The numeral system of Proto-Niger-Congo

A step-by-step reconstruction

Konstantin Pozdniakov

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3 Analogical changes in numerals

3.1 Issues pertaining to the detection of alignments by analogy

In addition to the grouping of numbers by noun class, a number of more radical strategies are used in the Niger-Congo languages. One of them is the formal alignment of numbers resulting from the diachronic alignment of forms by analogy. This strategy implies irregular phonetic changes in lexical stems. As a result, contiguous numerals in the Niger-Congo languages often have similar forms, that is they have common phonetic element(s).

Such cases are not easily distinguishable from phonetic similarities conditioned by morphological changes, when affixes that are no longer productive blend into lexical roots, for instance, or archaic noun class markers exist in the numerals. Thus, in Wolof, as shown in the introduction, phonetic similarities arise in the numerals '2'–'4' (***ñaar*** '2', ***ñett*** '3', ***ñeent*** '4') as a result of inclusion of the noun class marker Ñ in the lexical roots.

Only specialists of a concrete language can distinguish between morphological "accidents" and phonetic analogical changes, but sometimes even synchronic competence may not be enough. Table 3.1 shows the first six numerals in five Adamawa languages.

Table 3.1: Adamawa examples

	Languages	'1'	'2'	'3'	'4'	'5'	'6'
(1)	Tunya	sèlì	ari	ata	ana	aluni	nano
(2)	Vere	muo	ituko	tariko	nariko	gbanara	baburo
(3)	Mom Jango	muzoz	itez	taz	naz	gbana	babez
(4)	Dirrim	nuan	bara	tara	nara	tona	tini
(5)	Pere	dəə̀	īrō	ta͡a͡ārō	nārō	núnnō	nóndə́ə̄ (5+1)

In Tunya (1) it is clear that the initial **a-** in the numerals '2'-'5' etymologically has the nature of the noun class marker. In Vere (2) the final syllable **-ko** can

hardly be considered a noun class marker, but it is very likely that we are dealing with a morpheme and not with a phonetic alignment of numerals. In Mom Jango (3) the final -**z** in '1'-'4' and '6' is difficult to comment on; it is likely that this is an analogical change but its direction is not very clear. In Dirrim (4) *bara-tara-nara* is the case of analogical change and, considering the diachronic context, the numerals '2' and '4' were clustered together with '3'. In Pere, the final -o in '2'-'5' may represent an analogical alignment or a morpheme.

Let us exclude all the cases of integration of noun class markers into stems and consider all the other cases of phonetic (or hidden morphological) clustering in the systems of numerals in Niger-Congo. We will deal mainly with two questions:

1. In which branches of Niger-Congo do analogical alignments have a major role and in which they are practically absent? This question is of crucial importance for the step-by-step reconstruction of numerals in Niger-Congo.

2. Which numerals phonetically align together and which analogical groupings are rare? This question is important not only for the etymology of numerals but also for the typology of analogical changes in numerals.

The topic of the present chapter is not relevant to all the branches of Niger-Congo. For instance, in Bantu and Benue-Congo there is no systematic analogic phonetic alignment. But in some other branches it is impossible to discuss the etymology of numerals without considering this factor. In the twelve main branches of Niger-Congo the situation is as shown in Table 3.2.

In the first three branches the minus does not mean that there is no phonetic alignment of numerals. Some examples from Benue-Congo languages are given in Table 3.3.

Each of these examples is interesting for the study of concrete languages, but these seem to be the only languages, among hundreds of BC languages, where analogical changes have been found; therefore, no systematic changes of this type for the BC family have been attested.

In Mel there is only one case which is of interest to us, that is the unification of the initial root consonant in Krim: *yi-**g**in* '2', *yi-**g**a* '3'. The direction of analogical alignment in this case is not clear. It is impossible to study this particular case here, because the discussion of possible hypothesis would require a separate publication. It is important to underline that in other Mel languages cases of phonetic alignment of numerals have not been attested.

There are virtually no unifications of this type in Kru, excluding the phonetic alignment of the initial consonant in '4'-'5', reported in Table 3.4.

Table 3.2: Analogic alignment in NC numerals

	NC family	Analogy in numerals
1	Benue-Congo	–
2	Mel	–
3	Ijo	–
4	Kru	–?
5	Mande	–?
6	Atlantic	+
7	Kwa	+
8	Adamawa	+
9	Ubangi	+
10	Gur	+
11	Dogon	+
12	Kordofanian	+

Table 3.3: BC examples of analogic alignments

Language	'1'	'2'	'3'	'4'	'5'
Gweno (E30)	-m**wi**	-**vi**	-tharu	-nya	-thwanu
Tiv	mòm'	h**ar**	-t**ar**	-nyin	-tan
Mmen	mɔ̀ʔ	b**ege**	t**ege**	kaiko	ta
Bute	mui	bam	tare**b**	nasi**b**	-gi
Kila	mwe	han	t**ar**	n**ar**	tien
Mama	moʔon	mari	tar**u**	la jin**u**	ton**u**

Table 3.4: Kru alignments in '4'–'5'

Language	'1'	'2'	'3'	'4'	'5'
Gbe	do	so	ta	hyi~	hm
Southern Grebo	do	so	ta	ha	*hm
Bassa	doo	so	ta	hiye	hḿ

I will dare to assume (based on these data) that the initial consonant in '4' has undergone analogical change with the consonant in '5'. The final judgment should be done by specialists. In Ijo this type of alignment is absent.

3.2 Mande

There are no systematic analogical changes in the systems of numerals in Mande languages.[1] Some languages like Busa, San (South-Eastern branch) and Soninke (Western branch) present exceptional cases.

In Busa, we are probably dealing with the fossilized suffix **-hõ** which can be found inside the lexical roots of '3' and '4': **a-hõ* '3', **si-hõ* '4', i.e. the phonetic similarity can be explained morphologically.

In San, apparently, the regular reflex of the three different consonants of proto-language of South-Eastern Mande is **s-** (see 3.10 below). Finally, three of the contiguous numerals start with the same consonant: *so* '3', *si* '4', *soro* '5'.

Soninke represents a more complicated case, wherein the last vowel of each numeral is not distributed randomly (Table 3.5).

Table 3.5: Soninke

1	ba(a)ne	6	tu(n)mu
2	filo	7	nieru
3	siko	8	segu
4	(i-)nakato	9	kabu
5	karago	10	ta(n)mu

In '1' there is a particular vowel **-e**. "Minor" numerals ('2'-'5') have the final **-o**, and all the higher numerals ('6'-'10') – final **-u**. Following the reconstruction of Nazam Halaoui (Halaouï 1990): *fill-a* '2' (active voice) /*fill-e* '2' (passive voice) > *fill-e-nu* (PL) '2' > *fill-o* (PL) '2'. In other words, in the numerals '2-5' the vowel **-o** is interpreted by Halaouï as a phonetically conditioned allomorph of the plural morpheme **-nu**. But in the numerals '6-10' another vowel was found, not **-o**, but **-u**. Nazam Halaouï explains this in the following way: irregular final vowel **-u** initially appeared in the numeral '6' as a consequence of progressive assimilation (**tunm-o* > *tunmu*), and then following the analogy this vowel appeared in

[1] I would like to thank Valentin Vydrin for a detailed discussion of the history of numerals in Mande languages.

numerals ‘7’-‘10’. Halaoui’s hypothesis is not plausible (it presupposes a doubtful phonetic change *-**e**-**nu** > -**o** in the numerals ‘2’-‘5’), neither is it the only one possible.

Valentin Vydrin (2006: 171-204) shows that Soninke has two different plural suffixes, -**u**/-**o** and -**ni**/-**nu** (the allomorphs -**u** and -**o** are dialectal variants, the same is true for -**nu** and -**ni**). It is not quite clear, do we have the generic plural marker -**u** in all the numerals from ‘6’ through ‘10’, or whether it is the alternative plural marker -**nu** that appears in ‘6’ and ‘10’, while the generic plural -**u** appears in ‘7’ through ‘9’. In any case, it is evident that in the right column of Table 3.5, the final -**u** is of morphological origin, rather than a result of an analogical change. The fact of the appearance of a plural marker in the numerals ‘6’-‘10’ by itself is noteworthy; these numerals should be interpreted as pluralia tanta. Interpretation of the final -**o** in ‘2’-‘5’ is much more problematic. There is a singular morpheme -**o** in Soninke, however, Vydrin’s data do not clarify why it is -**o**, rather than -**e** or -**Ø**. Therefore, it can be conjectured that the final vowel of the numerals ‘2’-‘5’ result from analogical changes.

Now let us move to the branches where analogical changes are systematic. Even in these cases we will encounter different examples.

3.3 Atlantic

In Table 3.6, the data on the first five numerals in ten various Joola languages will be compared.

Table 3.6: Joola

Joola	‘1’	‘2’	‘3’	‘4’	‘5’
Joola Karon	ɔ-ɔnɔ(ɔ)l	supə**k**	həəciil	paa**k**ul	sa**k**
Bayot	ɛ-ndon	i-rigə**ʔ**	i-fiigi**ʔ**	i-βei**ʔ**	ɔ-ɽɔ̰**ʔ**
Joola Gusilay	ya-nɔ	su-ruba	si-fe**gir**	si-ba**gir**	fu-tok
Joola Banjal	a-nu	si-gaba	gu-fi**gir**	si-ba**gir**	fu-tok
Joola Fogny	yɛ-kon	si-gaba	si-feg**ir**	si-bak**ir**	fu-tok
Joola Mlomp	yɔ-nɔɔ**l**	si-sube**l**	si-heji**l**	si-baci**l**	ŋa-suwaŋ
Joola Kasa	ya-no(r)	si-lube	si-hej**i**	si-bak**i**	hu-tok
Joola Ejamat	a-yınka	ku-lube	si-heji	si-bacir	fu-tok
Joola Kerak	ya-nɔr	si-sube	si-heji	si-bacir	hu-tok

In the last group, apparently, there is no reason for the establishing phonetic alignments. In the meantime, in the first two groups such alignments are evident. In the first group the velar consonant is spread, and in the second group, the liquid consonant; furthermore, the roots are mostly related. These are classical "symptoms" of analogical change. It is clear that it is useless to etymologize the numerals without an in-depth analysis of these alignments.

Joola languages form one of the four branches of the Bak group in Atlantic. In Bijogo, there are no analogical changes in numerals. In the other two branches, these changes of various types can be found, and such changes differ from the type of changes in Joola.

In Pepel (Manjak branch) in some sources the numerals '2' and '3' have a final **-s**, in other sources they have a final **-ʈ** and in Koelle (1963[1854]) the final consonants are different, which can correspond to the situation in proto-language (Table 3.7).

Table 3.7: Pepel

'2'	'3'	Source
pugu**s**	ŋa-jen**s**	Ndao 2011
pugu**ʈ**	waa-jin**ʈ**	Wilson 2007
ge-pugu**s**	ga-ci**t**	Koelle 1963[1854]

In the branch that is represented by isolated languages Balant (Senegal; according to the data from Creissels & Biaye 2015) for the numerals '2' and '3' the following forms exist (Table 3.8).

Table 3.8: Balant

2	3
CL-sìbí	CL-hàbí ~ CL-yàbí
sɪ̀bí	yàabí

Apparently the numeral '2' has undergone the analogical change following the numeral '3'. The sources on Balant Kentohe give different but also phonetically clustered forms: *-sebm* '2', *-abm* '3'.

It is important to underline that analogical changes in the three aforementioned branches of Bak languages are not historically related – these changes

are of different origin. This means that for this group, the principle of phonetic alignments of numerals is characteristic, but different types of changes by analogy co-exist. A similar situation is also typical of Northern Atlantic languages, which show other types of phonetic alignments.

In Wolof, as previously mentioned, the alignment of the initial consonant in numerals '2'-'4' is of a morphological nature; these numerals maintain traces of the noun class prefix. Still, for native speakers these forms contain a similar phonetic marker that groups together the numerals for '2'-'4' and distinguishes them from other numerals.

In Sereer (Northern Atlantic), as in Joola (Bak Atlantic) the final velar can be clearly seen in the numerals '2'-'5': ɗi**k** '2', tadi**k** '3', nahi**k** '4', ɓeti**k** '5'. Here the clustering involves not only the final consonant but the precedent vowel as well, which creates an illusion of the existence of a specific morpheme ('suffix' -**ik**) used for marking the numerals '2'-'5'. As will be demonstrated later, this is a false intuition. In Sereer, for example, we deal with morphophonology and not with morphology. Moreover, the coincidence with Joola is not casual and reflects an important phonetic innovation which took place in Proto-Atlantic.

In Nyun (the branch Nyun-Buy, Northern Atlantic languages) form clustering occurs through the final velar -**k** as well: -**n**du**k** '1', -**n**a**k** '2', -re-**n**e**k** '4'. It is worth highlighting that the initial consonant of the aforementioned forms is also unified (**n**-).

The same isogloss can be encountered, although in its shorter version; in one of the five languages of the Cangin branch, that is in Palor, ka-na**k** '2, ke-je**k** '3'. For Cangin this alignment is definitely marginal, in all the languages of Cangin branch another analogical change is encountered: the initial consonant in the numerals '1'-'2' is unified, which is a rare phenomenon. In Proto-Cangin we have **ji- no?* '1', **ka-nak* '2' with the maintenance of the initial **n**- in all five languages (compare with the unifications in Nyun).

The final -**n** is the basis for phonetic alignment in Sua, though the affiliation to Atlantic languages has not been proven: sɔ**n** '1', m-ce**n** '2', b-rar '3', m-na**n** '4', sugu**n** '5'.

3.4 Kwa

54 out of the 111 sources for Kwa languages available in our database show a common initial consonant **n**- for the numerals '4' and '5'. For example, in Nzema: *na* '4', *nu* '5'. In the other half of the sources forms with **n**- can be found for '4' and with initial **t**- for '5'; for example, in Gbe-Fon: *e-ne* '4', *a-ton* '5'. The latter

forms correspond to Proto-Bantu numerals: **nàì* '4', **táànò* '5'. The question then arises: where do the forms for '5' with initial **n**- come from?

Mary Esther Kropp Dakubu (Kropp Dakubu 2012) includes the forms of the numeral '4' in the series of correspondences which go back to ***n**- and reflect as **n**- in all of the main branches of the family except for Ga-Dangme (GD): Proto-Potou-Tano **-nã*, Tano **-nã*, GTM (Ghana–Togo Mountain) **-inâ*, Gbe *e-ne*. The author includes the numeral '5' in the series 15b where Akan and GD both have **n**-, in Gbe **t**-, and inside GTM are both **t**- and **n**- (Na-Togo). Mary Esther Kropp Dakubu suggests the following historical interpretation of these forms:

> The fact that GTM is reconstructed with ***t**-, but its NA sub-group with ***n**, suggests that the **n** of Akan and GD are also secondary, and that these forms are to be reconstructed as beginning in Kwa ***t** (ibid., p.24).

All the details of complex reconstruction will not be discussed here, but this shows that modern Kwa languages come from *PTB (Proto-Potou-Tano-Bantu). It is worth underlining that the reported reconstruction does not explain why in some of the Kwa languages the numeral '5' with initial ***t**- has changed to **n**-. Furthermore, she does not explain why this irregular change has happened in the aforementioned languages and not in the others.

The most natural answer to the first question is that in some languages, in the numeral '5' the initial consonant has undergone analogical change with the numeral '4'. As a result, the same consonant was formed in both numerals.

In order to answer the second question, it is necessary to observe the distribution of forms of '4' and '5' in different branches of Kwa, adding up in case of necessity forms for '3' and '2'. In order to extend the analysis of Mary Esther Kropp Dakubu, the Lagoon languages will be added to her database (Table 3.9).

Table 3.9: Akan

Languages	'2'	'3'	'4'	'5'
Akan_Twi	abie-n	abie-sa	anan	anum
Ashanti	mie-nũ	mie-sã	enãn	enũm
Abron 1	mie-nu	mie-sa	nain	num
Abron 2	mie-nu**k**	mie-nza**k**	n-nai	n-num

In all the Akan languages the alignment can be observed not only in '4'-'5' but (probably morphologically) also in numerals '2'-'3' (this phenomenon cannot be

found outside this cluster). Furthermore, one of the sources clearly indicates a final velar in Abron. Table 3.10 reports data on the main languages of Central Tano.

Table 3.10: Central Tano

Language	'2'	'3'	'4'	'5'
Agni (Anyin)	ɲ̃-ɲua	n-sa	n-na	n-nu
Baule	nɲo	sa	na	nũ
Nzema[2]	ɲ-ɲu	n-sa	n-na	n-nu
Anufo	ɲɲo	nza	na	nu
Baule (Baoulé)[3]	nɲon	san	nan	nun
Ahanta[4]	ayin	asan	anla	enlu

Nearly identical forms are found in the other three branches of Tano (Table 3.11).

Table 3.11: Krobu-Ega, Western Tano, Tano Guang

Branch	Language	'3'	'4'	'5'
Tano: Krobu-Ega	Krobu	n-sa	n-na	n-nu
Tano West	Abure	ŋ-ŋa	n-na	n-nu
Tano West	Eotile (Beti)	a-ha	a-ni	a-nu
Tano Guang	Dwang (Bekye)[5]	a-sa	a-na	a-nu
Tano Guang	Ginyanga	i-sa	i-na	i-noun
Tano Guang	Foodo	sa	naŋ	nu/nuŋ
Tano Guang	Larteh	sa	ne	nu
Tano Guang	Cherepon	i-sa	i-ne	i-ni

[2] One of the sources on Nzema gives forms without an initial nasal: *sa* '3', *da* '4', *du* '5'. Let us note that even in this case the initial consonant is the same in the numerals '4' and '5'.

[3] In some sources Baule numerals '2'-'5' include also a final **-n**.

[4] Thus, in Ahanta the alignment of initial consonants for '4'-'5' is even more clear: **nl-**.

[5] The roots *-na* and *-nu* (for '4' and '5' respectively) can also be found in the Guang group in Awutu, Chumburung, Guang, Kplang, Krache, Nawuri, Nchumburu, Nkonya. For the subsequent exposition it is important that in all these languages the numeral '3' includes an initial **s-**.

Among the numerous Tano languages there is just one language in our database which does not have initial **n**- in ‘4’ and ‘5’. This language is Ega, which is misleadingly put in the sub-group with Krobu; its attribution to Tano is also doubtful, according to the majority of specialists. The forms of these numerals provide one more argument against this grouping.

Some other languages display unification of the initial consonant in ‘4‘-‘5’ outside of the Tano group.

As for Potou, forms with the initial **n**- in both ‘4’ and ‘5’: *ne-ni* ‘4’, *ne-na* ‘5’ were found only in Mbato, see Table 3.12.

Table 3.12: Potou

Language	‘3’	‘4’	‘5’
Mbato	ne-je	ne-ni	ne-na
Ebrie	bwa-dya	bwe-di	mwa-na

Examples from Mbato permit us to reconstruct the unification of the initial consonant in ‘4‘-‘5’ in Potou-Tano. Outside of Potou-Tano this unification, following Mary Esther Kropp Dakubu, was found only in some languages of Na-Togo (GTM). The numerals in the languages of this group are represented in Table 3.13.

Table 3.13: Na-Togo

	Language	‘3’	‘4’	‘5’
(1)	Anii	i-riu	i-naŋ	i-nuŋ
(2)	Logba	i-ta	i-na	i-nu
(3)	Selee	o-tie	o-na	o-no
(4)	Sekpele	cye	na	no
(5)	Lelemi	i-ti	i-ne	i-lo
(6)	Siwu (Akpafu)	i-te	i-na	i-ru
(7)	Adele	a-si	i-na	ton

In languages (1-4) **n**- appears in ‘4’–‘5’ (Anii displays an utmost variant of alignment with the unification of the final consonant as well). In language (7) the most ancient proto-language initial **t**- is attested in ‘5’, and this means that a reconstruction of **n*- in ‘5’ for Proto-Na-Togo is problematic. Furthermore, in languages (5-6) there is no alignment of the forms.

In other Kwa languages consonants in '4' and '5' differ. To be more precise, in Adjoukrou initial consonants are aligned but they are not nasals: *jar* '4', *jen* '5'.

All the other forms can be grouped into four main types:

1. the "basic" type, where, as in Bantu-Kwa, there is **n**- in '4' and **t**- in '5';
2. the type where '4' has initial **n**- while '5' shows a phonetic change of the initial consonant;
3. the type where '5' keeps **t**-, while '4' shows a phonetic deviation;
4. the most complicated type for the analogical interpretation which has **n**- only in '5' while '4' has a non-nasal initial consonant.

I will provide some examples followed by interpretations.

Type 1 is illustrated in (Table 3.14).

Table 3.14: n- '4', t- '5' (t- '3')

Group	Language	'3'	'4'	'5'
Gbe	Aja	e-to	e-ne	a-to
Gbe	Ewe	e-to	e-ne	a-to
Gbe	Gen	e-to	e-ni	a-to
Gbe	Fon	a-to	e-ne	a-to
Gbe	Kotafon	a-to	e-ni	a-to
Gbe	Saxwe	a-to	i-ne	a-tu
Gbe	Xwla	a-to	e-ne	a-to
GTM	Kebu	ta	nia	to
Ga-Dangme	Dangme	e-to	e-ne	a-to
Ka-Togo	Akebu	ta	nie	tu
Ka-Togo	Ikposo-Uwi	i-la	i-na	i-tu
Na-Togo	Adele	a-si	i-na	ton

It is clear that the basic etymological forms are represented extensively. They are not confined to Potou-Tano or the Lagoon languages but they can be found in four other branches of Kwa as well.

Type 2 is illustrated in (Table 3.15).

[6] Harley (2005: 155) "With the exception of mɔa – 'one' and nviã – 'two', the citation forms of these numerals are derived using the expletive third person pronoun ke, which has become incorporated into the attributive numeral : ke ɛlalɛ '3' > kaalɛ, ke ɛna '4' > kɛna ...".

Table 3.15: n- ‘4’, phonetic deviations in ‘5’

Group	Language	‘3’	‘4’	‘5’
Ka-Togo	Avatime	o-ta	o-ne	o-cu
Ka-Togo	Tuwuli[6]	ɛ-lalɛ	ɛ-na	e-lo
Na-Togo	Lelemi	i-ti	i-ne	i-lo
Na-Togo	Siwu (Akpafu)	it-e	i-na	i-ru
Lagoon	Avikam	a-za	a-na	a-ɲu

Type 2, like Type 1, is not difficult to interpret. In the single languages the reflexes of the original consonant are maintained in ‘4’, while in ‘5’ ***t**- undergoes phonetic changes.

Type 3 is illustrated in (Table 3.16).

Table 3.16: t- ‘5’, phonetic deviations in ‘4’

Group	Language	‘3’	‘4’	‘5’
Ka-Togo	Igo (Ahlon)	i-ta	a-la	u-to
Ka-Togo	Nyangbo	e-tae	e-le	e-tie

The proto-language consonant is maintained in only two languages in ‘5’ (Ka-Togo and GTM) while the initial consonant in ‘4’ undergoes regular phonetic change.

And finally, the most difficult type 4 is illustrated in (Table 3.17).

Here we see all the counter-examples against the hypothesis on the change ***t**- > **n**- in ‘5’ as analogous to **n**- in ‘4’. The solution is to imagine that in certain languages belonging to different branches of Kwa (independently from each other), firstly, this analogical change occurred, the original ***n**-, which was the basis of the analogical change, but was then lost in the numeral ‘4’.

Finally, let us get back to the question raised above: why does analogical change in ‘5’ take place in only some Kwa languages? Let us have a look at Table 3.18, where different initial root consonants in numerals ‘3’-‘5’ within different groups of Kwa are presented.

In the Kwa languages we see a clear tendency: in languages with the initial plosive ***t**- > fricative **s**-, the described analogical changes can be found. Where the plosive is maintained, this change is more difficult and can be found in only some

Table 3.17: n- in ‘5’ but not in ‘4’

Group	Language	‘3’	‘4’	‘5’
Potou	Ebrie	bwa-dya	bwe-di	mwa-na
Potou	Gã	e-tẽ	e-jwe	e-nũmo
Lagoon	Abé(Abbey)	a-ri	a-le	u-ni
Lagoon	Abiji	e ˈ-ti	a ˈ-la	e ˈ-ne
Nyo?	Ari (Abiji)	e-ti	a-la	e-ni
Central Tano	Ahanta	a-sa	a-la	e-nũ
Ga-Dangme	Dangme	e-te	e-ywi/e-wi	e-nuo
Lagoon	Alladian	a-o	a-zo	e-nri
Lagoon	Adioukrou	ŋa-hn	ya-r	ye-n

Table 3.18: Kwa initial consonants in ‘3’-’5’

Group **Sub-Group**	Bantu-Kwa	Tano Krobu	Tano Central Tano	Tano Akan	Tano Guang	Gbe Gbe	GD Gan-Dangme	GTM Ka-Togo
‘3’	***t**	**s**	**s**	**s**	**s**	**t**	**t**	**t**
‘4’	*n	n	n	n	n	n	j/y	n
‘5’	***t**	**n**	**n**	**n**	**n**	**t**	**t**	**t**

of the languages (for example, some of the above-mentioned Na-Togo cases). In this case we have not *t- > n- ‘5’, but *t- > s- > n. This observation can be interesting as a candidate for analogical changes – maybe, ‘weak’ consonants (for example, fricatives) can be more easily involved in analogical processes than ‘strong’ ones (plosives).

It is curious that this analogical isogloss can be found in a number of other branches of Niger-Congo, including Adamawa, Gur and Dogon (as well as Seenku from the Mande family).

3.5 Adamawa

In Adamawa the above-mentioned analogical change can be found in at least a dozen of languages (Table 3.19).

However, in Adamawa, analogies are much more widespread than in Kwa. For instance, in Gimme the numerals ‘2’-‘7’ share the same final syllable (morpheme?). In Chamba, only one similarity can be found for ‘4’-‘5’ and for ‘2’-‘3’

Table 3.19: Initial n- in ‘4’-’5’ in Adamawa languages

Language	‘2’	‘3’	‘4’	‘5’	‘6’	‘7’
Tula	rop	ta	na	nu		
Kwa	negbe	ne mwan	ne nat	ne nu		
Burak	rab	gbunuŋ	net	nob		
Chamba	bara	te-ra-	nasa	tu-na-		
Kolbila	inu	tonu	nereb	nunub		
Bangunji	yob	t**ar**	**nar**	**n**uŋ		
Yendang	ini	t**at**	**nat**	ghi-**n**an		
Dadiya	yo	t**al**	**nal**	**n**u		
Peere	**iro**	t**aro**	**naro**	**n**uno		
Samba Leko	ki**ra**~ki**re**	tu**re**	**nara**	**n**unak		
Gimme	idtige	tage	nage	nonige	nonge	nokidtige

(the final syllable **-ra**). In Kolbila, the situation is quite similar to the one in Chamba (‘2’-‘3’ share the same final syllable **-nu**) and in ‘4’-‘5’ both the initial **n-** and the final **-b** coincide.

Phonetic alignment follows more interesting models in Bangunji, Yendang, Dadiya, Peere and Samba Leko. In these languages, on the one hand, ‘4’-‘5’ are still grouped together (because of the initial consonant) and, on the other hand, (‘2’)-‘3’-‘4’ are also grouped (because of the final syllable). The numerals with the meaning ‘4’ have two simultaneously distinct features which mark two separate groupings. As a result, peculiar minimal pairs arise formed by contiguous numerals; for example, in Yendang: *tat – nat* ‘3’-‘4’, *nat – nan* ‘4’-‘5’.

Another alignment of numerals (2), ‘3’-‘4’ takes place in Adamawa where there is no alignment in numerals ‘4’-‘5’. Minimal pairs like in Dirrim *bara* ‘2’ – *tara* ‘3’ – *nara* ‘4’ are a very widespread phenomenon for the languages within this family. Some examples are presented in the following table (Table 3.20).

This kind of assonance may seem insignificant, but I would like to underline once more that among hundreds of Benue-Congo languages, it is impossible to find any similar case.

Table 3.20: Adamawa analogical alignments in '3'-'4'

Language	'1'	'2'	'3'	'4'
Vere (Mom Jango)		ituko	tariko	nariko
Galke (Ndai)			ca-?a-	na?a
Dama			sa-i	nai
Mono			sai	nai
Mundang			sa-i	nai
Pam			sa-i	nai
Fali			tan	nan
Kam			car	nar
Bali			tat	nat
Kumba			sat	nat
Teme			tat	nat
Waka			tat	nat
Yendang			tat	nat
Wom		ira	tara	nara
Taram		bara	tara	nara
Fanya		liru	taro	naro
Duupa		ito	tato	nato
Kotopo	wate	i-to	tato	nato
Mom Jango	muzoz	itez	taz	naz

3.6 Ubangi

Ives Moñino (1995) has reconstructed unified forms for '3'-'4' and partly for '5' in Proto-Gbaya. These forms resemble the above-mentioned "minimal pairs" in Adamawa. In Proto-Gbaya: **tar(a)* '3', **nar(a)* '4', **mor* '5' (notably, the numeral '5' coincides with the word 'hand'). In Ubangi-Sere, a different type of alignment can be found – the final **-o** in numerals '2'-'5' (in Ubangi-Zande – the final **-i**) (Table 3.21).

3.7 Gur

In some languages of the Gur family analogical changes in '4'-'5' can be found, as observed in Kwa and Adamawa (Table 3.21).

Table 3.21: Final vowel alignments in Ubangi

Language	'2'	'3'	'4'	'5'
Ndogo	so	tao	nao	vo
Sere	so	tao	nao	vo
Tagbu	so	tao	nao	vuo
Pambia	a-vai	wa-tai	(h)avai	boinyaci

Table 3.22: Gur initial n- in '4'-'5'

Language	'2'	'3'	'4'	'5'
Baatonum	yiru	ita / yita	ne	nobu
Chala (dial.)	-la	-toro	-nara	-nuŋ
Buli	ba-yi	ba-ta	ba-nasi	ba-nu
Dagaara	ayi	ata	a-nar	a-nu
Delo	ala	atoro	a-nara	a-noŋ
Ditammari	deni	tati / tadi	na	numu
Nawdm	mrek	mtak	m-na	m-nu
Safaliba	ayik	atak	anaasi	anu

Like in Chamba (Adamawa), some of the Gur languages have a common feature not only for '4'-'5' but also for '2'-'3'. For instance, in Nawdm and Safaliba, as can be deduced from Table 3.22, the numerals '2'-'3' have a final velar consonant. The final velar can be found in '2'-'3' in Hanga (*a-yik* '2', *a-tak* '3'), and in Dogose it is found in '2'-'5': *i-yok* '2', *i-sak* '3', *i-yi̱k* '4', *i-wak* '5'. Gudrun Miehe (Miehe et al. 2007: 157) shows in Khisa (Komono) the final **-ʔ** in '2'-'5': *ɲɔ́ɔ̀ʔ* '2', *sà̰aʔ* '3', *ɲéèʔ* '4', *ŋwáàʔ* '5'.

And finally I would like to report a rare case of strong alignment between the numerals '1' and '2' in Mbelime: *yɛ̃nde* '1', *yede* '2'.

3.8 Dogon

Assimilation of the initial consonant in '5' to the initial consonant **n-** in '4' (for example, Tommo So: *nay* '4', *no* '5') is characteristic of practically all the Dogon languages and should be reconstructed already for the Proto-Dogon. Other types

of unification cannot be found in this family.

3.9 Kordofanian

Phonetic / morphological alignments in this family are quite rare. In what follows, the most interesting cases are reported (Table 3.23).

Table 3.23: Kordofanian alignments

Group	Languages	'1'	'2'	'3'	'4'	'5'
Talodi	Tocho	puluk	we-rak	wa-tak		
Talodi	Jomang	y-íllik	y-ilrak	y-idak		
Talodi	Nding		-eta	t-atak	-ibiŋik	
Talodi	Tegem	tléedi	**pad**erig	**pad**aig		
Katla	Katla	te:ták	sek			
Orig	Orig				arum	wuram
Katla	Tima		**eh**ek	**eh**oat	**eh**alam	

In Talodi the final velar is present, similarly to other branches of Niger-Congo. Some cases of phonetic alignment can be found, though this alignment is reserved to singular languages rather than to the whole family.

In sum, the data examined in this chapter can be found in Appendix C where 50 different cases of probable analogical changes in Niger-Congo are highlighted. The Table in Appendix C permits the evaluation of the scale of analogical changes in the system of numerals in Niger-Congo in general.

It is worth mentioning that in the cases where numerals '6'-'10' are not derived, it is very unusual to find phonetic alignment in them (exceptional systems, such as that of Soninke, were previously discussed). For this reason, only the numerals '1'-'5' are included in Appendix C. Three main questions are to be answered concerning these numerals: 1) Which groupings of numerals are most typical for the Niger-Congo languages when we deal with analogical changes? 2) Which phonetic (or hidden morphological) means are used to produce the alignment of numerals? 3) Are there any reasons to consider that similar analogical changes in different branches of Niger-Congo can be diachronically related? Otherwise, can these materials be useful for the study of other isoglosses in Niger-Congo?

As demonstrated in Appendix C, mostly contiguous numerals are aligned (see some rare examples above, for example in Nyun languages, where features for

'1'–'2'/'4' are shared, but not for '3').

It is quite rare that '1' shares a submorphemic marker with the numeral '2', while for other contiguous numerals this is more common. Such rare examples are found in Ha (Bantu J) and in Mbelime (Gur). In both languages the forms of numerals '1' and '2' have minimal phonetic difference. As will be demonstrated in the following sections dealing with the etymology of numerals '1' and '2', the forms in Ha (*mbele* '1', *bhili* '2') are of great interest for the diachronic interpretation of numerals.

As can be seen in Appendix C, the final phonemes have phonetic alignment much more often than the initial ones.

The appearance of the diachronically irregular initial **n-** in the numeral '5' as analogous to the regular form of the numeral '4' represents a common feature in different families of Niger-Congo: Potou-Tano (Kwa), Adamawa, Gur and Dogon. More attention should be paid to this phenomenon because it is unlikely that one analogical feature could appear in four different branches of Niger-Congo independently.

There are two remarkable cases in the alignment of final phonemes which are typical for several branches of Niger-Congo.

Firstly, there is the appearance of a final velar (**-k**) in the groupings of the numerals '2'-'5', '2'-'4', '2'-'3', '3'-'4' (in Kordofanian and Atlantic also '1'-'2'-('3')). This feature is typical for the Atlantic, Adamawa, Gur and Kordofanian groups (thus, one more common feature can be found for Adamawa-Gur). In Benue-Congo and Mande the reported examples are clearly marginal.

Secondly, similarly to the regular dental reflexes of the final consonant in the numeral '3' (*-**t(h)**), in '4' the final consonant undergoes an irregular change (non dental consonant becomes dental). This type of change is particularly characteristic for Atlantic, Adamawa and Gbaya (Ubangi), but it is also found in Kordofanian and in Benue-Congo, which do not have analogic changes as characteristic features.

The most common case is the appearance of the identical final vowel in some languages of different families (mostly in numerals '2'-'5'): Mama (Bantoid), Soninke (Mande), Peere (Adamawa) and Ndogo, Pambia (Ubangi).

All the reported cases should be taken into consideration for the process of etymologization of numerals, which will be done in the following chapter.

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The numeral system of Proto-Niger-Congo

This book proposes the reconstruction of the Proto-Niger-Congo numeral system. The emphasis is placed on providing an exhaustive account of the distribution of forms by families, groups, and branches. The big data bases used for this purpose open prospects for both working with the distribution of words that do exist and with the distribution of gaps in postulated cognates. The distribution of filled cells and gaps is a useful tool for reconstruction.

The first chapter of this book is devoted to the study of various uses of noun class markers in numeral terms. The second chapter deals with the alignment by analogy in numeral systems. Chapter 3 offers a step-by-step reconstruction of number systems of the proto-languages underlying each of the twelve major NC families, on the basis of the step-by-step-reconstruction of numerals within each family. Chapter 4 deals with the reconstruction of the Proto-Niger-Congo numeral system on the basis of the step-by-step-reconstructions offered in Chapter 3. Chapter 5 traces the history of the numerals of Proto-Niger-Congo, reconstructed in Chapter 4, in each individual family of languages.