

Long-distance major place harmony

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Supplementary materials

Appendix: Full statistical results

This appendix shows the results of the statistical tests of consonant co-occurrence restrictions in Ngbaka Minagende. Fisher's exact test is chosen rather than a χ^2 (chi-squared) test, as it is more accurate with a smaller sample size (specifically, when $n < 1000$ or when any calculated E value is less than 5 (Agresti 2007: 45), both of which are the case here). All tests were conducted in R, using the `fisher.test` function.

The 2×2 tables below are collapsed versions of Table I in the paper.

1 Place co-occurrence restrictions

P- $\widehat{\text{KP}}$ combinations

P- $\widehat{\text{KP}}$ combinations are significantly underrepresented in the data in Maes (1959). There are no observed forms, as shown in Table V.

C ₂	labial-dorsal			other		
	O	E	O/E	O	E	O/E
labial	0	6.39	0.00	152	145.61	1.04
other	37	30.61	1.21	691	697.39	0.99

Table V

2×2 contingency table for P- $\widehat{\text{KP}}$ (significant; $p < 0.00625$).

This coincides with the description of Ngbaka Ma'bo in Thomas (1963).

$\widehat{\text{KP}}\text{-P}$ combinations

$\widehat{\text{KP}}\text{-P}$ combinations are significantly underrepresented in the Ngbaka Minagende dictionary data. There are two observed forms, as shown in Table VI.

C_2	C_1	labial			other		
		O	E	O/E	O	E	O/E
labial-dorsal		2	9.09	0.22	84	76.91	1.09
other		91	83.91	1.08	703	710.09	0.99

Table VI

2×2 contingency table for $\widehat{\text{KP}}\text{-P}$ (significant; $p < 0.00625$).

While there are two observed forms, given in (37), the O/E value is still below 1 ($p < 0.00625$), so these combinations are significantly underrepresented.

- (37) $\widehat{\eta^m}\widehat{\text{gbámù}}$ (N) ‘antelope (sp.)’
 $\widehat{\text{gbò}^m\widehat{\text{bè}}}$ (N) ‘marabou stork’

Both are fauna, which could be relevant, as specialised vocabulary might survive with otherwise illicit phonotactics. (Thanks to Laura McPherson for pointing this out.)

 $\text{K-}\widehat{\text{KP}}$ combinations

$\text{K-}\widehat{\text{KP}}$ combinations are significantly underrepresented in Maes (1959). There is one observed form, as shown in Table VII.

C_2	C_1	labial-dorsal			other		
		O	E	O/E	O	E	O/E
labial		1	8.49	0.12	201	193.51	1.04
other		36	28.51	1.26	642	649.49	0.99

Table VII

2×2 contingency table for $\text{K-}\widehat{\text{KP}}$ (significant; $p < 0.00625$).

The single observed form is given in (38).

- (38) $\text{kū}^{\widehat{\eta^m}}\widehat{\text{gbā}}$ (N) ‘large mortar for pounding corn’

$\widehat{\text{KP}}\text{-K}$ combinations

There are 13 observed forms with $\widehat{\text{KP}}\text{-P}$ combinations, compared with an expected value of 16.71, as shown in Table VIII. While this O/E ratio is below 1, it is not significant, so it is assumed that these forms appear exactly as expected.

C_2	C_1	labial			other		
		O	E	O/E	O	E	O/E
labial-dorsal		13	16.71	0.78	73	69.29	1.05
other		158	154.29	1.02	636	639.71	0.99

Table VIII

2×2 contingency table for $\widehat{\text{KP}}\text{-K}$ (not significant; $p = 0.32$).

The observed forms are listed in (39).

- (39) $\widehat{\text{gbaka}}$ (N) 'help, rescue'
 $\widehat{\text{gbák5-}}$ (N) 'branch'
 $\widehat{\text{gbana}}$ (V) 'be afraid'
 $\widehat{\text{gbà}^{\text{ngà}}$ (N) 'door leaf'
 $\widehat{\text{kpá}^{\text{ngà}}$ (N) 'cassava bread'
 $\widehat{\text{kpèkà}}$ (N) 'knife for tattoos'
 $\widehat{\text{kpèkà}}$ (N) 'click of a trap'
 $\widehat{\text{kpè}^{\text{ngā}}$ (N) 'iron blade or weapon'
 $\widehat{\text{ŋmgbàkà}}$ (N) 'Ngbaka people or language'
 $\widehat{\text{ŋmgbà}^{\text{ngà}}$ (N) 'litigation'
 $\widehat{\text{ŋmgbà}^{\text{ngá-}}$ (N) 'combat leader'
 $\widehat{\text{ŋmgbókó-}}$ (N) 'pain in the knee'
 $\widehat{\text{ŋmgbù}^{\text{ngà}}$ (N) 'main rope of a trap'

Homorganic combinations

Among the homorganic combinations, labial pairs and coronal pairs both appear exactly as expected. Dorsal pairs are likely significantly under-represented, and labial-dorsal pairs are significantly overrepresented.

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- (40) $\widehat{gb}\widehat{agb}\widehat{a}$ (N) 'bridge'
 $\widehat{gb}\widehat{agb}\widehat{a}$ (N) 'fence'
 $\widehat{gb}\widehat{agb}\widehat{a}$ (N) 'palm laths for baskets'
 $\widehat{gb}\widehat{a}\widehat{m}\widehat{gb}\widehat{a}$ (N) 'trap for animals'
 $\widehat{gb}\widehat{o}\widehat{m}\widehat{gb}\widehat{o}$ (N) 'laugh'
 $\widehat{gb}\widehat{o}\widehat{gb}\widehat{o}$ (N) 'lion'
 $\widehat{kp}\widehat{o}\widehat{m}\widehat{gb}\widehat{o}$ (N) 'stool'
 $\widehat{kp}\widehat{o}\widehat{kp}\widehat{o}$ (N) 'shoes'
 $\widehat{m}\widehat{gb}\widehat{a}\widehat{m}\widehat{gb}\widehat{o}$ (N) 'carrying stick'
 $\widehat{m}\widehat{gb}\widehat{e}\widehat{m}\widehat{gb}\widehat{e}$ (N) 'small iron bell'
 $\widehat{m}\widehat{gb}\widehat{o}\widehat{m}\widehat{gb}\widehat{o}$ (V) 'coincide'

The form $[\widehat{m}\widehat{gb}\widehat{o}\widehat{m}\widehat{gb}\widehat{o}]$ has an alternative pronunciation $[\widehat{m}\widehat{gb}\widehat{u}\widehat{m}\widehat{gb}\widehat{a}]$.

2 Voicing and nasality restrictions

To test for significance of the voicing and nasality restrictions, consonant pairs were sorted into either homorganic or non-homorganic (heterorganic and semihomorganic) on one dimension, and voiced stop–voiceless stop, nasal–prenasal, voiced stop–prenasal and all other pairs on the other dimension. The *p*-value is compared with an alpha of 0.0167, as this is 0.05 adjusted for three tests.

Voicing Agreement

This section shows that homorganic pairs containing voiced and voiceless stops together are significantly underrepresented. There was one $[g\dots g]$ form found in Maes (1959) with an alternative $[g\dots k]$ pronunciation: $[g\widehat{o}k\widehat{o}]$ 'tooth'. If this form is included in the totals (so $O = 1$), Voicing Agreement is still significant at $p = 0.025$.

C ₁	homorganic			other		
	O	E	O/E	O	E	O/E
T–D	0	5.10	0.00	22	16.90	1.30
other	204	198.90	1.03	654	659.10	0.99

Table IX

Voicing Agreement (significant; $p = 0.004$).

Five to six forms are expected to occur with homorganic stops with a mismatch in voicing, yet none occur. This is significant. The conclusion is that there is a grammatical ban on homorganic stops that disagree in voice.

Nasal Agreement

While only one observed form appears in the data with a homorganic nasal–prenasal pair, between two and three are expected. Such pairs are not significantly underrepresented or overrepresented, so no grammatical ban on homorganic nasal–prenasal pairs is assumed. While previous analyses have assumed a ban on N–ND sequences, the fact that the data here do not support this could be due to the size of the word-list. The O/E ratio is less than 1, but only very few actual examples are expected. In a longer word-list, it might be the case that this underrepresentation is significant. However, for the purposes of this article, no ban on N–ND sequences is assumed.

C ₂	C ₁ homorganic			C ₁ other		
	O	E	O/E	O	E	O/E
N–ND	1	2.32	0.43	9	7.68	1.17
other	203	201.68	1.01	667	668.32	1.00

Table X

Nasal Agreement (not significant; $p = 0.47$).

Sonorant Agreement

Sonorant Agreement is the term used here to describe possible agreement for the feature [sonorant] between homorganic stops, i.e. voiced stops and prenasalised stops. In the representational theory assumed here, these stops differ only in their value for the feature [sonorant].

C ₂	C ₁ homorganic			C ₁ other		
	O	E	O/E	O	E	O/E
D–ND	8	7.19	1.11	23	23.81	0.97
other	196	196.81	1.00	653	652.19	1.00

Table XI

Sonorant Agreement (not significant; $p = 0.67$).

The observed voiced–prenasal forms are listed in (41).

- (41) $\widehat{b\grave{a}mb\acute{u}}$ (N) ‘wide waistband after childbirth’
 $\widehat{d\acute{a}nd\grave{e}\grave{a}}$ (N) ‘small black swallow’
 $\widehat{d\grave{o}nd\grave{o}}$ (N) ‘slippery surface’
 $\widehat{g\grave{a}g\bar{a}}$ (N) ‘hook, barb’
 $\widehat{g\bar{b}\acute{a}g\bar{b}\grave{a}}$ (N) ‘trap for animals’
 $\widehat{g\bar{b}\acute{o}g\bar{b}\acute{o}}$ (N) ‘laugh’
 $\widehat{g\grave{o}g\grave{o}}$ (N) ‘basket with long bottom’
 $\widehat{mb\acute{o}bi}$ (N) ‘rattan for tying’

Semihomorganic \widehat{KP} -K patterns with heterorganic pairs

The pairs $P\dots\widehat{KP}$, $\widehat{KP}\dots P$ and $K\dots\widehat{KP}$ are all significantly underrepresented in Maes (1959), as shown in §1. The pair $\widehat{KP}\dots K$ appears as expected, assuming free combination. A question that remains is whether $\widehat{KP}\dots K$ patterns like purely homorganic pairs or like purely heterorganic pairs with respect to Voicing Agreement. \widehat{KP} -K pairs that show a mismatch in voicing among oral stops are significantly overrepresented. Because voicing mismatches among oral stops in \widehat{KP} -K pairs are not significantly underrepresented, they pattern more like heterorganic pairs.

C ₁	\widehat{KP} -K			other		
	O	E	O/E	O	E	O/E
T-D	2	0.34	5.89	21	22.66	0.93
other	11	12.66	0.87	846	844.34	1.00

Table XII

Semihomorganic $\widehat{KP}\dots K$ and Voicing Agreement (significant; $p = 0.043$).

The observed forms are given in (42).

- (42) $\widehat{g\bar{b}aka}$ (V) ‘help, rescue’
 $\widehat{g\bar{b}\acute{a}k\grave{o}}$ - (N) ‘branch’

Table XII shows that the O/E value of 5.89 for \widehat{KP} -K pairs of oral stops that differ in voicing is significantly overrepresented at $p = 0.04$. However, it is not crucial for the argument that these pairs be overrepresented, simply that they are not significantly underrepresented. So, while the p -value is only slightly less than an alpha of 0.05, the conclusion would be the same with $p > 0.05$, as long as the O/E value is near or greater than 1. If the O/E value were less than 1 *and* the p value were less than 0.05, then the conclusion would be that \widehat{KP} -K pairs pattern like purely homorganic stops. However, this is not the case. This is the empirical basis for assuming that \widehat{KP} -K pairs are not in correspondence in the ABC analysis.