

# Similar Place Avoidance: A statistical universal

KONSTANTIN POZDNIAKOV and GUILLAUME SEGERER

To †Sergei Starostin

## Abstract

*In recent years there has been an interest in the phenomenon of “Similar Place Avoidance” (SPA), particularly as concerns Arabic CCC radicals. Although little evidence has been considered outside Arabic, Hebrew, and perhaps Semitic in general, where roots with successive consonants sharing the same place of articulation are underrepresented, similarity avoidance has sometimes been hypothesized as a universal tendency. Progressively extending our scope from the Atlantic subgroup of Niger-Congo in its relation with other Niger-Congo languages, which had been our original, diachronic concern, to almost all of Africa and beyond, we undertook an extensive crosslinguistic investigation of SPA and found impressive support for this notion.*

*Keywords: consonant co-occurrence, dissimilation, Obligatory Contour Principle, phonology, place of articulation, root, Similar Place Avoidance, word*

## 1. Introduction

Based on what we know about phonological systems, it seems reasonable to suppose that the major place features of two consonants which make up a  $-C_1VC_2-$  root should be independent of each other. After all, no language has been reported where, say, a  $C_2$  coronal consonant assimilates in labiality to a  $C_1$  labial consonant, or vice versa. Thus, an input such as /bat/ is never realized as \*[bap] or \*[dat]. Major place assimilation is not expected to apply across a

vowel.<sup>1</sup> While opposite dissimilatory processes affecting place of articulation are attested (Grammont 1895), they are rare and seldom regular. We therefore do not expect an input such as /bap/ to be realized as \*[bat] or \*[dap] by regular phonological rule. Given the relative independence of major features on consonants separated by a vowel, it comes as somewhat of a surprise that there are statistical biases in which transvocalic consonants can succeed each other within roots. Specifically, in a number of languages which are discussed below, we have noted that two consonants produced at the same place of articulation are significantly underrepresented in lexical -CVC- sequences. Below we report on statistical studies we have done on more than 30 genetically, typologically, and geographically diverse languages. Our calculations reveal a striking regularity in the underrepresentation of homorganic consonants in -CVC- sequences.

Such distributional irregularities involving consonant place have been long noted in Semitic studies, particularly as concerns Arabic, whose trilateral  $\sqrt{\text{CCC}}$  roots avoid consonants at the same place of articulation (Greenberg 1950, Fleisch 1961). The Arabic instantiation of Similar Place Avoidance (henceforth SPA) has been studied in great detail by Frisch (1996) and Frisch et al. (2004), who also demonstrate that speakers are aware of such statistical biases, which they relate to the Obligatory Contour Principle (OCP): “Adjacent identical elements are prohibited” (McCarthy 1986: 208). Some recent detailed statistical studies have also confirmed SPA in Japanese (Kawahara et al. 2005), in Muna (Coetzee & Pater 2006), and in Proto-Bantu (Teil-Dautrey to appear).

The purpose of the present article is to show that the SPA phenomenon is not a specific property of Arabic, Japanese, or other isolated languages, but is in fact observed in most, if not all languages of the world. It should be noted that this result is not the confirmation of an *a priori* theoretical postulate. We approached this issue with no bias – in fact, we stumbled on it quite by accident. Surprised to discover SPA in a number of languages in the Atlantic sub-branch of Niger-Congo,<sup>2</sup> we believed we were dealing with an inherited genetic trait. In order to verify the Atlantic hypothesis, we felt compelled to investigate possible SPA effects in other languages. In the process, and based on extensive crosslinguistic testing, we arrived at our current position that (statistical) SPA is a likely universal property of human language.

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1. As has been recently documented by Hansson (2001) and Rose & Walker (2004), non-adjacent consonant harmony is typically limited to nasal, laryngeal, and secondary coronal features such as anteriority and retroflexion. Major place harmony is of course widely attested in child language (see, for example, Pater & Werle 2001 and references cited therein).

2. For more information on Niger-Congo and its sub-branches, see Williamson & Blench (2000) and the chapters in Bendor-Samuel (ed.) (1989).

The remainder of this article is organized as follows. Section 2 introduces the circumstances which initially led us to conduct our statistical counts as well as the statistical techniques we adopted. Sections 3 to 5 respectively explore Atlantic languages, other Niger-Congo languages, and non-Niger-Congo African languages. In order to show that we are not dealing only with an African areal phenomenon, we document SPA in a few non-African languages in Section 6. Here we also address the question of how our findings might have been affected in languages which we do not know well, particularly as concerns the morphological structure of the lexical items used in our statistical analyses. In the final discussion (Section 7) and conclusion (Section 8), we consider the implications of our finding, presenting hypotheses and raising questions for future research.

## **2. Problem and methodology**

The problem under discussion in this article attracted our attention during the course of preparing a lexical corpus of a group of West African languages which belong to the Atlantic sub-branch of Niger-Congo. Our goal was to do lexical comparison for the purpose of subgrouping and ultimate reconstruction. In fact, the Atlantic languages are lexically very heterogeneous, and although most specialists continue to treat them as belonging to a single Niger-Congo sub-branch, lexicostatistical counts often result in low cognate counts almost at the level of chance (e.g., 5–7 % based on the Swadesh 100-word list; cf. Sapir 1971). To take one example, an allegedly stable notion such as ‘big’ produces several dozen different roots among the 40 Atlantic languages we examined. Confronted by such variation, we developed a procedure which would permit us to display lexical information in such a way as to reveal possible formal relationships between the lexical items in question: for each notion, we constructed a table where the languages are listed in the first column and the diverse consonant combinations ( $C_1$ - $C_2$ ) head the additional columns. The cells of the table are filled by the roots themselves, based on the place of articulation of their  $C_1$  and  $C_2$ .

As a first step in preparing these tables, we assigned each phoneme of each root to one of the major place classes: P, T, C, K. Thus, the phonemes /p, b, f, v, w, m, mb, β/ are represented by the symbol P for the class of labial consonants. Similarly, dental (and alveolar) consonants are symbolized as T, (alveo-)palatal consonants as C, and velar consonants as K. By this procedure, the consonants of all the examined roots will have been assigned to one of the symbols P, T, C, K. Since the majority of the lexical roots examined in these languages have the structure -CVC-, we therefore have a total of sixteen possible combinations based on the four major classes P, T, C, and K. These sixteen combinations are the sixteen columns which follow the language names in the table. Table 1 illustrates this procedure for the notion ‘hair’. As can be seen, the roots that are

Table 1. Words for 'hair' in the Atlantic languages

	P-P	P-T	P-C	P-K	T-P	T-T	T-C	T-K
Fula		<i>wa:r</i>			<i>leβ</i>			
Sereer		<i>wiil</i>						
Basari		<i>mban, fur</i>						
Bedik		<i>mbal</i>	<i>mboy</i>					
Konyagi		<i>muul</i>						
Pen		<i>mban</i>						
Ndut		<i>fen</i>						
Noon		<i>fen</i>						
Safen		<i>fan</i>						
Lehar		<i>mul</i>						
Palor		<i>fen</i>						
Wolof		<i>*war</i>						
Buy				<i>bunk</i>				<i>dung</i>
Nyun								
Biafada			<i>wey</i>					
Balanta								
Joola 1		<i>wal</i>						
Joola 2		<i>wan</i>						
Manjaku		<i>wel, faal</i>						
Mankañ		<i>wel, fal</i>						
Pepel								
Bijogo		<i>wen</i>						
Nalu		<i>fel</i>						
Nalu					<i>θob</i>			
Sua			<i>wij</i>					
Baga K.		<i>foon</i>						
Baga M.		<i>foon</i>						
Landuma		<i>foon</i>						
Temne		<i>fon</i>						
Bullom								<i>ring</i>
Kisi								
Sherbro								
Gola					<i>dum</i>			

grouped together in the same column are not necessarily related. In addition, depending on sound changes, historically related roots may appear in different columns. Despite this, there is a greater probability that related roots will be found in the same rather than a different column. This is the justification of the procedure.

We applied this method and constructed this type of table for numerous basic lexical notions. In the course of this we noticed that certain columns, on average, seem “more empty” than others. For example, despite the numerous reflexes seen in Table 1, the column K-K is completely devoid of words for ‘hair’, but also is strikingly empty for other basic lexical notions. For a given gloss, it would be completely normal if certain columns were empty. The closer

Table 1 (cont). Words for 'hair' in the Atlantic languages

	C-P	C-T	C-C	C-K	K-P	K-T	K-C	K-K
Fula							<i>gac</i>	
Sereer								
Basari								
Bedik								
Konyagi								
Pen								
Ndut					<i>xob</i>			
Noon								
Safen								
Lehar								
Palor								
Wolof	<i>*jaaw</i>			<i>cok</i>				
Buy					<i>kum</i>		<i>gen</i>	
Nyun							<i>gen</i>	
Biafada								
Balanta				<i>yεεg</i>			<i>hul</i>	
Joola 1	<i>jab</i>							
Joola 2								
Manjaku								
Mankañ	<i>jab</i>						<i>gaal</i>	
Pepel								
Bijogo								
Nalu								
Nalu								
Sua								
Baga K.								
Baga M.								
Landuma								
Temne								
Bullom								
Kisi		<i>yin</i>						
Sherbro	<i>zem</i>							
Gola								

the attested reflexes are of an ultimate proto-root, the fewer filled columns there should be. However, it was quite surprising to us that for dozens of basic notions, we find almost the same columns empty.

What does this mean? Should one conclude that the Atlantic languages avoid certain combinations of consonants? If so, could this be taken to be a property of Proto-Atlantic which is preserved in the daughter languages? In this case, the shunned combinations could provide a solid argument in favor of the existence of the Atlantic group itself, for which no shared linguistic trait has been offered as evidence of the alleged genetic sub-branch of Niger-Congo. In addition, if valid, consonant distribution patterns of this sort might furnish very interesting pathways for the reconstruction and comparison of Proto-Atlantic with

other subgroups of the Niger-Congo macro-family. In this case the appropriate research strategy would be to establish the precise consonant combinations favored or disfavored in languages from each of the other subgroups. To do so, one would have to transform any intuitive impression into numeric values.<sup>3</sup>

Let us return to the “simplified” roots, where each consonant is represented by the symbol of its class. For each biconsonantal root, there is an initial consonant ( $C_1$ ) and a non-initial consonant ( $C_2$ ). For longer roots, for example of the form CVCVC, the medial consonant is  $C_2$  with respect to the initial consonant, but it is  $C_1$  with respect to the final consonant. In our statistical counts, the lexicon is thus broken up into  $C_1$ -V- $C_2$  sequences, where the medial consonant of a triconsonantal root is calculated both with respect to the consonant which precedes and the consonant which follows it. For sequences including consonant clusters, as for example CVCCVC, the cutting was CVC-CVC; when two adjacent consonants are of the same class, as for example CVPPVC, then it is equivalent to the CVPVC case, the P being final for the first sequence and initial for the second one.

As an illustration, consider the consonant system of Balanta, displayed according to place and manner of articulation in Table 2. There are eight labial consonants /f, b, gb, w, m, mf, mb, ŋgb/, nine dental consonants /t, th, d, l, r, n, nt, nth, nd/, seven palatal consonants /c, s, j, y, ɲ, ns, nj/, and five velar consonants /k, h, g, ŋ, ŋg/, which we can symbolize by P, T, C, and K, respectively.<sup>4</sup> Table 3 presents the measured frequencies of each place of articulation from a Balanta lexicon of 766 entries containing 904  $C_1VC_2$  sequences (Ndiaye-Corréard 1970).<sup>5</sup>

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3. For an application of statistical methods to comparative studies, see Pozdniakov (1991).

4. /th/ and /nth/ are interdental. /s/ is treated as palatal, as it frequently occupies the “[j] slot”, and labiovelars are treated as labials. These choices have been suggested by our knowledge of the Atlantic languages, where for example /s/ is associated with /c/ in all the languages showing consonant mutation, such as Fula, Sereer, the Tenda cluster, Wolof. We chose not to change these while computing data from other languages. Other possibilities would have been to treat /s/ as a dental, or labiovelars as velars, or both. This would have slightly changed the figures, but not the tendencies. Moreover, as will be shown soon, dentals share some statistical features with palatals while labials share some features with velars.

5. The number of sequences used for calculating the tables is indicated by “ $n=xx$ ” in all tables hereafter.

Table 2. *The Balanta consonant system*

f	t, th	c, s	k, h
b	d	j	g
gb			
w	l, r	y	
m	n	ɲ	ŋ
mf	nt, nth	ns	
mb	nd	nj	ŋg
ɲgb			

Table 3. *Balanta: Observed frequencies (O), in % (n=766)*

	P	T	C	K
C <sub>1</sub>	26.8	31.7	23.7	17.8
C <sub>2</sub>	20.5	48.7	14.8	16.0

The next step in the procedure is to calculate the theoretical frequencies of the different combinations. The theoretical frequency of any of the sixteen C<sub>1</sub>-V-C<sub>2</sub> combinations is obtained by multiplying the absolute frequency of the C<sub>1</sub> consonant by the absolute frequency of the C<sub>2</sub> consonant. The theoretical frequency thereby obtained assumes an absence of correlation between the quality of the C<sub>1</sub> and that of the C<sub>2</sub>. Table 4 furnishes the theoretical frequencies of the sixteen combinations for Balanta.

Table 4. *Balanta: Expected frequencies (E), in %*

		C <sub>2</sub>			
		P	T	C	K
C <sub>1</sub>	P	5.5	13.1	4.0	4.3
	T	6.5	15.4	4.7	5.1
	C	4.9	11.5	3.5	3.8
	K	3.6	8.7	2.6	2.8

To illustrate, consider the example of K-P, that is, cases where any velar is followed by any labial consonant. The frequency of C<sub>1</sub> K is 17.8%, and the frequency of C<sub>2</sub> P is 20.5%. The frequency of the combination K-P is therefore theoretically 17.8% × 20.5%, or 3.6%. Based on the 904 sequences examined, this means that one should find 904 × 3.6%, or 33 sequences of the form KVP. Among the 766 entries in the Balanta lexicon, one does in fact

find 34 sequences of this form. We can therefore consider this distribution as “normal” (i.e., conforming to the anticipated theoretical frequency).

On the other hand, the combination K-K, for which we should find  $17.8\% \times 16.0\% \times 904 = 26$  sequences, attests only nine such forms. For each language, one thus compares the theoretical or expected (E) frequency with the actual or observed (O) frequency of each combination. If a correlation exists between the qualities of  $C_1$  and  $C_2$ , this should be manifested by a significant discrepancy between the E and O values. Thus, taking the example of the actual K-K sequences in Balanta, the discrepancy is  $-65\%$  with respect to the theoretical frequency. Table 5 presents the E/O discrepancies for  $C_1$ - $C_2$  in Balanta.

Table 5. *Balanta*:  $100 * \frac{(O-E)}{E}$

		$C_2$			
		P	T	C	K
$C_1$	P	-57.6	+30.7	+19.9	-38.2
	T	+22.6	-22.0	+1.1	+36.9
	C	+32.4	-20.3	-24.3	+42.8
	K	+3.2	+20.0	+0.6	-65.1

By convention and for purposes of readability, we adopt the following procedure in presenting our results: (i) a discrepancy whose absolute value is less than  $15\%$  is considered to be non-significant and is not noted; (ii) a discrepancy whose absolute value is between  $15\%$  and  $30\%$  is noted by a “+” or “-” sign; (iii) a discrepancy whose absolute value is greater than  $30\%$  is noted by a double “+ +” or “- -” sign.<sup>6</sup> The actual values, i.e., the observed number of each combination, are given in the Appendix at the end of the article.

Table 6. *Results of Table 5 in terms of +/- categories*

		$C_2$			
		P	T	C	K
$C_1$	P	--	++	+	--
	T	+	-	-	++
	C	++	-	-	++
	K		+		--

6. For ease of readability we do not use the  $\chi^2$  test. As another advantage, the method used here preserves the direction of deviation with respect to the norm, which  $\chi^2$  does not.



Following these conventions, the percentages in Table 5 produce the values in Table 6. The presentation in Table 6 has the advantage of nicely exposing the positive and negative tendencies. Thus, as indicated by the minuses along the descending diagonal, Balanta systematically underrepresents combinations of consonants at the same place of articulation. Not only is it the case that velars rarely combine (as seen in the discussion of K-K above), but the same is true of labials, palatals, and to a somewhat lesser extent dentals. The systematic nature of the distribution observed in Table 6 (and elsewhere to follow) is a good indicator of the validity of the general approach and of the specific method. Such results in fact encourage us to seek other distributional regularities.

Before moving on to consider other languages, we should take note of two other observations that can be made on the basis of Table 6. First, the presence of negative discrepancies must be compensated for by positive discrepancies. By definition, the total sum of the discrepancies with respect to the norm must be zero. The negative discrepancies are almost exclusively due to the principle of SPA: Balanta disfavors sequences where  $C_1$  and  $C_2$  are produced at the same place of articulation. On the other hand, the positive discrepancies do not seem to be principled. We thus do not see the relationship between the fact that  $C_1$  palatals preferentially combine with  $C_2$  labials and velars and the fact that  $C_1$  labials more frequently combine with  $C_2$  palatals. In other words, while the distribution of the minuses is (relatively) regular and systematic, the distribution of the pluses is not.

A second observation that can be made from Table 6 is that from a statistical point of view, the four consonant classes P, T, C, and K can be grouped into two “superclasses”: P and K vs. T and C. Within roots, not only do palatal consonants show a statistical tendency to not combine with another palatal, but also not with a dental. Similarly, labial consonants tend not to combine with other labials, but also not with velars. We will refer to the two superclasses as “peripheral” (P, K) and “medial” (T, C). The peripheral/medial opposition corresponds exactly to the grave/diffuse distinction of Jakobson et al. (1952) and inversely to the coronal/non-coronal opposition of generative phonology (Clements & Hume 1995).

The two superclasses behave as basic classes in that consonants from within each set rarely combine with each other. However, of equal significance is the fact that the lack of combinations within a superclass corresponds to an excess of combinations between the superclasses, as summarized in Table 7.

Table 7. Superclasses

	Peripheral	Medial
Peripheral	–	+
Medial	+	–

Table 8. Balanta: PKTC order

		C <sub>2</sub>			
		P	K	T	C
C <sub>1</sub>	P	–	– –	++	+
	K		– –	+	
	T	+	++	–	
	C	++	++	–	–

Because of these new groupings, we propose to modify the order of presentation within the tables. Instead of the articulatory order PTCK, we shall henceforth adopt the order PKTC, as shown for Balanta in Table 8. As seen by the borders, we can now distinguish four quadrants in these tables: the upper left and lower right quadrants enclose combinations where C<sub>1</sub> and C<sub>2</sub> belong to the same superclass. As seen, all of the minus signs fall within these quadrants. The lower left and upper right quadrants indicate combinations where C<sub>1</sub> and C<sub>2</sub> belong to different superclasses. All of the plus signs fall within these quadrants. Finally, the C<sub>1</sub> and C<sub>2</sub> which combine in the cells along the descending diagonal belong to the same class (place of articulation). Here and in the subsequent tables, these cells are shaded.

The Balanta facts have served as an illustration in presenting the methodology and an initial set of results for comparison. In the following sections we shall see that SPA by class and superclass is widespread in Africa and beyond.

### 3. Similar Place Avoidance in Atlantic

As mentioned, our initial interest was both diachronic and Atlantic-specific: in all of the Atlantic languages we have examined, one finds the same distributional tendencies concerning the classes P, T, K, C, as well as the peripheral and medial superclasses. We present the results from twelve Atlantic languages in Table 9, where the cells along the descending diagonal representing same place combinations are shaded. The shaded cells along the descending diagonal are almost all characterized by one or two minus signs. This corresponds to the ten-

dency for roots to avoid C<sub>1</sub>-C<sub>2</sub> sequences made at the same (or similar) place of articulation. The tables show that this tendency also affects consonants from the same superclass: peripheral consonants tend not to combine, just as medial consonants tend to avoid one another. The P/K and T/C groupings, which one might have considered specific to our discussion of Balanta in Section 3, are relevant in all of the languages examined, without exception.

Table 9. CVC combinations in twelve Atlantic languages

Fula (Labatut 1994; n=672)

	P	K	T	C
P	---	--	+	
K	--	---		++
T	++	++	---	-
C	+	++		---

Palor (d'Alton 1987; n=2,116)

	P	K	T	C
P	---	-	+	+
K	-	---	++	
T	++	++	---	
C		++	-	---

Wolof (Fal et al. 1990; n=8,456)

	P	K	T	C
P	---	-	+	+
K		---	+	+
T	+	++	---	
C	+	+		---

Nyun-Buy (Lespinay 1991; n=4,428)

	P	K	T	C
P	---			++
K	-	---	++	+
T	+	++	---	---
C	++		-	---

Jaad (Ducos 1971; n=1,200)

	P	K	T	C
P	---	--		++
K		---		+
T	++	++	---	---
C	++	+		---

Balanta (Ndiaye-Corréard 1970; n=904)

	P	K	T	C
P	---	--	++	+
K		---	+	
T	+	++	---	
C	++	++	-	---

Joola Kwaatay (Payne 1992; n=2,183)

	P	K	T	C
P	---	-	+	+
K	-	---	+	
T	++	+	---	
C	+	+	-	---

Manjaku (Buis 1990; n=3,145)

	P	K	T	C
P	---	--	+	+
K	-	---		+
T	++	+	---	
C		+		---

Bijogo (Segerer 2002; n=1,499)

	P	K	T	C
P	---	-	+	++
K		---	++	
T	++	++	-	-
C	++			---

Bullom (Nyländer 1814; n=827)

	P	K	T	C
P	---	-		++
K		---	++	n.s.
T	+	++	-	--
C				---

Sua (Segerer 1998; n=495)

	P	K	T	C
P	-	--		++
K	-	---	+	n.s. <sup>a</sup>
T	+	+	---	-
C		+		---

Kisi (Childs 2000; n=2,981)

	P	K	T	C
P	---	-	+	+
K	-	---	++	
T	++	+	-	--
C		+	-	---

a The abbreviation “n.s.” (non-significant) indicates that the value of the norm (E) is too low to have a statistical value. If the expected amount of a given combination is 2 and we find three examples of this combination, it will make a 50% positive deviation. We consider that in such cases the deviation is not relevant, because the influence of chance is too great. We arbitrarily set the minimal value for the norm at 10.

Let us separately examine the two superclass diagonals in Table 9, each one consisting of two quadrants. One, the “grey super-diagonal”, represents the combination of consonants of the same superclass (including the shaded descending diagonal). The other, the “white super-diagonal”, represents the combination of consonants of different superclasses. Given the twelve languages examined, for each of the combinations peripheral-peripheral, peripheral-medial, medial-peripheral, and medial-medial, there are  $12 \times 4 = 48$  cells to fill (since each combination of two superclasses corresponds to four combinations of place). The result is striking: as seen in Table 10, all of the minus signs are concentrated in the grey super-diagonal. In other words, the number of combinations of consonants from the same superclass is always less than the norm, and the number of combinations of consonants from different superclasses is never less than the norm.

Table 10. Number of minuses in each quadrant

	Peripheral	Medial
Peripheral	41 / 48	0 / 48
Medial	0 / 48	30 / 48

This very marked tendency found in all branches of the Atlantic group motivated us to postulate a similar distribution in Proto-Atlantic. As Atlanticists, the possibility of such a reconstruction was good news to us for two reasons. First, it provided us with an element of proof in establishing the reality of the Atlantic group. As already mentioned, no one up to this point had cited a single linguistic trait found only in the Atlantic group. Second, the reconstruction of SPA at the Proto-Atlantic level seemed to open new perspectives in seeking regular correspondences with languages within other sub-branches of Niger-Congo: if SPA were the result of a Proto-Atlantic innovation involving place dissimilation, then it might be that Atlantic labials in a certain context correspond to Niger-Congo dentals, or that Atlantic velars correspond to Niger-Congo palatals. As seen in the following sections, what has instead turned out to be “bad” news for Proto-Atlantic has wider consequences for the study of language in general.

**4. Similar Place Avoidance in Niger-Congo**

If it is reasonable to postulate that Proto-Atlantic innovated SPA, it should be the case that, statistically, other Niger-Congo subgroups do not exhibit the same systematic restrictions in their consonant distributions. In other words, if SPA is really an Atlantic innovation, it should be absent in other Niger-Congo subgroups. This was our belief, but we were wrong. In this section we examine several other sub-branches of the Niger-Congo phylum for which we have reconstructions.

Table 11 presents the results obtained by mapping out Moñino’s (1995) lexical reconstructions of Proto-Gbaya. The Gbaya languages which are spoken in Central Africa (Cameroun, Central African Republic) constitute a branch of Niger-Congo, perhaps at the same level as Adamawa or Gur. As can be seen, the situation is similar to what we saw in Atlantic: all of the same-place combinations are avoided, and the remaining minus signs concern combinations within the same superclass.

Table 11. *Proto-Gbaya (Moñino 1995; n=761)*

		C <sub>2</sub>			
		P	K	T	C
C <sub>1</sub>	P	--	--	+	++
	K		--		++
	T	++	++	-	--
	C		++		n.s.

Similar results are found in Proto-Ijo (Nigeria; reconstructed by Williamson 2004), which constitutes one of the highest branches of the Niger-Congo phylum. Again, combinations of homorganic consonants are avoided.

Table 12. *Proto-Ijo* (Williamson 2004;  $n=509$ )

		C <sub>2</sub>			
		P	K	T	C
C <sub>1</sub>	P	--		+	
	K	-	--	+	n.s.
	T	++	++	--	n.s.
	C	+	n.s.	-	n.s.

With distant Proto-Gbaya and Proto-Ijo joining Proto-Atlantic, the alleged “Atlantic dissimilation” is obviously not an isolated fact. The probability of systematic SPA occurring by inheritance in three Niger-Congo branches is extremely low. At this point, we are conditioned to expect the same grey diagonal minuses in other branches.

Table 13 shows that Proto-Mande, another early offshoot of Niger-Congo, does not disappoint. (The calculations in Table 13 are based on the Proto-Mande reconstructions presented by Valentin Vydrine at the Workshop on Proto-Niger-Congo, Paris 2004.) As in previously examined cases, all of the minuses are concentrated within the grey super-diagonal, and the only double minuses are in the grey cells within the narrow diagonal. Thus, as far back as Proto-Mande we see a clear avoidance of consonant combinations at the same place of articulation and, to a lesser extent, consonants belonging to the same superclass. In addition, one observes that within the shaded cells along the narrow diagonal, SPA is stronger among peripheral vs. medial consonants. In fact, this observation is valid for all of the languages described up to now.

Table 13. *Proto-Mande* (Vydrine 2004;  $n=511$ )

		C <sub>2</sub>			
		P	K	T	C
C <sub>1</sub>	P	--	-		++
	K	n.s.	--	+	n.s.
	T	n.s.	++		n.s.
	C	n.s.	++	-	n.s.

The only languages which show a certain deviation from the reported regularities are the Bantu languages, whose combinatorial properties are documented in Table 14. Here for the first time, a grey cell in the table has a “+ +”. It appears that Proto-Bantu had access to a disproportionate number of palatal consonant sequences. Since this has to do with medial consonants, another tendency evoked above remains valid: peripheral consonants avoid each other more. An examination of individual Bantu languages from different zones (Guthrie 1967–1971) shows that the Proto-Bantu situation is well-reflected in present-day daughter languages (see Table 15).

Table 14. *Proto-Bantu (Bantu Lexical Reconstructions 1998; n=12,426)*

		C <sub>2</sub>			
		P	K	T	C
C <sub>1</sub>	P	--		+	
	K		--	+	
	T	+	+	--	--
	C	+	+	--	++

Table 15. *Four individual Bantu languages of four different zones*

Swahili (zone G; Rugemalira 1993; n=1,481)

	P	K	T	C
P	--	+		
K		--	++	+
T	+		--	-
C	+		--	--

Mpongwe (zone B; Mouguiama 1994; n=3,506)

	P	K	T	C
P	--		+	+
K		--	+	
T	+		--	--
C		+	-	++

Bemba (zone M; Mann 1995; n=10,653)

	P	K	T	C
P	--		+	
K		--	+	+
T	+	+	--	-
C		+	-	++

Kiga-Nkore (zone J; Taylor 1959; n=17,944)

	P	K	T	C
P	--			
K		--	+	-
T		+	--	-
C	+		-	+

One does not have to be a specialist in Bantu historical linguistics to assume that the unusual statistical distribution of palatal consonants in the reconstructed roots as well as in present-day languages reflects a Proto-Bantu

innovation with respect to Proto-Niger-Congo. In fact, the Bantu languages are the only ones which show any tendency for  $C_1$  and  $C_2$  consonants to agree in place of articulation – and, except for Swahili P-K, only among palatals.

### 5. Similar Place Avoidance as an African areal feature?

The Bantu deviation just discussed should not hide the fact that SPA represents a formal characteristic of the entire Niger-Congo family. The question addressed in this section is whether SPA is specific to Niger-Congo or whether it is an African areal feature. If the former is true, then languages from other African phyla should have behaviors that are significantly different from those just seen in Niger-Congo.

We begin with Sara-Kaba-Na, a Nilo-Saharan language of the Sara-Bongo-Bagirmi branch. As seen in Table 16, the distributions are absolutely comparable to what we have thus far observed in Niger-Congo: the grey diagonal is entirely filled with minuses, and we find no minus outside the grey super-diagonal. If these distributions could be shown to be a valid genetic marker, they would have something to offer to those who favor a union of the Niger-Congo and Nilo-Saharan families into a even larger macro-family (see, however, Section 6).

Table 16. *Sara-Kaba-Na* (Danay et al. 1986;  $n=3,300$ )

		$C_2$			
		P	K	T	C
$C_1$	P	--	--	++	
	K		--		+
	T	+	++	-	
	C		++		--

Let us therefore take a language of Africa which we know not to be involved in this hypothesis. Based on its unique genetic source and relative isolation from the continent, Malagasy, an Austronesian language, would not be expected to share linguistic properties with Niger-Congo or Nilo-Saharan languages. One nevertheless clearly sees in Table 17 the same discrepancies with respect to the norm to which we have become accustomed. What better example could we find of a typical Niger-Congo, even Atlantic distribution? All of the minuses are in the grey super-diagonal, and all of the pluses are in the white super-diagonal. At this point of the investigation, we have grounds for suspecting that we are dealing with a more general phenomenon which goes beyond the boundaries of genetic divisions. Could SPA be an African areal feature?



Table 17. *Malagasy, Sakalava (Lacroix 2001; n=1,944)*

		C <sub>2</sub>			
		P	K	T	C
C <sub>1</sub>	P	--		+	+
	K		--		+
	T	++		-	-
	C		++	-	--

The examination of African languages would not be complete without representation from the Afro-Asiatic phylum, here represented by the Chadic subgroup.<sup>7</sup> In this connection we have only tested two lexicons: the tentative Proto-Chadic reconstructions of Jungraithmayr & Ibrizsimow (1994) and the lexicon of the Ader dialect of Hausa (Caron 1991). The results are presented in Table 18. In the Proto-Chadic corpus, the shaded diagonal is even more marked than in Atlantic or other Niger-Congo languages. Recall that the “--” sign indicates that the number of combinations is at least 30 % below the norm calculated according to the percentages observed independently in each position. Here the situation is uniform for all four combinations of homorganic consonants. In Hausa the tendency is a little less strong, but it is not contradictory, since all of the minuses remain in the grey super-diagonal. As in Niger-Congo, the tendency is greater for peripheral than for medial consonants.

Table 18. *Chadic and Hausa (Ader dialect)*

Proto-Chadic (n=1,306)					Hausa (n=3,880)						
		P	K	T	C			P	K	T	C
P	--			+	++	P	--				++
K		--		+	+	K	-	--		+	
T	++	++	--			T	+	+	--		-
C	++	+	-	--		C	++		-	--	

One might perhaps be less surprised that SPA is in full force within Chadic than in the other language families that we have examined. Chadic is a branch of the Afro-Asiatic macro-family to which Arabic, Hebrew, and the Semitic subgroup also belong. As stated in Section 1, the avoidance of combinations of

7. Unfortunately we have not been able to study any language from Khoisan, the fourth African macro-phylum.

similar consonants has been noted in these languages for some time, and with Chadic we can extrapolate perhaps to the level of Afro-Asiatic itself.

Since Semitic takes us marginally outside of Africa, the possibility that SPA is an African areal feature is somewhat weakened. The final blow comes in the next section, where we demonstrate that SPA is a linguistic universal.

### 6. Similar Place Avoidance as a linguistic universal

Before presenting evidence for SPA from outside the African continent, where we have less expertise, we wish to comment again on the steps that have been involved in conducting this study. We reiterate that we first discovered the SPA phenomenon in the Atlantic languages. As specialists of these languages, we have developed tools for treating important corpora without making too many methodological errors. However, we were surprised to see the SPA phenomenon so distinctly manifested. It is clear that we do not have the same expertise to treat the data from other families. Despite this, and despite any possible biases, we have noted the same tendency working on lexicons which have not been subject to the kind of phonological and morphological analyses that should logically precede this kind of calculation.

To illustrate this, we conducted an experiment based on Fula. The whole corpus has 1,153 items (1,651 CVC sequences). However, out of these 1,153 words, there are only 643 primary lexical stems (672 CVC sequences), the others being derived. So we calculated the tables for both corpora. We can see in Table 19 that the general tendency is the same in both cases, even if the details are different: all the minuses are in the descending diagonal and all the pluses are in the ascending one. In addition, we can see that SPA is in every case more important for peripheral consonants than for medial ones. This experiment shows that even with no expertise on a given language, we are able to gather statistics on this language.

Table 19. *Fula*: difference between “clean” and “raw” corpora

“Clean” corpus, n=672				“Raw” corpus, n=1,651					
	P	K	T	C		P	K	T	C
P	--	--	+		P	--	--		+
K	--	--		++	K	--	--		++
T	++	++	--	--	T			--	--
C	+	++		--	C	++	++		--

In each of the languages examined up to now, the same tendencies have been at work. The African languages presented in the preceding sections belong to

four different families, but are still tied geographically. The question that now arises is: What happens outside of Africa?

It seems that even in Indo-European statistical skewings in the combination of C<sub>1</sub>-C<sub>2</sub> consonant sequences have not been very appreciated. Table 20 presents our findings for Proto-Indo-European (PIE), based on Starostin's (1998–2005) STARLING database.

Table 20. Proto-Indo-European (n=3,085)

		C <sub>2</sub>			
		P	K	T	C
C <sub>1</sub>	P	--		+	
	K		--	+	
	T	++	++	--	
	C	+	+		--

Indo-European is without a doubt the most-studied language family, and that for more than two centuries. As seen in Table 20, the same SPA tendency is observed in Proto-Indo-European reconstructions. We note again that combinations of consonants at the same place of articulation exist in most, if not all languages, and that they are not necessarily rare. Some examples from Indo-European taken from Starostin (1998–2005) include:

- (1) a. labial-labial: \*pib 'to drink', \*paw 'few, small', \*bhebhru-u- 'bear'
- b. dental-dental: \*tal-/e- 'earth, ground', \*del 'long', \*nan-/\*nen- 'mother, nurse'
- c. palatal-palatal: \*yes 'to boil'
- d. velar-velar: \*(s)kek- 'hair, beard', \*koks- 'armpit'

It is likewise quite easy to find examples of consonant sequences at the same place of articulation in African languages in general and in Atlantic in particular. Often these are words of great frequency of usage, e.g., Wolof *bopp* 'head', *sàcc* 'steal'. From such examples one might easily conclude that there are no constraints on transvocalic C<sub>1</sub>-C<sub>2</sub> sequences. As this study has documented, this would be an error. As we have shown, STATISTICALLY, these combinations are relatively rare.

Although the notion of a Proto-Nostratic existing at a considerably greater time depth than Proto-Indo-European is quite controversial, Table 21 shows that SPA is observed in the reconstructions proposed in the etymological dictionary of Illič-Svityč (1971–1984).

Table 21. *Proto-Nostratic* (n=318)

		C <sub>2</sub>			
		P	K	T	C
C <sub>1</sub>	P	--	-	++	-
	K		--		++
	T	n.s.	++	--	--
	C	n.s.	n.s.		n.s.

Since Altaic is one of the branches of Nostratic, it is not surprising to find SPA effects in the languages of that family. Table 22 presents the facts of “Classical” Mongolian. In this table the tendencies are more marked than ever: not only do the shaded cells contain seven minuses out of eight possible, but also the cells of the inverse diagonal contain seven out of eight possible pluses. (Only one minus and one plus occur outside these “narrow” diagonals, but both are found within expected quadrants.) The distribution of these pluses strikingly suggests that the heterorganic combinations P-C, C-P, T-K, and K-T are strongly favored in Classical Mongolian. We have already remarked that the two diagonals do not have the same status: while there is a tendency to find the most minuses along the descending (shaded) diagonal in all of our tables, there does not appear to be a corresponding tendency for the greatest number of pluses to congregate along the inverse diagonal. Rather, these pluses appear randomly distributed within the cells of the lower-left and upper-right quadrants.

Table 22. *Classical Mongolian* (n=66,407); the data were extracted from an online dictionary of over 25,000 entries (Lainé 2004)

		C <sub>2</sub>			
		P	K	T	C
C <sub>1</sub>	P	--	-	+	++
	K		--	++	
	T		++	--	
	C	+			-

While the other languages examined are not systematic in their preferences for certain heterorganic sequences, the question naturally arises as to whether the distribution of the pluses in Classical Mongolian is in fact principled. We summarize the relevant facts as follows, where “>>” means “is preferred over”.

- (2) a. P-C >> P-T
- b. T-K >> T-P
- c. C-P >> C-K
- d. K-T >> K-C

As seen, combinations of labials and palatals (P, C) are preferred over combinations of labials and dentals (P, T), and combinations of dentals and velars (T, K) are preferred over combinations of dentals and labials (T, P). Up until now we only recognized peripheral (P, K) and medial (T, C) superclasses, which group together the most similar places of articulation. The commonality of the two places of articulation in each superclass can be defined either in terms of their shared acoustic properties (grave vs. acute) or their shared articulatory (non-)involvement of the front of the tongue (coronal vs. non-coronal). Mongolian now suggests that anterior consonants (P, T) and posterior consonants (C, K) also share a property, which corresponds roughly to [ $\pm$ high] (raising of the body of tongue) in the Chomsky & Halle (1968) distinctive feature framework. In this framework the four places of articulation would have the feature values in Table 23.

Table 23. Shared features among P, T, C, K

	P	T	C	K
Coronal	–	+	+	–
High	–	–	+	+

Approached in these terms, we see that two groupings do not share either feature: P, C and T, K. It could therefore be that Classical Mongolian has the flip-side of SPA, namely the favoring of the most dissimilar consonant sequences. We note that Classical Mongolian is the only language in our study which has front-back vowel harmony, which may turn out to be a relevant factor, hence worthy of further study.<sup>8</sup>

To summarize thus far, we have seen that SPA effects are widespread in the world’s languages. Even if we have not tested all of the languages or language families of the world, there is reason to believe that we are dealing with a universal phenomenon. What would it take to be even more convincing, specifically to rule out any possibility of an Afro-Eurasian genetic or contact phenomenon? A genetically isolated language? A recently formed language, e.g.,

8. Many of the African languages cited have either ATR or height harmony which may be expected to interact less with SPA than front-back vowel harmony. More languages having the latter, as well as rounding harmony, need to be investigated (e.g., Turkish).

a pidgin? A language belonging to more distant language families (Australian, American Indian)? Table 24 presents an example of each of these.<sup>9</sup>

Table 24. *Other languages*

Basque, Euskara  
(<http://weblandarbaso.miarroba.com>;  
n=3,140)

	P	K	T	C
P	--			
K	--	--	+	
T	+	++	--	+
C	++			--

Quechua (Ancey 1997;  
n=5,254)

	P	K	T	C
P	--	-	++	
K		--		
T	+	++	--	-
C	+	++	-	--

Pidgin English, Port Moresby  
(Barhorst & O'Dell-Barhorst  
no date; n=2,215)

	P	K	T	C
P	--		+	
K		--		
T	++	+	--	
C		+		--

Kamilaroi, Australia  
(Austin & Nathan 1998; n=980)

	P	K	T	C
P	--	++		
K	++	--		
T	+		--	+
C		-	+	--

In this arbitrary sample of four languages, we note no contradiction with the tendencies previously seen. Of the sixteen shaded cells in Table 24, twelve contain one or two minuses, and none contains any pluses. In contrast, the tendency is less clear concerning the “wide” diagonal, i.e., combinations within the same superclass. This is particularly striking in the case of Kamilaroi, where P-K, K-P, T-C, and C-T are overrepresented. As seen, the minuses found along the grey diagonal are unexpectedly compensated by pluses in the white cells of the upper-left and lower-right quadrants. This case is unique among our sample. Perhaps what we can say is that even if every language shows the effects of SPA, each language preserves its own originality. Out of the 31 tables presented above, no two are exactly identical. Evaluating the significance of the individual differences is of course a task reserved for specialists of each language and language family.

9. All the data for these four languages were found on the internet. The links are given at the end of the reference section.

## 7. Discussion

### 7.1. *Making sense of similarity avoidance*

The preceding sections have clearly established that SPA is a likely universal property of human language. We are aware that other studies have been concerned with the tendency of like features or segments to resist repetition or be kept at a distance from one another. Within non-linear phonology, the Obligatory Contour Principle (OCP) is often cited as a universal tendency:

- (3) Adjacent identical elements are prohibited (McCarthy 1986: 208)

Various authors have invoked the OCP or related principles under different names to account for a variety of phenomena that minimize the same or similar elements (consonants, vowels, tones, whole syllables, etc.). The following quote from Tang (2000: 34) succinctly references much of this work:

In the literature, the principle in (1) [here (3)] has been called the “obligatory contour principle”, the OCP (Leben 1973; Goldsmith 1976; McCarthy 1986), the “repeated morph constraint” (Menn and MacWhinney 1984), ANTIHOMOPHONY (Golston 1995), \*REPEAT (Yip [...]), and IDAVOID (Brentari 1998). The effects of this principle not only can be observed in autosegmental phonology and feature geometry (Leben 1973; Goldsmith 1976; McCarthy 1986; Myers 1987; Yip [1988]; Pierrehumbert 1993, among many others) but also can be found in morphology (Stemberger 1981; Menn and MacWhinney 1984; Mohanan 1994; Golston 1995; Yip 1995, 1998; Brentari 1998, among many others).

Within phonology, SPA effects of the type described in this article have long been observed within Semitic languages and continue to be the subject of study, especially as concerns Arabic (Frisch et al. 2004) and Hebrew (Berent & Shimron 2003). While SPA effects have been presented as static distributional tendencies, the diachronic process of consonant dissimilation has received considerable attention for over a century, mostly notably in Grammont (1895). The question we would like to raise in this section is whether the SPA effects we have reported in tabular form are one of the manifestations of the OCP. As attractive as this may seem, our approach and findings differ from some of the above work in at least three ways.

First, in spite of a few exceptions (Yip 1995, Frisch et al. 1996, MacEachern 1999, Berent & Shimron 2003, Coetzee & Pater 2006), the universal OCP mostly concerns IDENTICAL elements. In our case, we have dealt not only with restrictions on combinations of identical, but also similar elements: we have been concerned with restricted sequences of consonants made in a same or similar place of articulation. We have also shown that the restrictions hold not only of exact homorganic consonants, but also of consonants that belong to the same “superclass”. In this connection, we have seen the SPA at work within both the

medial and peripheral superclasses, although the tendency has a greater effect among peripheral consonants.

Second, the results obtained for Semitic exploit the fact that in these languages consonantal roots have a concrete reality which can be observed in their templatic morphology. Their isolability makes the calculations relatively easy. Our measurements have involved languages where the notion of “consonantal root” is rarely justified. We have even evaluated corpora with no preliminary knowledge of the morphological structures of the languages in question. Despite this, the SPA effects were still evident.

Third, whereas recent discussions of SPA, especially those based on Semitic, seek above all to discover the nature of this phenomenon in synchrony,<sup>10</sup> for us the phenomenon has great diachronic consequences for the comparative method. If consonant combinations have to satisfy a principle of equilibrium, the phonetic changes that affect consonants will presumably be in part conditioned by SPA. Thus, alongside the two major sources of language change, regular sound change and analogical change, a third factor must be at play which we can call “dissimilation consonantique”. Within this category, we can classify the examples given by Greenberg (1968: 107–108) such as Latin *arbor* > Spanish *arbol* or Latin *anima* > \**anma* > Spanish *alma*. Here we have neither a regular sound change (\**r* > *l* or \**n* > *l*) nor analogical change, but rather “sporadic” dissimilations: of two *r*’s in the first case, of two nasals in the second. Greenberg formulates this tendency only for sonorants (liquids and nasals) and s(h)ibilants, thus for specific manners of articulation. We have tried to show the importance of similarity avoidance for place of articulation.

Since SPA is general in language, we should expect to find processes that affect  $C_1VC_2$  sequences where  $C_1$  and  $C_2$  belong to the same class or superclass with respect to place. Logical possibilities include one consonant dissimilation from the other in place, or dropping out under identity. Another possibility is that lexical items that repeat the same place of articulation may be disfavored and drop out – or may not have been formed in the first place. On the other side of the equation, when we find a language which violates SPA in an unexpected way, we might conclude that the language in question has undergone a specific diachronic change to produce the unusual situation. For example, in Bantu we observed an excess of C-C (palatal-palatal) combinations. Since Bantu diverges significantly from the norm in this respect, it behooves the Bantuist scholar to seek a diachronic explanation. From a wider comparative point of view, this unique distribution leads one to hypothesize that the homorganic C-C sequences of Proto-Bantu must correspond to other consonant combinations in other groups of Niger-Congo.

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10. Cf. Frisch et al. (2004), especially Section 4.1 “The Psychological Reality of OCP-Place”.



The Bantu example might give the impression that only such an “anomaly” can be exploited for comparative purposes. However, although all of the languages presented here show the same general SPA tendency, they all differ in their statistical details, which may therefore furnish precious indices for comparison.

As we indicated in Section 6, there may also be an important interest in closely studying the possible relationship between SPA and the inverse tendency of vowel harmony. Vowel harmony is of course a quite different phenomenon operating synchronically and productively, contrary to consonantal incompatibility. As we hypothesized in the case of Classical Mongolian (Table 22), the tendency for consonant place to be dissimilar may be more accentuated in languages with front-back vowel harmony. If the distribution of pluses in the inverse diagonal of Table 22 is not fortuitous or isolated, this could mean that there is a tendency for an equilibrium to be established between the two subsystems (vowels and consonants) within the phonological structure of the word.

There is one limitation on SPA that we have not yet addressed. Contrasting with the very clear tendency to avoid successive consonants of similar place, the Atlantic languages shows an inverse tendency which at first appears contradictory: in Atlantic, as in other languages of the world, IDENTICAL consonants combine easily, especially in certain lexical subclasses, e.g., ideophones, intensifier adverbs, and other iconic words. One of the possible sources of combinations of identical consonants is reduplication, which is often associated with the expression of intensity. However, the statistical results presented here in support of SPA are robust DESPITE these well-known cases of identical consonant combination. It is not impossible that these two opposing tendencies are interrelated.

To test the effect of identical  $C_1$ - $C_2$  consonants on our results, we did a more detailed statistical count on Wolof which distinguished between sequences of identical vs. non-identical homorganic consonants. This further study yielded the following results:

- (i) If one takes into account the relative frequencies of the different consonants in the dictionary, there is no general tendency to combine identical consonants, with the exception of two special cases: (a) combinations of identical nasal or prenasalized consonants, especially *mb-mb*, *nd-nd*, *m-m*, and *n-n*, are considerably more frequent than expected; (b) the sequences *f-f* and *c-c* are particularly frequent.
- (ii) Besides those combinations whose frequency exceeds or corresponds to the norm, two combinations of identical consonants have a frequency below the norm: *r-r* and *t-t*.
- (iii) An analysis of lists of words which present sequences of identical consonants shows that these words are not generally formed by lexical redup-

plication. They are, however, often formed by a sort of “grammatical” reduplication. In Wolof, for each noun class there is a series of determiners of the form *CooCV* where C is the consonant of the noun class and V is a “deictic” vowel (*i* for ‘near’, *a* for ‘far’, *u* for ‘unmarked’). Other forms exist which are accompanied by a particle with an emphatic value (*i* or *le*), which increases the number of words containing a sequence of two identical consonants. For example, for the “M class”, we find:

- (4)
- a. *muus mi* ‘this cat’
  - b. *muus moomu* ‘this cat (in question)’
  - c. *muus moomule* ‘idem (emphatic)’
  - d. *muus mooma* ‘that cat (of which you had spoken and which is not present)’
  - e. *muus moomale* ‘idem (emphatic)’
  - f. *muus moomee* ‘idem (emphatic)’ (< \**mooma* + *i*)
  - g. *muus moomii* ‘this cat here (of which you had spoken, emphatic)’

Besides the above, the consonant *n* is repeated in the lexical base meaning ‘other’, e.g., *m-eneen* in the M class. The presence of these multiple series increases the frequency of combinations of identical consonants.

In the above examples, the repetition of identical consonants is associated with the morphology of the language. They are thus exempt from any possible phonetic or phonological motivation for SPA. If we remove all of the words that have a sequence of identical consonants from the wordlists, the tendency for successive consonants to be of different place is of course enhanced. This is seen in Table 25, which compares the percentages of each combination with vs. without identical  $C_1=C_2$  sequences.

Table 25. Wolof percentages with vs. without  $C_1=C_2$  sequences

With	P	K	T	C	Without	P	K	T	C
P	-54	-17	+23	+17	P	-74	-15	+28	+23
K	-9	-69	+27	+15	K	-6	-83	+30	+20
T	+27	+31	-22	-4	T	+35	+37	-31	-4
C	+26	+30	-14	-26	C	+33	+33	-10	-49

Instead of considering the combinations of identical consonants with respect to the whole dictionary, we shall limit ourselves to the expected number of  $C_1=C_2$  words compared to the total set of consonants made at the same place of articulation. For example, the list of Wolof words which contain a TVT sequence (where T=any dental/alveolar) provides 988 sequences. The frequency

of  $C_1$  *l* is 16% among the TVT sequences. Its frequency in  $C_2$  position is 28%. In the absence of mutual influence, we should find  $988 \times 16\% \times 28\% = 45$  occurrences of *lVl* sequences in the Wolof dictionary. It turns out that we find 47. We can therefore conclude that *lVl* either escapes the effects of SPA, or that the effect of SPA is canceled out by the inverse tendency to favor identical consonants, in this case *l*'s. Let us now compare *nVn* sequences. The frequency of  $C_1$  *n* is 14% (among TVT sequences). Its frequency in  $C_2$  position is 18%. We should therefore find  $988 \times 14\% \times 18\% = 25$  occurrences of the sequence *nVn*. In this case we find 41, which represents a deviation of 65% with respect to the norm. This discrepancy is sufficiently large enough to suggest that the sequence *nVn* is relatively privileged among the possible combinations of dental consonants (TVT).

We have chosen these specific illustrations because it is among dental consonants that we find the only negative discrepancies for identical consonants. Within the labial, palatal, and velar series combinations of identical consonants are systematically favored. For the dental place, the results are mixed, as seen in Table 26.

Table 26. Wolof percentages for dentals, where  $C_1=C_2$

ndVnd	nVn	dVd	lVl	tVt	rVr
+132 %	+65 %	+41 %	+4 %	-35 %	-64 %

To summarize, two inverse tendencies are at work in Wolof. In a general way, combinations of homorganic consonants are avoided (SPA). However, in the midst of such homorganic consonants, combinations of identical consonants are statistically favored, sometimes reflecting the fact that these sequences are charged with a grammatical function. This second tendency confirms that it is the place of articulation which constitutes the relevant context for statistical biases in the combination of consonants.

But there is something more: we have pointed out several times that our statistical counts show strong tendencies, even with a poor knowledge of the phonology of the language studied. Languages often have additional features which, if taken into consideration, might make the counts more accurate or revealing. Thus, for every language, good knowledge of the phonology could help find some otherwise hidden tendencies. Let us illustrate this with Wolof again. In Wolof, there is a vowel length contrast that has not been taken into account for the tables presented here (cf. Tables 9 and 25). It is interesting, however, to calculate separate tables for short and long vowels respectively. The result is shown in Table 27.

Table 27. *Wolof* percentages with  $C_1VC_2$  vs.  $C_1VVC_2$  sequences; the -CVC- and -CVVC- counts are based on 5,991 CVC sequences and 2,104 CVVC sequences, respectively.

$C_1VC_2$	P	K	T	C	$C_1VVC_2$	P	K	T	C
P	---	-	++	+	P	■			
K		---	++		K	-	■		+
T	+	++	-		T	+		■	
C	++	+	-	---	C		+		■

There is an enormous difference between these two tables. For CVVC sequences, there is no trace of SPA! Only four cells show a slight deviation from the expected frequency, but there is nothing systematic here. So, it seems that the “phonological distance” between two consonants is too big for the SPA effect to appear. This kind of analysis has not been made for other languages with a vowel length contrast. Therefore, we cannot consider this phenomenon as a universal. But it might well be, for the theoretical explanation involving “phonological distance” seems reasonable enough. In addition to the lack of SPA in the CVVC table above, we observe a reinforcement of SPA in the CVC table, which is quite logical, given that SPA was sensible even on the global corpus.

### 7.2. *The problem of reconstructed languages*

As pointed out by an anonymous reviewer, the use of reconstructed lexical forms could introduce some bias in the tables. There are several reasons that make us think that we still can use these. First, the nature of the lexicon is different: in a reconstructed one, there are usually no borrowings or ideophones, and it is precisely those items that can blur the observed tendencies by having irregular phonological shapes. So the observed tendencies can only be stronger. However, this is not always the case. For example, the Proto-Bantu lexicon as elaborated by the Tervuren group contains all the reconstructed dialectal variants of all zones of Bantu. Thus, the proto-lexicon has far more items than any of the present-day Bantu languages surveyed for this study. Here we can expect the statistical tendencies to be slightly different, and that is the reason why we included not only the Proto-Bantu table, but also four present-day Bantu languages.

Second, concerning diachronic aspects of the problem, it is important to determine if the SPA phenomenon results from historical processes of dissimilation or if its effects are purely synchronic. If we compare the measurements made of the lexicons of proto-languages and their descendent living languages, we find that the differences are of exactly the same order as those observed

between the individual living lexicons and their average. (Compare, for example, Proto-Bantu in Table 14 with “Average Bantu” in Table 29 below.) This means that the data from the proto-language better represent the family of the descendent languages than any one of these languages taken by chance. Thus, the Proto-Indo-European lexicon is more representative of Indo-European in general than is, say, the Albanian lexicon. Consequently, in the absence of rigorously established reconstructions, it is justified to use the average calculated on the basis of the living languages of a family, as we do, for example, with the Atlantic languages in Section 8.

### **8. Similar Place Avoidance and the hierarchy of combinations**

So far, we have shown that SPA is a reality for every individual language. But a given language may well show some deviations with respect to SPA, especially as far as superclasses are concerned. For example, a K-K combination is avoided in all languages, but K-P is overrepresented in Quechua and Kamilaroi and underrepresented in Basque (see Table 24). This might raise some doubts about the existence of superclasses. A more general question is whether there would be a kind of hierarchy with respect to the respective “rate of avoidance/affinity” of each of the sixteen possible combinations. To address these issues, we need a general overview of the values disseminated in the language-individual tables. This table can be obtained in the following way: in Table 28, for the 31 languages examined, we have put the total number of the six possible E/O values (“+”, “+ +”, etc.) for each of the sixteen combinations of P, K, T, and C. For example, among the 31 tables presented above, the T-C combination has never shown up as “+ +”, but is attested twice as “+”, ten times as “–”, eighth times as “– –”, nine times empty (i.e., with an E/O discrepancy of less than 15%), and twice as non-significant (“n.s.”) for lack of sufficient T-C occurrences. In the last column we have put the numeric value corresponding to the sum of the plus and minus values in the preceding columns. This total represents the E/O discrepancy proper to each combination: a positive value represents an overrepresented combination of consonants, while a negative value signals an underrepresented combination. To highlight the wide range obtained in these values, the rows have been arranged with the greatest negative value (–31) at the top and the greatest positive value (28) at the bottom.

Table 28. *Summary of the preceding tables*

	++	+	-	--	norm	n.s.	Total
<b>K-K</b>			5	26			-31
<b>P-P</b>			6	24	1		-30
<b>T-T</b>			17	6	8		-23
<b>C-T</b>		1	14	2	14		-15
<b>T-C</b>		2	9	7	11	2	-14
<b>P-K</b>	1	1	9	6	14		-13
<b>C-C</b>	2	1	6	8	10	4	-11
<b>K-P</b>	1		8	2	19	1	-9
Total		<b>9</b>		<b>155</b>	<b>77</b>	<b>6</b>	
<b>K-C</b>	4	10	1	1	13	2	12
<b>P-C</b>	10	8	1		12		17
<b>C-P</b>	7	10			12	2	17
<b>C-K</b>	9	11	1		8	2	19
<b>P-T</b>	4	17			10		21
<b>K-T</b>	7	14			10		21
<b>T-K</b>	13	14			2	2	27
<b>T-P</b>	18	10			3		28
Total		<b>166</b>		<b>4</b>	<b>70</b>	<b>8</b>	

Two facts are immediately visible:

First, the table is divided into two equal parts of eight positive and eight negative rows each. This means that there are as many overrepresented combinations as there are underrepresented ones. In addition, the zeros and “n.s.” are also equally distributed within the upper and lower halves of the table.

Second, all of the combinations of consonants from the same class (represented by the gray cells) are in the upper part of the table, indicating that these combinations are globally underrepresented. This is the concrete trace of the SPA phenomenon.

Another important phenomenon can also be noted: all of the combinations within the same superclass (i.e., peripheral K/P vs. medial T/C) are also underrepresented. Thus, the eight combinations which show a negative total are EXACTLY THE COMBINATIONS OF CONSONANTS WITHIN THESE SUPERCLASSES, whether the consonants are homorganic or not.

Recall that this result is a global one. In an individual language, one or another of these combinations can be overrepresented, as seen in five of the eight rows in the upper half of Table 28. We also observe that the three remaining rows which lack a positive value are all combinations of homorganic consonants (K-K, P-P, and T-T).

The consequence of the preceding observations is that the combinations with a positive total, i.e., those which are globally overrepresented, are all combinations of consonants BELONGING TO DIFFERENT SUPERCLASSES.

Among the 31 languages examined, seventeen belong to Niger-Congo: twelve Atlantic languages and five Bantu languages, among which Proto-Bantu. Afro-Asiatic is represented by two Chadic lexicons. All of the other languages are the only representatives of their group. Thus, in order to avoid any bias which might be due to the consideration of related languages, we have recalculated the general table in such a way that each group of languages is represented by a single language. For the Atlantic languages and Bantu, we have taken the average of the observed individual values shown in the following tables.<sup>11</sup>

Table 29. Atlantic and Bantu average values

Average Atlantic				Average Bantu					
	P	K	T	C		P	K	T	C
P	--	-	+	+	P	-		+	
K	-	--	+	+	K		--	+	
T	++	++	-	-	T	+	+		-
C	+	+		-	C	+	+	-	+

For the Chadic group, we have eliminated the relatively small Proto-Chadic lexicon which shows too much internal variability.

The fifteen groups of languages now each having one set of values are the following: Atlantic, Bantu, Mande, Kwa, Ubangi (Niger-Congo); Sara-Bongo-Bagirmi (Nilo-Saharan); Chadic (Afro-Asiatic); Malagasy (Austronesian); Indo-European; Nostratic; Mongolian (Altaic); Basque; Quechua; Kamilaroi (Australian); and Port Moresby Pidgin English. With these changes, Table 30 represents the recomputed values.

11. The average is calculated by dividing the difference of the number of “+” and the number of “-” by the number of languages. For example, the combination C-C in the five Bantu languages presents the value “++” three times, the value “+” once, and the value “-” once. The average is therefore:  $\frac{(3 \times 2) + 1 - 1}{5} = 1.2$ , which we round to 1. For the combination C-C, “Average Bantu” will thus have the value “+”.

Table 30. *Summary table, recomputed*

	++	+	-	--	norm	n.s.	Total
<b>K-K</b>			1	14			<b>-15</b>
<b>P-P</b>			1	14			<b>-15</b>
<b>T-T</b>			6	4	5		<b>-10</b>
<b>C-C</b>		1	3	4	3	4	<b>-6</b>
<b>P-K</b>	1		4	2	8		<b>-5</b>
<b>T-C</b>		2	5	2	4	2	<b>-5</b>
<b>C-T</b>		1	6		8		<b>-5</b>
<b>K-P</b>	1		3	1	9	1	<b>-3</b>
Total		<b>6</b>		<b>70</b>	<b>37</b>	<b>6</b>	
<b>P-C</b>	4	2	1		8		<b>5</b>
<b>K-C</b>	2	3			8	2	<b>5</b>
<b>C-K</b>	5	4	1		3	2	<b>8</b>
<b>C-P</b>	2	6			5	2	<b>8</b>
<b>K-T</b>	1	7			7		<b>8</b>
<b>P-T</b>	3	8			4		<b>11</b>
<b>T-P</b>	6	6			1	2	<b>12</b>
<b>T-K</b>	10	3			2		<b>13</b>
Total		<b>72</b>		<b>2</b>	<b>38</b>	<b>8</b>	

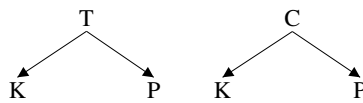
While Table 30 is comparable overall to Table 28, the tendencies are now even more evident:

- (i) This time, the four combinations of homorganic consonants are at the top of the table, which signifies that they are the most underrepresented (the totals go from -15 to -6). Among these four combinations, only one positive value occurs, viz. C-C in “Average Bantu”.
- (ii) Among the combinations forming the second part of the upper half of the table (i.e., non-homorganic combinations from the same superclass), there does not appear to be any neat hierarchy. One can just point out that the combination K-P is the most “normal” of the four, the totals ranging from -5 to -3. The peripheral combinations are favored twice with “++” but only in Kamilaroi, with both K-P and P-K. The medial combinations are also favored three times, but only with “+” (T-C in Basque and both T-C and C-T in Kamilaroi).
- (iii) The lower half of the table, which contains the eight combinations of medial + peripheral consonants reveals a surprising internal structure: the first four combinations are exactly and only those which contain C (totals of +5 to +8). The lowest four combinations are exactly and only those which contain T (totals from +8 to +13). Among all these combinations,



only P-C (in Nostratic) and C-K (in Kamilaroi) present a single case each of a negative value.

- (iv) The two subgroups in the lower half of the table in turn present an identical internal structure: combinations in which the medial consonant precedes the peripheral consonant are preferred to the reverse. T-P and T-K have a higher global value than P-T and P-K. Similarly, C-P and C-K have a higher value than P-C and K-C. This preference is graphically symbolized as follows:



Combinations of peripheral consonants (P, K) with dentals (T) are never underrepresented. Even more striking, the combinations T-K and T-P are nearly always overrepresented (thirteen of the fifteen linguistic groups examined). Contrary to what we proposed earlier, this means that more is going on than a simple compensation for the underrepresented restricted sequences. If this were the case, we would not expect the “+” and “+ +” values to represent such a hierarchical structure, rather that each of the “compensatory” combinations would have approximately the same values in Table 30. We are therefore forced to conclude that besides the rather spectacular restrictions concerning consonants of the same (super-)class, certain cross-superclass combinations are “favored” by languages. In other terms, beside “bad” words such as *toad* and *bug*, one finds “good” words such as *dog* and *cat*. This conclusion, which goes beyond the objectives of this article, merits a detailed study of its own. It does, however, raise a further possibility: If there are good words and bad words, are there also good and bad languages? In fact, the very nature of Table 30 allows us to calculate the average values for each combination. By doing so, we obtain what could be an “average” language in Table 31, one which conforms exactly to the tendencies shown by all the languages as a whole. Obviously Table 31 is not that of any of the languages studied.

Table 31. *An average language*

	P	K	T	K
P	--		+	+
K		--	+	
T	+	++	-	
C	+	+		-

Finally, Table 30 allows us to establish a hierarchized list of the constraints:

- (i) pure SPA: adjacent identical classes are disfavored;
- (ii) extended SPA: adjacent identical superclasses are disfavored;
- (iii) combinations involving dentals (T) are preferred over combinations involving palatals (C);
- (iv) the order “medial > peripheral” is preferred over the order “peripheral > medial”.

While it must be repeated that these constraints do not describe dynamic processes, it is worth noting that they might be responsible for dynamic effects, as when the Bantu language, Tiene, metathesizes CVP-VT and CVK-VT to CVT-VP and CVT-VK (Hyman 2006).

## 9. Conclusions and hypotheses

In the course of this study we have reached the following conclusions.

First, the phenomenon of Similar Place Avoidance (SPA), previously described for Semitic languages, seems to be a linguistic universal, being observed in languages which are both genetically and geographically unrelated.

Second, since the effects of SPA are non-categorical and vary slightly from language to language, SPA is best seen as a STATISTICAL TENDENCY. This tendency can be observed IN SPITE OF the following factors that may lower its effects:

(i) REDUPLICATION. Reduplication processes are well documented and often operate on morphological grounds. This leads to numerous sequences of identical consonants separated by a vowel. Not only are these sequences not forbidden, but they are rather favored in some grammatical categories (cf. Wolof demonstratives above, but also ideophones, baby talk, and other words with expressive or intensive meaning).

(ii) PREFERENCE FOR IDENTICAL VS. SIMILAR CONSONANTS. At the phonological level, a close examination of similar-place consonant sequences shows that SPA may not operate equally on all types of same-place consonant sequences. For example, in Russian, the number of initial CVC sequences involving labial consonants is inferior to what is expected, but there are important discrepancies as for the possibilities of combinations within this subset: *pVp*- or *bVb*-sequences are relatively frequent (while their number is still inferior to what is expected), but *bVp*- sequences, for which the two consonants are “dangerously” similar, are strictly limited to a very small number of borrowings: *baptist* (and a few derived forms), *biplan*, *bipol’arnyj* (‘baptist’, ‘biplane’, ‘bipolar’). Furthermore, two of these show a visible prefix *bi*-.

(iii) Consequently, sequences containing a morphological boundary may be more tolerant with respect to SPA, as illustrated with two of the three *bVp*- ex-

amples in Russian above. This is even more evident for *pVb-* sequences where, aside from two borrowings *publika* (and a few related forms) and *pubertal'ny* ('public', 'pubescent'), all the 147 forms among the 97,328 items of Zalizniak's (1977) dictionary involve the prefix *po-*, so that the sequences are actually *po-b-*, *b-* being the real initial of the stem. As another example, Larry Hyman (2006, personal communication) points out that in Chichewa, Ciyao, and many other Bantu languages, the unproductive verb extensions *-am-* and *-at-* almost fail to occur following CVP and CVT, respectively. On the other hand, productive extensions such as *-i(t)s-* 'causative', *-il-* 'applicative', and *-an-* 'reciprocal' show no such effects.

(iv) As illustrated with the *bi-p-* examples in Russian above, borrowings may be less subject to SPA. This may be due to differences in morphological analysis in source and target languages: if a word contains a morphological boundary in its source language, the speakers of the language that has borrowed it have no awareness of this boundary, and thus treat the word as a monomorphemic one. Or, to put it in a different way, a word treated as monomorphemic in a language may have a "disfavored" shape because its origin was bimorphemic and therefore less sensitive to SPA.

(v) We are responsible for two additional sources of discrepancies. The first one inevitably arises from our lack of competence for morphological segmentation. For a number of languages, we simply took the data without doing any segmentation at all. The second one is our arbitrary classification of phonemic features into four classes, whereas some languages could require more contrasts, e.g., labiovelar consonants, which have been included in the labial class (Bijogo, etc.), and postvelar consonants, which have been placed in the velar class (Wolof, etc.). Moreover, the particular status of some elements may be different from one language to another. The most problematic case is undoubtedly that of *s* (resp. *z*), which we have always included in the palatal class. In languages where there is a contrast between *s* and *sh* (French, English, etc.), */s/* would better fit in the dental class. In some cases, we have computed wordlists that we found on the internet. These files generally came with no information about the orthographical conventions. For Quechua and Basque, we could assume that the spelling was influenced by Spanish, but we had no such information for Malagasy, Pidgin English, or Kamilaroi.

In spite of all these factors blurring the tendency, it is still present not only in each individual language, but also as an average for all the languages.

Third, given the universality of SPA, it follows that any counter-tendency in a language must be regarded as an anomaly, e.g., the overrepresentation of sequences of palatal consonants in Bantu (Tables 14 and 15).

Fourth, while Frisch (1996) has hypothesized that constraints on consonant sequences should be proportional to the number of shared phonological features (with  $C_1=C_2$  being a special case), additional counts not presented here

reveal that SPA is more sensitive to some feature classes than others. Our measurements show that the dominant effect concerns PLACE OF ARTICULATION, not manner, nasality, or state of the glottis – which may in fact tend to harmonize (Hansson 2001).

Fifth, we have shown that SPA effects justify grouping the four places of articulation into two SUPERCLASSES: peripheral P, K (grave, non-coronal) vs. medial T, C (acute, coronal). While affecting both superclasses, it appears that SPA has a stronger effect on peripheral than on medial consonants.

Sixth, as suggested by the Classical Mongolian data, it is possible that an elevated level of SPA effects may be compensated by processes of vowel assimilation, especially by back and round vowel harmony. More such languages need to be investigated, however, to test this potential interaction.

Seventh, in the course of our investigations we have noted that the statistical biases attributable to SPA are even more robust if the counts are limited to basic lexical items, i.e., a part of the lexicon that includes fewer derived words, borrowings, and elements with an “expressive” value (e.g., ideophones). We have used dictionaries containing as many as 25,000 entries, but also as few as 318 CVC sequences (in the Nostratic wordlist). Although one might *a priori* tend to doubt results based on such a small number of items, SPA effects were found in corpora of all sizes.

Eighth, when examined in detail, restrictions due to SPA reveal internal hierarchies. By compiling all measurements of consonant co-occurrence restrictions for our sample of fifteen genetic units (that is, languages or proto-languages representative of their genetic family), we have found that this hierarchy involves not only restriction constraints, but also preference ones. The formers concern classes and superclasses and are ordered as follows:

- (i) pure SPA: adjacent identical classes are prohibited;
- (ii) extended SPA: adjacent identical superclasses are disfavored.

Within the four classes P, K, T, and C, there exists another hierarchy: peripheral classes (P and K) tend to combine less than medial ones.

The preferences may be attributed a different status. In fact, the more we find restrictions, the more we can expect “preferences” to be compensatory. Thus, their distribution is expected to be arbitrary. While this is often the case for individual languages, the distribution of preferences shows more consistence when we consider the summary of all the data, as presented in Table 30. The preferences concern combinations of different superclasses, as expected, and are ordered as follows:

- (iii) combinations involving dentals (T) are preferred over combinations involving palatals (C);
- (iv) the centrifugal order (medial > peripheral) is preferred over the centripetal one (peripheral > medial).

So, not only is SPA worth studying, but we are convinced that the study of

preferences, which we can label CPA (for “Centrifugal Place Asymmetry”), will lead to many important discoveries.

These conclusions have relevance not only to synchronic phonology, but also to comparative and historical linguistics. Grammont (1895) and Greenberg (1968) have recognized consonant dissimilation as one of the three important factors playing a role in phonetic change, alongside regular sound change and analogical change. If the phenomenon of SPA is universal, and if language imposes a certain phonetic contour within the limits of the word, questions naturally arise as to how SPA effects come into being and are maintained in the face of the different diachronic pressures to which the shapes of words are subjected. Is SPA a statistical property of proto-language that has survived with different nuances in all of the world’s languages? While cases of palatalization and labialization are well-known, most processes of sound change affect features other than place: spirantization/affrication, nasalization, voicing/devoicing, aspiration/deaspiration, etc. However, there are changes which affect place of articulation, sometimes limited to  $C_2$ , as when final  $*m$  and  $*p$  become  $n$  and  $t$  in the history of Chinese (Chen 1973). It is not hard to imagine possible, but as far as we know unattested, SPA effects such as the following:

- (5)
- a.  $C_2 *m > n$ , unless  $C_1$ =dental
  - b.  $C_2 *m > n$  only if  $C_1$ =labial
  - c.  $C_2 > \emptyset$ , if it is identical in place to  $C_1$

Such hypothetical changes, however interesting, appear to be a misapplication of the statistics presented here, which should not be taken for what they are not. SPA is not a law, but rather a universal tendency. There is no categorical prohibition against words containing sequences of homorganic consonants, and hence no expectation that sound changes such as the above will ever take place. More reasonable to us might be cases where certain words or combinations of morphemes within words are avoided if they produce violations of SPA. Nevertheless, the highly predictable nature of the tendency suggests that words that violate SPA may be more susceptible to change than those which do not. All such speculations can and, of course, should be tested against further data.

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*LLACAN (CNRS, INALCO)*

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*Correspondence address:* LLACAN, 7, Rue Guy Môquet, Bât. C, 94801 Villejuif Cedex, France;  
e-mail: (Pozdniakov) [pozdniakov@vjf.cnrs.fr](mailto:pozdniakov@vjf.cnrs.fr), (Segerer) [segerer@vjf.cnrs.fr](mailto:segerer@vjf.cnrs.fr)

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### Appendix: Observed number of every consonantal combination for each language examined

	PP	PK	PT	PC	KP	KK	KT	KC	TP
*Bantu	557	812	1,635	205	614	470	1,543	215	999
*Chadic	23	65	205	66	69	16	183	52	133
*Gbaya	24	33	163	20	33	23	129	18	43
*Indo-European	58	145	586	117	159	71	455	83	339
*Ijo	25	38	131	13	19	14	71	7	62
*Mande	2	23	132	22	8	9	101	6	14
*Nostratic	2	14	47	9	25	12	78	34	18
Balanta	21	24	154	43	34	9	94	24	72
Basque	20	69	344	131	39	47	542	163	106
Bemba	655	664	1,638	392	424	247	1,004	320	906
Bijogo	24	78	249	64	48	23	167	31	133
Bullom	39	70	157	40	20	20	100	8	46
Hausa	92	145	279	226	249	166	563	287	293
Jaad	44	48	226	95	50	11	127	51	84
Joola Kwaatay	59	82	299	140	68	50	222	75	170
Kamilaroi	36	79	181	47	68	22	161	47	48
Kiga-Nkore	391	742	1,434	672	747	840	2,423	697	1,059
Kisi	164	213	436	140	98	119	268	59	252
Malagasy	82	133	349	88	69	48	182	44	175
Manjaku	119	111	515	156	73	73	238	85	300
Mongolian	153	2,108	4	1,332	1,233	3,399	11,245	2,525	1,92
Mpongwe	155	223	411	135	198	155	454	142	257
Nyun-Buy	94	220	478	183	179	68	703	141	349
Palor	47	97	222	100	84	57	311	106	169
Fula (clean)	33	7	109	30	23	9	73	34	65
Fula (raw)	58	24	267	48	34	20	186	49	132
Pidgin English	126	94	406	111	108	32	184	49	307
Quechua	74	181	402	631	160	118	353	737	141
Sara Kaba Na	71	105	384	139	208	172	491	262	188
Sua	21	18	74	33	9	9	37	7	34
Swahili	75	131	151	86	76	49	134	74	120
Wolof	178	326	1,171	397	283	94	938	306	716

	TK	TT	TC	CP	CK	CT	CC	Total	Table
*Bantu	1,164	1,457	69	724	821	803	338	12,426	14
*Chadic	99	123	48	85	47	82	10	1,306	18
*Gbaya	63	90	5	18	32	65	2	761	11
*Indo-European	308	414	145	50	45	92	18	3,085	20
*Ijo	39	35	6	14	15	17	3	509	12
*Mande	24	61	5	14	27	57	6	511	13
*Nostratic	23	13	7	7	7	19	3	318	21
Balanta	63	109	43	58	49	83	24	904	8; 9
Basque	237	550	324	69	84	335	80	3,14	24
Bemba	857	1,229	309	513	508	596	391	10,653	15
Bijogo	207	196	53	53	64	93	16	1,499	9
Bullom	101	86	12	18	37	61	12	827	9
Hausa	229	352	167	278	148	247	159	3,88	18
Jaad	56	112	35	77	45	109	30	1,2	9
Joola Kwaatay	164	193	113	132	139	185	92	2,183	9
Kamilaroi	38	110	40	15	11	71	6	980	24
Kiga-Nkore	1,657	2,189	103	899	922	1,348	894	17,944	15
Kisi	260	226	64	179	223	192	88	2,981	9
Malagasy	178	261	59	61	94	106	15	1,944	17
Manjaku	226	393	130	145	174	325	82	3,145	9
Mongolian	12,184	6,654	2,715	1,586	6,082	7,567	1,704	66,407	22
Mpongwe	306	262	79	176	258	215	80	3,506	15
Nyun-Buy	566	472	60	271	231	326	87	4,428	9
Palor	231	138	93	92	159	147	63	2,116	9
Fula (clean)	23	66	19	59	29	76	17	672	9; 19
Fula (raw)	54	364	48	108	46	190	23	1,651	19
Pidgin English	137	266	117	88	47	104	39	2,215	24
Quechua	283	236	417	214	379	259	669	5,254	24
Sara Kaba Na	278	296	177	101	177	186	65	3,3	16
Sua	37	71	18	25	32	52	18	495	9
Swahili	97	90	50	115	98	70	65	1,481	15
Wolof	722	1,025	454	445	445	734	222	8,456	9

## References

- Ancey, Jean-Luc (1997). Dictionnaire quechua-français. <http://members.tripod.com/~jlancey/Peda/Quecfran.htm>
- Austin, Peter & David Nathan (1998). Kamilaroi/Gamilaraay dictionary. <http://coombs.anu.edu.au/WWWVLPages/AborigPages/LANG/GAMDICT/GAMDICTF.HTM>
- Barhorst, Terry D. & Sylvia O'Dell-Barhorst (no date). Pidgin/English dictionary. <http://www.june29.com/HLP/lang/pidgin.html>
- Bendor-Samuel, John (ed.) (1989). *The Niger-Congo Languages*. London: University Press of America.
- Berent, Iris & Joseph Shimron (2003). Co-occurrence restrictions on identical consonants in the Hebrew lexicon: Are they due to similarity? *Journal of Linguistics* 39: 31–55.
- Brentari, Diane (1998). Comment on the paper by Yip. In Lapointe et al. (eds.) 1998, 247–258.
- Buis, Pierre (1990). *Essai sur la langue manjako de la zone de Bassarel*. Bissau: Instituto Nacional de Estudos e Pesquisas.
- Caron, Bernard (1991). *Le haoussa de l'Ader*. Berlin: Reimer.

- Chen, Matthew (1973). Cross-dialectal comparison: A case study and some theoretical considerations. *Journal of Chinese Linguistics* 1: 38–63.
- Childs, G. Tucker (2000). *A Dictionary of the Kisi Language with an English-Kisi Index*. Köln: Köppe.
- Chomsky, Noam & Morris Halle (1968). *The Sound Pattern of English*. New York: Harper & Row.
- Clements, George N. & Elizabeth V. Hume (1995). The internal organization of speech sounds. In John A. Goldsmith (ed.), *The Handbook of Phonological Theory*, 245–306. Oxford: Blackwell.
- Coetzee, Andries & Joe Pater (2006). Lexically ranked OCP place constraints in Muna. Unpublished manuscript, University of Michigan and University of Massachusetts, Amherst. Available at <http://roa.rutgers.edu/view.php?id=1219>
- d'Alton, Paula (1987). *Le palor: Esquisse phonologique et grammaticale d'une langue cangin du Sénégal*. Paris: Editions du CNRS.
- Danay Kamis, Mando Makode, Ganda Nikubu, Maurice Tambyo, Namala Ngarassim, & Augustin Goytisololo (1986). *Dictionnaire sara-kaba-na-français, Kyabe (Tchad)*. Sarh: Centre d'Etudes Linguistiques, Collège Charles-Lwanga.
- Ducos, Gisèle (1971). *Structure du badiaranké de Guinée et du Sénégal (phonologie, syntaxe)*. Paris: SELAF.
- Fal, Arame, Rosine Santos, & Jean Léonce Doneux (1990). *Dictionnaire wolof-français suivi d'un index français-wolof*. Paris: Karthala.
- Fleisch, Henri (1961). *Traité de philologie arabe (vol. 1)*. Beyrouth: Imprimerie catholique.
- Frisch, Stefan A. (1996). Similarity and frequency in phonology. Doctoral dissertation, Northwestern University, Evanston, Ill.
- Frisch, Stefan A., Janet Pierrehumbert, & Michael Broe (2004). Similarity avoidance and the OCP. *Natural Language and Linguistic Theory* 22: 179–228.
- Goldsmith, John (1976). Autosegmental phonology. Doctoral dissertation, Massachusetts Institute of Technology.
- Golston, Chris (1995). Syntax outranks phonology: Evidence from Ancient Greek. *Phonology* 12: 343–368.
- Grammont, Maurice (1895). *La dissimilation consonantique dans les langues indo-européennes et dans les langues romanes*. Dijon: Darantière.
- Greenberg, Joseph H. (1950). The patterning of root morphemes in Semitic. *Word* 6: 161–182.
- (1968). *Anthropological Linguistics: An Introduction*. New York: Random House.
- Guthrie, Malcolm (1967–1971). *Comparative Bantu: An Introduction to the Comparative Linguistics and Prehistory of the Bantu Languages*. 4 volumes. London: Greggs.
- Hansson, Gunnar (2001). Theoretical and typological issues in consonant harmony. Doctoral dissertation, University of California at Berkeley.
- Hyman, Larry M. (2006). Affixation by place of articulation: Rare AND mysterious. Paper for the proceedings of the Rara and Rarissima conference, Max-Planck-Institut für evolutionäre Anthropologie, Leipzig, March 29–April 1, 2006.
- Illič-Svityč, Vladislav (1971–1984). *Opyt sravnenija nostratičeskix jazykov*. 3 volumes. Moskva: Nauka.
- Jakobson, Roman, C. Gunnar M. Fant, & Morris Halle (1952). Preliminaries to speech analysis: The distinctive features and their correlates. (Technical Report, 13.) Cambridge, Mass.: Acoustics Laboratory, Massachusetts Institute of Technology.
- Jungraithmayr, Herrmann & Dymitr Ibrizimow (1994). *Chadic Lexical Roots*. 2 volumes. Berlin: Reimer.
- Kawahara, Shigeto, Hajime Ono, & Kiyoshi Sudo (2005). Consonant co-occurrence restrictions in Yamato Japanese. In Timothy Vance (ed.), *Japanese/Korean Linguistics*, Volume 14, 27–38. Stanford, Cal.: CSLI.
- Labatut, Roger (1994). *Initiation au peul*. Paris: INALCO.
- Lacroix, Jean-Michel (2001). Lexique des termes sakalava. [http://www.zomare.com/lts\\_ab.html](http://www.zomare.com/lts_ab.html)



- Lainé, Bruno (2004). Dictionnaire mongol-français. <http://membres.lycos.fr/brunogml/sub/corps.htm>
- Lapointe, Steven, Diane K. Brentari, & Patrick M. Farrell (eds.) (1998). *Morphology and its Relation to Syntax and Phonology*. Stanford, Cal.: CSLI.
- Leben, William R. (1973). Suprasegmental phonology. Doctoral dissertation, Massachusetts Institute of Technology.
- Lespinay, Charles de (1991). *Langue et parlers baynunk: Lexique comparatif. Compte-rendu d'enquêtes et synthèse de lexiques anciens (17<sup>e</sup>/18<sup>e</sup> s. – 1988)*. 2nd edition. Paris: Centre de Recherches Africaines.
- MacEachern, Margaret R. (1999) *Laryngeal Cooccurrence Restrictions*. New York: Garland.
- Mann, Michael (1995). Bemba–English dictionary. <http://www.cbold.ddl.ish-lyon.cnrs.fr/>
- McCarthy, John J. (1986). OCP effects: Gemination and antigemination. *Linguistic Inquiry* 17: 207–263.
- Menn, Lise & Brian MacWhinney (1984). The repeated morph constraint: Toward an explanation. *Language* 60: 519–541.
- Mohan, Tara W. (1994). Case OCP: A constraint on word order in Hindi. In Miriam Butt, Tracy Holloway King, & Gillian Ramchand (eds.), *Theoretical Perspectives on Word Order in South Asian Languages*, 185–216. Stanford, Cal.: CSLI.
- Moïno, Yves (1995). *Le Proto-Gbaya: Essai de linguistique comparative historique sur vingt-et-une langues d'Afrique centrale*. Leuven: Peeters.
- Mouguiama, Patrick Daouda (1994). Mpongwe word list. <http://www.cbold.ddl.ish-lyon.cnrs.fr/>
- Myers, Scott (1987). Tone and the structure of words in Shona. Doctoral dissertation, University of Massachusetts at Amherst.
- N'Diaye-Corréard, Geneviève (1970). *Etudes fca ou Balanta (dialecte ganja)*. Paris: SELAF.
- Nyländer, Gustav Reinhardt (1814). *Grammar and Vocabulary of the Bullom Language*. London: Church Missionary Society by Ellerton and Henderson.
- Pater, Joe & Adam Werle (2001). Typology and variation in child consonant harmony. In Caroline Féry, Antony Dubach Green, & Ruben van de Vijver (eds.), *Proceedings of HILP5*, 119–139. Potsdam: Universität Potsdam.
- Payne, Stephen (1992). *Une grammaire pratique avec phonologie et dictionnaire de kwatay (parler du village de Diémbéring, Basse Casamance, Sénégal)*. (Cahiers de Recherche Linguistique, 1.) Dakar: Société Internationale de Linguistique.
- Pierrehumbert, Janet (1993) Dissimilarity in the Arabic verbal roots. *North Eastern Linguistics Society* 23: 367–381.
- Pozdniakov, Konstantin (1991). Perspectives of comparative studies on the Mande and West Atlantic language groups: An approach to the quantitative comparative linguistics. *Mandenkan* 22: 39–69.
- Rose, Sharon & Rachel Walker (2004). A typology of consonant agreement as correspondence. *Language* 80: 475–531.
- Rugemalira, Josephat (1993). Nyambo word list. <http://www.cbold.ddl.ish-lyon.cnrs.fr/>
- Sapir, J. David (1971). West Atlantic: An inventory of the languages, their noun class systems and consonant alternation. In Thomas A. Sebeok (ed), *Current Trends in Linguistics*, Volume 7: *Linguistics in Sub-Saharan Africa*, 45–98. The Hague: Mouton.
- Segerer, Guillaume (1998). Lexique sua. Unpublished manuscript.
- (2002). *La langue bijogo de Bubaque*. (Afrique et Langage, 3.) Leuven: Peeters.
- Starostin, Sergei (1998–2005). STARLING database. <http://starling.rinet.ru/>
- Stemberger, Joseph P. (1981). Morphological haplology. *Language* 57: 791–817.
- Tang, Sze-Wing (2000). Identity avoidance and constraint interaction: The case of Cantonese. *Linguistics* 38: 33–61.
- Taylor, Charles (1959). Kiga–Nkore dictionary. <http://www.cbold.ddl.ish-lyon.cnrs.fr/>
- Teil-Dautrety, Gisèle (to appear). Et si le proto-bantou était aussi une langue ... avec ses contraintes et ses déséquilibres. *Diachronica*.

- Tervuren Bantu Group (1998). Bantu lexical reconstruction 2. <http://www.cbold.ddl.ish-lyon.cnrs.fr/>
- Vydrine, Valentin (2004). Mandé reconstructions. Unpublished manuscript.
- Williamson, Kay (2004). Ijo reconstructions. Unpublished manuscript.
- Williamson, Kay & Roger Blench (2000). Niger-Congo. In Bernd Heine & Derek Nurse (eds.), *African Languages: An Introduction*, 1–42. Cambridge: Cambridge University Press.
- Yip, Moira (1988) The Obligatory Contour Principle and phonological rules: A loss of identity. *Linguistic Inquiry* 19: 65–100.
- (1995) Repetition and its avoidance: The case of Javanese. In Keiichiro Suzuki & Dirk Elzinga (eds.), *Proceedings of 1995 South Western Workshop on Optimality Theory*, 238–262. Tucson: Coyote Papers, University of Arizona.
- (1998). Identity avoidance in phonology and morphology. In Lapointe et al. (eds.) 1998, 216–246.
- Zalizniak, Andrei A. (1977). *Grammatičeskij slovar' russkogo jazyka*. [Grammatical Dictionary of the Russian Language.] Moskva: Russkij Jazyk.