienne Jula)(Manding)</td>
<td>(p)/b, t/d, k(g)</td>
<td>Derive 1983</td>
<td></td>
</tr>
</tbody>
</table>

The overwhelming majority of these (20 out of 28) have a normal inventory of voiced and voiceless stops at labial, alveolar, and velar places.

Comparing the tables in (1) and (2), it is suggestive that while a lack of /\text{gb}/ in (1) is correlated with other gaps in the segmental inventory (particularly a lack of /g/), the lack of /\text{kp}/ in (2) has no such systematic correlation. This suggests that the reason for the absence of /\text{kp}/ relates to factors internal to the characteristics of /\text{kp}/, rather than being related to external factors. These will be explored below.

In the next section, I summarise historical evidence that *\text{kp} and *\text{gb} have merged to /\text{gb}/ in some languages. In Section 3, I discuss three phonetic characteristics that /\text{kp}/ often has which are usually associated with voiced stops, and in Section 4, I summarise the obvious conclusion, that it is these phonetic

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\(^\text{11}\) The UCLA Phonetics Lab Archive (http://archive.phonetics.ucla.edu/Language/SUS/SUS.html) has a recording of a Susu word with [kp]. One recording, with no [kp] noted, was made by Peter Ladefoged in 1963 in West Africa, while the second recording, with the [kp], was made at UCLA by an unnamed student in 1979. Metadata suggests that some variety of Susu has the characteristics Houis reports, but possibly not all varieties.
characteristics that drive the sound change that results in a typologically-unexpected system, and discuss some related issues.

2 Merger of /gb/ and /kp/

2.1 Senufo

Most Senufo languages, such as Cebaara, have both voiced and voiceless labial-velar stops (Carlson 1994:8-9). However, the labial-velar stops in northern Senufo languages merged their voiceless and voiced counterparts into /gb/. Sucite is an example of this merger, having no /kp/ but a /gb/ which is quite common, despite the relative uncommonness of other voiced stops relative to voiceless ones (Garber 1987). Tenyer (Western Karaboro) and Shenara (Syenara Senoufo), listed in (2), also belong to this group. Supyire went a step further and changed merged *gb/ and *b to current /b/.

(3) Cebaara Shenara Sucite Supyire gloss
kpâ?ä gba?a gbãxã bãgã ‘house’
gbâ?ãlgã gba?alaga ----- bãhãgã ‘bedbug’

Correspondingly, the Supyire /b/ is disproportionately common, the results of combining the frequencies of words with *b, *gb, and *kp.12

2.2 Mande

Northern Mande languages evidently followed the same sort of historical path. Long (1971), in discussing the challenges of reconstructing labial-velars in northern Mande languages (which have many reflexes), never discussed the correspondences illustrated below between /kp/ and /gb/. Below, we see the correspondence kp ~ gb in the left five columns and the correspondence gb ~ b in the right two columns.

12 The ratio of d/t is 0.18, that of g/k is 0.005, that of j/c is 0.19, but the ratio of b/p is 1.03 (Carlson 1994:9).
(4) Northern Mande (Long 1971)

<table>
<thead>
<tr>
<th>language</th>
<th>‘skin’</th>
<th>‘hit’</th>
<th>‘white’</th>
<th>‘hot’</th>
<th>‘cry’</th>
<th>‘big’</th>
<th>‘all’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vai</td>
<td>kpolo</td>
<td>kpasi</td>
<td>kpei</td>
<td>kpandile</td>
<td>kpala</td>
<td>---</td>
<td>gbi</td>
</tr>
<tr>
<td>Ligbi</td>
<td>kpolo-</td>
<td>---</td>
<td>kpiɛ</td>
<td>---</td>
<td>gbarɛ</td>
<td>gbonkase</td>
<td>gbo</td>
</tr>
<tr>
<td>Maninka</td>
<td>gbolo</td>
<td>gbasi</td>
<td>gbɛ</td>
<td>---</td>
<td>bon</td>
<td>bɛɛ</td>
<td></td>
</tr>
<tr>
<td>Konyanka</td>
<td>gbolo</td>
<td>gbasi</td>
<td>gbɛ</td>
<td>gban</td>
<td>---</td>
<td>bɛ</td>
<td></td>
</tr>
<tr>
<td>Marka</td>
<td>gboo</td>
<td>gbasi</td>
<td>gba-ni</td>
<td>gban</td>
<td>---</td>
<td>bo</td>
<td></td>
</tr>
<tr>
<td>Kurankɔ</td>
<td>bole</td>
<td>gbɛsi</td>
<td>gbɛ</td>
<td>gba-</td>
<td>---</td>
<td>ba</td>
<td></td>
</tr>
<tr>
<td>Kɔnɔ</td>
<td>boo</td>
<td>gbasi</td>
<td>gbɛ</td>
<td>gban</td>
<td>gbai</td>
<td>---</td>
<td>gbe</td>
</tr>
<tr>
<td>Wassunlunka</td>
<td>golo</td>
<td>gbɛɛ</td>
<td>gbɛ</td>
<td>---</td>
<td>---</td>
<td>bo</td>
<td></td>
</tr>
</tbody>
</table>

Vai and Ligbi alone above have kp, and most of the other languages have corresponding gb. (Kurankɔ, Kɔnɔ, and Wassunlunka also have other correspondences with ‘skin’.) The last two columns show correspondence between gb in Vai and Ligbi and b in the other languages, illustrating another common historical process with labial-velars, that they lose the velar articulation altogether, retaining the labial articulation.13 Putting these two patterns together, the proposal is that originally the proto-language had both *kp and *gb. Vai and Ligbi have retained both of these. In the others, *gb > b, and this was followed by another sound change of *kp > gb. This would imply that the last seven languages listed have no /kp/, but only /gb/. I do not have access to the full phonological inventories of all six of these languages, but note that Maninka, one of these, is in fact included in the list of languages in (2) as having only /gb/. It could very well be the case that the other five of these could be added to the “gb-only” list in (2).

2.3 Ono of New Guinea

Labial-velars are found in most of the languages of the Huon Peninsula in Papua New Guinea. An early investigation by McElhanon (1967) lists phonemes of twelve of these languages. Of these, ten have labial-velars – Kâte, Dedua, Mape,

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13 There are good perceptual reasons for losing the velar rather than the labial articulation. Basically, labial-velars have a labial release (Ladefoged & Maddieson 1996) and thus perceptually labial-velars “sound like” labials more than they do velars.
Hube, Tobo, Kosorong, Mindik, Burum (the last two now considered one language),
Komba, and Ono.\textsuperscript{14}

More generally, of the 21 Huon languages listed in the Ethnologue (Gordon
2005), 16 have both $\text{k}_\text{p}$ and $\text{g}_\text{b}$ (McElhanon \& Voorhoeve 1970). Four have no
labial-velars at all, having changed labialvelars to plain labials, e.g. $\text{g}_\text{b} > \text{b}$ in
‘thunder’, illustrated by Kâte $\text{g}bu\text{ŋ}$, Ono $\text{gbu\text{ŋ}}$, but Selepet $\text{bu\text{ŋ}bu\text{ŋ}}$, and the more
extensive set illustrating $\text{k}_\text{p} > \text{p}$ in the last three languages below.

\begin{equation}
\begin{array}{ll}
\text{(5)} & \text{‘wing’ in Huon languages (data from McElhanon \& Voorhoeve 1970)} \\
\text{a. Dedua} & \text{kpegaŋ} \\
\text{b. Kube} & \text{kpeŋgaŋ} \\
\text{c. Migabac} & \text{kpegeʔ} \\
\text{d. Momare} & \text{kpageʔ} \\
\text{e. Mindik} & \text{kpeŋgam} \\
\text{f. Kinalakna} & \text{kpiŋgalap} \\
\text{g. Kumukio} & \text{kpiŋgim} \\
\text{h. Nomu} & \text{kpimdim} \\
\text{i. Sialum} & \text{kpimdim} \\
\text{j. Timbe} & \text{pinŋim} \\
\text{k. Selepet} & \text{penŋam} \\
\text{l. Mese} & \text{poyom}
\end{array}
\end{equation}

From this, it is safe to conclude that Proto-Huon had both voiced and
voiceless labial-velar stops, which have reflexes of $\text{k}_\text{p}$ and $\text{g}_\text{b}$ today in most of the
daughter languages. Four languages merged labial-velar stops with plain labial stops,
as happened in the Senufo case discussed in section 2.1. In the other language, Ono,
$\text{k}_\text{p}$ and $\text{g}_\text{b}$ merged to $\text{g}_\text{b}$, and that is what we want to focus on here.

For Ono in Papua New Guinea, we are fortunate in having not only
comparative data, but some diachronic data as well. Ono presently has $\text{g}_\text{b}$ but no
$\text{k}_\text{p}$, in contrast to the other Ono stops which have voiced/voiceless pairs

\textsuperscript{14} McElhanon’s data on Ono was limited to Wacke (1931), at which time $\text{g}_\text{b}$ and $\text{k}_\text{p}$ were likely
both present. However, the more recent investigations of Phinnemore discussed below show that
present-day Ono has only $\text{g}_\text{b}$.
(Phinnemore 1985). However, in the early twentieth century, Ono was reported as having a contrast between /\k\p/ and /\g\b/ (Wacke 1931). Assuming the general accuracy of Wacke’s report, then early Ono k\p has merged with g\b. More recently, an extensive dictionary is available for present-day Kâte, a related Huon language (Flierl & Strauss 1977). Kâte has a robust k\p/g\b contrast, and a fair number of relevant cognates may be identified. These are listed below, along with the few relevant Ono words from Wacke which correspond to Kâte forms, and the more recent additional Ono data from Phinnemore’s field notes and personal communications.

(6) Kâte  |  Ono (W.)  |  Ono (P.)  |  gloss
---|---|---|---
\k\p~\g\b \ correspondences
kporu?  |  gborot  |  gbaruga  |  ‘loincloth, dress, tree (sp.)’
kpaka?\(^{15}\)  |  gbakum  |  gbakum  |  ‘flood, tide’
kp\t\o  |  ---  |  gbatu  |  ‘death adder’
kpera  |  ---  |  gbelue  |  ‘cassowary’
kpe?moroŋ  |  ---  |  gbemoron  |  ‘empty stalks’
kp\o\s\u?\-kezo  |  ---  |  gbeziŋ-maike  |  ‘tear into pieces/strips’
kp\i\k\i\n\-nezo  |  ---  |  gbikka-maike  |  ‘refuse to do something’
kp\o\r\u\n\-kezo  |  ---  |  gborok-maike  |  ‘sink’
kporo hezo  |  ---  |  gbotau-maike  |  ‘overgrow’
kpau?  |  ---  |  gbabutuj  |  ‘white bird of paradise’
kp\a\ b\t\i\n\-ezo  |  kpe  |  gbe  |  ‘hit’
kp\o\s\i\n\-nezo  |  kpesiŋ-  |  gbesiŋ-nagu  |  ‘lean on, support’
\g\b~\g\b \ correspondences
gb\o\t\o\-zo  |  kpetut-kpetule  |  gbetut-maike  |  ‘sew’ (Wacke ‘sewn’)
gbegbeu?  |  ---  |  gbebete  |  ‘crooked, out of line’
\-gbewagbeket
gb\o?\-kezo  |  ---  |  gbotke-maike  |  ‘swallow (v)’
gb\o\s\u  |  ---  |  gboso  |  ‘earthworm’
gb\o?\-kezo  |  ---  |  gbotke-maike  |  ‘swallow’

\(^{15}\) The gloss given in Flierl & Strauss for opo gbaranj kpaka? is “floods subside,” and unfortunately it is not possible from the dictionary to determine which word means what.
Comparative studies are not at present readily available for the remainder of the languages listed in (2) which have /g\b/ but no /k\p/, but in light of those which have been done, as well as the phonetic characteristics of /k\p/ discussed below, it is likely that studies of many of these languages will indicate a similar merger of *k\p/ and *g\b/ to /g\b/.

3 Why /g\b/?

The sound change of merging *k\p/ and *g\b/ in favor of voicing demands explanation, and as noted before, the fact that the languages in question have full sets of voiced and voiceless stops points to internal characteristics of k\p/ as the crucial reason, rather than relation to other sounds. The crux of the matter is that voiceless labial-velars have at least three phonetic factors which are largely in common with voiced stops. Though not universal, these characteristics are common enough so it is likely they are connected with the merger to voicing.

3.1 Lack of aspiration

Labial-velars are almost always either unaspirated or less aspirated than other voiceless stops, and this relative lack of aspiration may be interpreted over time as voicing.

For example, Smith (1967) reports aspiration on all voiceless stops in Nupe except labial-velars, which he specifically states are unaspirated. Similarly, Stuart Showalter (pc) mentions labial-velars alone among the stops in Kaanse are unaspirated. For Konkomba (Steele & Weed 1966), Vagala (Crouch & Smiles 1966), Tampulma (Bergman, Gray & Gray 1969), Kusaal (Spratt & Spratt 1968), Nafaara (Jordan 1980), Dilo (Jones 1987), Ewe (Maddieson (1984) and Sisaala-Pasaale (Toupin 1995), /k\p/ alone among voiceless stops is not aspirated. Konni has an unaspirated /k\p/, as seen in waveforms compared to other voiceless stops (Cahill 1999). Bora of Peru has a phonemic contrast between aspirated and unaspirated

<table>
<thead>
<tr>
<th>gbuŋ</th>
<th>gburaŋ</th>
<th>‘thunder’</th>
</tr>
</thead>
<tbody>
<tr>
<td>gbigbite?-kezo</td>
<td>(piridiŋ) gbise-maike</td>
<td>‘vibrate, tremble, shiver’</td>
</tr>
<tr>
<td>gba</td>
<td>gba</td>
<td>‘younger brother (Kâte), younger sister (Ono)’</td>
</tr>
</tbody>
</table>
voiceless stops (p, t, c, k), with the exception of the labial-velar stop (Thiesen & Thiesen 1975), as does Phwin (Kevin Warfel, pc). A few sources, such as Kennedy (1966) for Dagaare, do include aspiration on [kp] as well as other voiceless stops in their phonetic descriptions (though Adams Bodomo (pc) informs me that [kp] in Dagaare is less aspirated than [p]).

A phonetic [kpʰ] is rare but has been noted. Giryama and Duruma (Constance Kutsch Lojenga, pc) have a phonetically aspirated [kp]. In Giryama, the aspiration is the reflex of a nasal morpheme in an earlier stage of the language. Now this morpheme appears as aspiration on all voiceless stops.

### 3.2 Implosive air mechanism

Secondly, many labial-velars have an ingressive air mechanism as part of their phonetics. Though distinct from true implosives, it is suggestive that there is some similarity, and that most implosives are voiced (Ladefoged and Maddieson 1996). Thus there may be a tendency to interpret these as voiced consonants.

Ladefoged (1968), in his phonetic survey of 33 West African languages with labial-velars, notes three mechanisms for producing them.

(7) Mechanisms for Producing Labial-velars

1. Simple pulmonic airstream. (2 languages)
2. Pulmonic egressive & velaric ingressive airstream. Dorsum slides back, air flows into oral cavity from both directions. (23 languages)
3. Pulmonic egressive, velaric ingressive, glottalic ingressive airstreams. Partly voiced. (8 languages)

Ladefoged himself notes that these categories are to be treated with caution, in that these are based on few informants from each language, and there is considerable variation in the actual mechanisms. (For example, he puts Ibibio in category 2, when later studies by Garnes 1975 and by Connell put Ibibio firmly in category 3.) In spite of this, it is noteworthy that an ingressive airstream, or suction, is present in the overwhelming majority of languages studied.

Besides Ladefoged’s data, others have noted similar phenomena. Labial-velars in the Tyebaara dialect of Senufo are pronounced “with noticeable suction in the oral cavity, and with a pop upon release” (Mills 1984). Dan (Santa) is described as
having “bilabial implosion” for /g b/ and “strong bilabial implosion” for /k p/ (Bearth & Zemp 1967). Kaanse (Stuart Showalter, pc) also seems to have some suction associated with labial-velars, sounding somewhat similar to an implosive stop. Moba is another which has some sort of suction or “popping” associated with labial-velars (Jann Russell, pc). The Owa labial-velar of the Solomon Islands also is pronounced with an ingressive air mechanism (Greg Mellow, pc). The Engenni /k p/ and /g b/ are specifically listed as “ingressive,” in contrast to the other “egressive” stops (Thomas 1978). Wilhoit (1999) labels /k p/ and /g b/ as “implosive” in Loma of Guinea and Liberia. About Vata (Lakota Dida) “l'on note un bruit de succion caractéristique”16 (Vogler 1987:9). About Toura /k p/ (Bearth 1971:18) says “À l’ouverture des deux fermetures buccales, une inspiration bilabiale se produit simultanément avec un explosion vélaire. Ce double mouvement d’air en sens opposés est dû à un élargissement de la cavité buccale, amorçant l’ouverture de la bouche.”17 In Bandi (Grossmann 1992:13), /k p/ and /g b/ have implosive character. Wilson (1961b) notes that the Temne /g b/ can be implosive.

Labial-velars are not implosive in all languages, of course. Besides Ladefoged’s notes above, Painter (1970) specifically notes that Gonja has a simple pulmonic airstream. Konni also has a simple pulmonic airstream for labial-velars (Cahill 1999). And Ega evidently has both; it is reported as having a contrast between implosive and non-implosive voiced labial-velars, symbolised as /g b/ and /g b/ (Connell, Ahoua and Gibbon 2002).

However, it seems that Ladefoged’s 1968 survey where a majority of languages with labial-velar stops had some sort of ingressive air mechanism does indeed reflect the majority situation. And since most true implosives are voiced, it is quite a natural progression for speakers hearing an ingressive sound to group these together with voiced sounds.

16 “A characteristic sucking noise is noted.”
17 “With the opening of two oral closures, a bilabial implosion occurs simultaneously with a velar explosion. This double movement of air in opposing directions is due to an expansion of the oral cavity, bringing about the opening of the mouth.”
3.3 Partial voicing

Finally, in a number of languages, even the “voiceless” labial-velars have some pre-voicing, which simple stops lack (Connell 1994), and over time, this partial voicing could very well extend into the entire consonant.

This is clearly similar to the lack of aspiration discussed above, in that both are related to VOT. However, the languages mentioned in this section go beyond a zero or small positive VOT into an actual negative value of VOT. Since languages exist that contrast voiceless aspirated stops, unaspirated stops, and voiced stops, there is a categorical difference between an essentially zero VOT and a negative VOT, and so I treat lack of aspiration and partial voicing separately.

Connell (1991) reports on specific voice onset times for phonemically voiceless stops in Ibibio, with average VOTs of +6 ms for /p/, +21 ms for /k/, but –26 ms for /kp/. The latter is measurably prevoiced. Similarly, Olson (2005:141) measured VOTs for Mono as +10.2 ms for /p/, +27.6 ms for /k/, but –10.0 ms for /kp/.

Innes (1964) reports that Loko has partial voicing of the voiceless labial-velar, to the point that he transcribed it as /kb/, but that another researcher, Dr. Pichl, found the Loko speakers interviewed by him all had /gb/, with no voiceless labial-velar at all. This may be a case of a merger in progress.

Marquita Klaver (pc) mentions the difficulty that beginning literacy students in Ifè have in writing orthographic <kp> vs. <gb>, due to partial voicing of [kp], even though the airstream mechanism is totally pulmonic.

4 Summary and Discussion

Languages which have only /kp/ or only /gb/ have the respective gap for quite different reasons. A language with only /kp/ always has other gaps in the segmental inventory, suggesting strongly that the reason for the lack of /gb/ is because it never developed, or that there was a simultaneous historical devoicing of all stops having a velar component. In contrast, the reason for the lack of /kp/ is in many cases a demonstrable historical merger of *kp and *gb.

I propose that the reason *kp and *gb have often merged to /gb/ is because [kp] often has characteristics normally associated with voiced stops – little or no
aspiration, often an ingressive air mechanism, and sometimes actual partial voicing. Cross-linguistically, lack of aspiration is extremely common with labial-velars. An ingressive air mechanism is also more common than not. Partial voicing is reported less frequently. Detailed phonetic studies have not been made of most languages, so the relative frequencies of these characteristics may change with more complete data available.

The hypothesised change, then, for many, perhaps all, of the languages which have /g̟b/ but no /k̟p/, is that their ancestral languages had both *k̟p and *g̟b, but that phonetic characteristics of /k̟p/ -- i.e. lack of aspiration, implosion, partial voicing -- led speakers to identify /k̟p/ as voiced, with subsequent merger with /g̟b/.

However, as we have seen, the most common state of affairs is that a language will have both /k̟p/ and /g̟b/. The implication is that for most languages, the perceptual cues present are sufficient to robustly differentiate these two sounds. While perceptual studies have not been made, a few observations can be made. While lack of aspiration is a very common characteristic of /k̟p/, and an implosive air mechanism seems common, though not universal, the partial voicing of /k̟p/ has been less noted and is probably rarer. A typical African language has significant negative voice onset time (VOT) for word-initial voiced stops, and this would cue identification in that position. Moreover, intervocalic voicing of /g̟b/ and voicelessness of /k̟p/ is a robust phonetic difference. For the majority of languages, the simple phonetics of voicing is enough to maintain the contrast of these diachronically.

This paper has focused on g̟b-only languages arising through merger of *k̟p and *g̟b. Another conceivable way in which a g̟b-only language could have arisen is that *p was missing from the proto-language, while *b was present. On first glance, this appears to be a reasonable hypothesis, since /p/ is not uncommonly missing from a language’s segmental inventory (Maddieson 2005). In this case, another documented origin for k̟p, that is, via *pu > pw > k̟p, would be impossible, since the starting segment *p would be absent (while g̟b would develop via *bu > bw > g̟b). If, however, we re-examine the inventories of the specific languages listed in

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18 This seems to be what happened in Aghem (Cameroon, Western Grassfields Bantu group), that labial-velars /k̟p, g̟b, ɲ̊m/ developed from labialized labials /pw, bw, mw/. Evidence comes from
(2), we see that only two languages – Amele and Maninka-Kan – lack /p/, though it is marginal in Mahou and Wojenakakan. Most languages in fact do have /p/. The idea that /kp/ never developed is to be entertained as a possibility in these four languages, but for the other 25 of the languages listed, it is not a likely hypothesis.

It is also noteworthy that Owa in (2) has only /gb/, in spite of the fact that all other stops are voiceless! Comparative data is not yet available, and this of course needs further investigation, but this striking pattern is consistent with the assertion that /kp/ has internal characteristics that would push it toward phonemic voicing.

The point to be noted here is that a phonetically natural sound change may lead to a total system which appears to be typologically unnatural, or at the least, unusual. Though voiced stops are less common typologically than voiceless ones, the merger of /kp/ and /gb/ into /gb/ has led to the typologically unusual situation in which a specific voiced stop has no voiceless counterpart. The typological tendencies of labial-velars are thus counter to the typological tendencies of other stops.

References

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a synchronic alternation in singular and plurals of noun classes 7/8 in which the plural has a /w/ inserted after the initial consonant if the following vowel is non-round. However, when the consonant is /b/, the plural form does not have [bw], but [gb] (Hyman 1979):

<table>
<thead>
<tr>
<th>singular</th>
<th>plural</th>
<th>gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>kɪ-tɛɛ</td>
<td>ð-twɛɛ</td>
<td>‘cricket’</td>
</tr>
<tr>
<td>kɪ-bá</td>
<td>ð-ɡbá</td>
<td>‘rope’</td>
</tr>
</tbody>
</table>

No alternations are cited with /p/ or /m/, but Hyman notes that /p/, /kp/, and /ŋm/ are rare. Reinforcing the alternation above is the distributional pattern that [w] is never found after [b, p, m].


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