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Comparing causal-noncausal alternation in three West-African families in contact: Atlantic, Mel and Mande

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Abstract: This paper investigates the coding of causal-noncausal alternation in three West-African families of languages, studying divergence and convergence within and between these families. Atlantic, Mande and Mel languages belong to the same Niger-Congo phylum but display quite different typological profiles and have long lasting historical contacts in Senegal and the surrounding areas. In order to evaluate the correlation between typological profile and valence orientation and to identify contact-induced changes, the same eighteen verb-pair meanings have been analysed for all the documented Atlantic languages, and for the Mande and Mel languages in contact with them. A new methodology was designed for this, combining family standard-patterns and measure of deviation of individual languages. After overcoming biases in the list of pairs due to verb types and animacy, the results confirm the expected correlation between the favored strategies and the typological profiles. Moreover, beside pointing to some contact-induced changes and revealing a strong internal variation inside Atlantic family, attributed here to its historical depth, this study shows that some structural features may favor or preclude specific coding strategies. In this view, the equipollent strategy appears to be important for some languages and usefully included into a new typological cluster of derivational strategies.

Keywords: causation, typological profiles, genetic affiliation, contact, Niger-Congo, Atlantic

Introduction

The causal-noncausal alternation is defined here as a *semantic* distinction built on the presence/absence of a *causer* in a pair of verbs referring to the same core event or state-of-affairs, such as *kill/die*, *break* (tr.)/*break* (intr.), *raise/rise* or *frighten/fear* in English. Although this semantic opposition is often correlated with an opposition between transitive and intransitive constructions (e.g. *break* (tr.)/*break* (intr.), *kill/die*) or between processes and states (e.g. *frighten/be afraid*, *dry/be dry*), these syntactic and aspectual oppositions are not defining properties of the causal-noncausal alternation, they rather appear as realizations of this alternation, depending on the various verb types or Aktionsarten involved in the causal-noncausal pairing. In a typological perspective, several studies point that the coding of causal-noncausal alternation shows an interesting crosslinguistic variation. Depending on the semantic subtypes of causal-noncausal pairs, the crosslinguistic variation for coding this alternation is more or less important. On the one hand, there is a general tendency of languages to code this alternation by deriving (morphologically or syntactically) the causal verb form out of the noncausal one by means of causative markers (e.g. *laugh/make laugh*),

that is using a transitivity strategy, as evidenced by Nichols *et al.* (2004). On the other hand, Haspelmath (1993) has shown that the cross-linguistic variation in the coding of causal-noncausal pairs is particularly important for a specific subtype of verb pairs, referred to as ‘inchoative/causative’ pairs and defined as follows: The ‘inchoative’ (noncausal) member of the pair “generally refers to a change of state (more rarely a going-on), excludes a causing agent and presents the situation as occurring spontaneously” (*ibid.* p.90), as in *The stick broke* (inchoative) vs. *The girl broke the stick* (causative). For this type of pairs (such as ‘break’ intr./tr., ‘melt’ intr./tr., ‘open’ tr./intr.), the direction of formal derivation (i.e. causative, decausative or non-directed alternations using labiality, equipollence or suppletion) is not predictable and languages differ considerably in their preferences for coding this alternation.

In order to account for crosslinguistic diversity in the coding of causal-noncausal verb pairs, various factors can be called into play, such as genetic affiliation, typology (Nichols *et al.* 2004), frequency (Haspelmath *et al.* 2014) or contact (Bickel 2015). As a contribution of African linguistics to the debate, this article investigates the coding of causal-noncausal alternation in three families of languages spoken in West Africa. Atlantic, Mande and Mel languages belong to the same Niger-Congo phylum¹ but display quite different typological profiles and have long lasting historical contacts in Senegal and the surrounding areas. These features make them good candidates for (i) evaluating the correlation between typological profile and “valence orientation” that is the overall tendency of a language to treat members of causal-noncausal verb alternations in a particular way (Nichols *et al.* 2004), (ii) tackling contact-induced changes in valence orientation.

The five possible strategies for the coding of causal-noncausal pairs are actually attested in the three families, as illustrated in the three tables below, namely:

- the *suppletive* strategy (abbreviated here as $nC \neq C$) whereby the causal-noncausal pair is made of two different lexemes;
- the *labile* strategy ($nC = C$) whereby the same verb is used with a causal or noncausal meaning without formal change;
- the *causative* or transitivity strategy ($nC > C$) whereby the causal verb is formed through a causative derivation² of the noncausal verb;
- the *decausative* or detransitivity strategy ($nC < C$) whereby the noncausal verb is formed through a decausative derivation of the causal verb;
- the *equipollent* strategy ($nC \sim C$) whereby the causal-noncausal pair is made of two different forms of a same verb, both displaying the same degree of morphological complexity. Alternation can be achieved through derivational, inflectional or phonological marking.

Table 1. Examples of the five coding strategies in Atlantic family

<i>Jóola Kwaatay</i> (Coly 2010)				
suppletive	$nC \neq C$	<i>ketu</i>	<i>yoolu</i>	die / kill
labile	$nC = C$	<i>liiken</i>	<i>liiken</i>	learn / teach
causative	$nC > C$	<i>lab</i>	<i>lab-n</i>	boil / boil
decausative	$nC < C$	<i>welej-o</i>	<i>welej</i>	break / break
equipollent	$nC \sim C$	<i>siij-o</i>	<i>siij-an</i>	be straight / make straight

¹ The belonging of Mande to the Niger-Congo phylum is presently questioned by some authors (Dimmendaal 2008, 2011, Creissels 2017) and remains an outstanding issue (Vydrin 2016).

² Periphrastic causatives are not studied here.

Table 2. Examples of the five strategies in Mel family

<i>Landuma</i> (Rogers & Bryant 2012)				
suppletive	nC ≠ C	<i>nənk</i>	<i>mənk</i>	see / show
labile	nC = C	<i>pɔc</i>	<i>pɔc</i>	cook / cook
causative	nC > C	<i>wos</i>	<i>wos-əs</i>	dry / make dry
decausative	nC < C	<i>wəkək-ɔ</i>	<i>wəkək</i>	break / break
equipollent	nC ~ C	<i>funp.ɔ</i> ³	<i>funp-əs</i>	fall / drop

Table 3. Examples of the five strategies in Mande family

<i>Bobo</i> (Bris & Prost 1981)				
suppletive	nC ≠ C	<i>siri</i>	<i>yε</i>	die / kill
labile	nC = C	<i>yɔ</i>	<i>yɔ</i>	break / break
causative	nC > C	<i>tanga</i>	<i>tanga-be</i>	sit / seat
decausative	nC < C	—	—	(not found in data)
equipollent	nC ~ C	<i>kibε</i>	<i>kɔba</i>	open / open

However, considering their respective typological profiles, distinct strategies are expected to be favored in the different families. Labile strategy is expected to be favored in Mande languages which are rather isolating languages with a limited set of derivational suffixes (Williamson & Blench 2000: 21) and regularly labile verbs, as exemplified in (1). For instance, in Mano, four verbs out of five (actually 66 out of 297) are labile in Khachaturyan's study (2014).

Mandinka (Mande) (Creissels & Bassène 2013)

- (1) *dádaa*
 'to repair' ~ 'to be repaired'

In contrast, directed (i.e. causative and decausative strategies, as exemplified in (2)) or, more largely, derivational strategies (consisting of causativization, decausativization and equipollence) are expected to be favored in Atlantic where large inventories of verbal extensions are widespread (Williamson & Blench, 2000: 22). In accordance with this rich and productive inventories of verbal affixes illustrated in example (2), equipollence is mostly coded by a double derivation in these languages (as exemplified in Table 1 above). Therefore a grouping of all these strategies⁴ together (including equipollence), may be more relevant for Atlantic than the usual distinction between directed (causative and decausative) vs. non-directed strategies (labile and equipollent strategy).

Wolof (Atlantic)

- | | |
|----------------------------|--------------------------------|
| (2) noncausal > causal | causal > noncausal |
| <i>réer</i> 'to be lost' | <i>sakk</i> 'seal' |
| → <i>réer-al</i> 'to lose' | → <i>sakk-u</i> 'to be sealed' |
| be_lost-CAUS1 ⁵ | seal-MID |

³ Hyphen (-) indicates a derivational morpheme, dot (.) indicates a morpheme analyzable as an inflectional ending or as a frozen suffix.

⁴ This unusual grouping of equipollence with directed strategies is also supported by Plank and Aditi's position (2015: 1) arguing that "phonological alternations [equipollent, here], on their own or attendant upon conjugation class switches between intransitives and transitives, can be as directed as derivations are which are implemented through adding segmental markers".

⁵ List of abbreviations: ACT *active*, CAUS *causative*, MID *middle*, INF *infinitive*, PASS *passive*. Number after CAUS *causative* indicates that language has several causative derivations, the number refers to a specific one.

	<i>génn</i>	‘go out’
→	<i>génn-e</i>	‘take out’
	go_out- CAUS2	
	<i>jooy</i>	‘cry’
→	<i>jooy-loo</i>	‘make cry’
	cry-CAUS3	

As for Mel, this small family is too poorly documented for defining a typological profile. However, considering that these languages were classified as a sub-group of Atlantic family until recently⁶, some affinity between the two families can be assumed so that we hypothesize for Mel a coding profile closer to that of Atlantic.

Temne (Mel)

(3)	noncausal > causal		causal > noncausal	
	<i>shel</i>	laugh	<i>mánk</i>	hide (tr.)
	<i>shel-əs</i>	make laugh	<i>mánk-ənɛ</i>	hide (intr.)
	laugh-CAUS		hide-MID	

In order to check these predictions and to identify contact-induced changes, we have documented the three families by retrieving and analyzing the same eighteen verb-pair meanings from the *RefLex* lexical database (Seegerer & Flavier 2011). The list of eighteen verb pairs proposed by Nichols *et al.* (2004) was used here to ensure continuity and built on the previous works. As can be seen in Appendix 1, this list designed for targeted investigations includes proxies (e.g. cry/laugh) and does not distinguish between states and processes (e.g. be/become angry as noncausal member of pair 07) nor between durative and inceptive processes (e.g. burn/catch fire for pair 11). These data were also complemented and substantiated by available grammars, and by some inquiries of specialists of individual languages when needed and possible.

This article is structured as follows. Section 1 presents the language sample, its limitations and the problems encountered for collecting data. Section 2 is dedicated to the study of the correlation between typological profile and valence orientation across the three families. The coding profiles of the different families emerging from our quantitative study are here confronted with our hypotheses. While these first results confirm the predictions about Atlantic (2.1), they provide contradictory results for Mande. This leads us to consider a possible bias due to the list of verbs and to check again the coding profiles using a restricted list of verbs. The results obtained with this new list concerning the favored strategies in the three families are then presented (2.2), along with two additional results (2.3 and 2.4.) which were unexpected according to general predictions. Using optimized patterns of distribution of the coding strategies used in each family, the last section (3) tackles the issue of contact-induced changes in valence orientation by sorting out the possible causes for the deviation of individual languages from the family standards. This methodology is applied to Mel (3.2.), to the Mande sample (3.3.), and finally to Atlantic family on which this study focuses (3.4). Eventually, a possible genetic distribution of deviation according subgroups is investigated for this last family.

⁶ The classification of the Mel languages into a distinct family has been recently confirmed by Pozdniakov and Seegerer (to appear), after a first suggestion by Dalby (1965).

1. The language sample: limitations and problems

As a first step, the whole Atlantic family has been investigated in the database. Since a preliminary study had revealed a greater diversity among Atlantic languages than inside the Mande family, we decided to focus our study on Atlantic languages and restrict the Mande sample to languages in contact with Atlantic. All the languages of the small Mel family were also investigated because they are in contact with the two other families (see Map 1). For Mande, we have added to the six languages in contact with Atlantic and Mel, two other languages with no contact, for balancing somehow a possible effect of contact in the coding profile emerging from our study of Mande. However, after retrieving all the data from the database, several languages have been discarded for this study because they were too poorly documented.

Map 1- Languages of Senegal and the surrounding areas (Pozdniakov *et al.* 2019)



In spite of the extraordinary coverage of *RefLex*⁷ and our personal effort for substantiating these data with additional documentation on the various languages, the list of 18 verb pairs could not be fully completed for the majority of the languages in the sample. This is due to missing information in *RefLex* (which is a lexical database using uneven sources, from short lists of words to full dictionaries), to data collection through a *lexical* database and not through elicitation, and ultimately to the insufficient documentation of African languages (many languages are still poorly documented). Consequently when a derived form was not found in the dictionaries used for building this lexical database (or in the descriptions used additionally for this study), it does not mean that it does not exist in the language (lexicographers have various strategies about including or not suffixal forms in their dictionaries or lexicons). Moreover, for Mel and Atlantic, some items had to be removed from our sample of verb pairs because, according to our documentation, the causal member or even sometimes the two members of a pair have a periphrastic coding. These problematic pairs are: 01 ‘laugh’ and 04 ‘eat’ in Atlantic, 03 ‘sit’ in Mel, and most frequently 07 ‘be/become angry’ in the two families. Accordingly, they are missing for several languages, not because they are not documented but because the causal periphrastic coding is excluded from our study. This situation has generated gaps in our samples and also a possible bias in favor of the verb pairs

⁷ *RefLex* (*Reference Lexicon of the Languages of Africa*), is an online lexical database devoted to the languages of Africa. It covers presently 789 languages with over one million words, retrieved from referenced and accessible sources, and provides additional tools, mainly dedicated to phonological and lexical reconstruction.

universally coded by suppletion. This data shortage results in an unbalanced coverage of the verb pairs across individual languages with risks of bias in the comparison. We have figured out various solutions to counterbalance these possible bias (see 2.1 and 3.1.). Still our results on the families' coding profiles about valence orientation should be interpreted with caution due this uneven sampling. However, a complementary analysis (Tang, Voisin & Robert submitted), based on permutations with bootstrap samples of the data and randomly selected subset of variables shows that the available information is sufficient to capture the regularities of verb pairs in the three different language families.

2. Correlations between typological profile and valence orientation

In order to study the correlation between typological profile and valence orientation across the three families, the coding profiles of the different families have been defined by calculating the average of the various strategies used for coding the 18 causal-noncausal verb pairs in each set of languages. Considering the gaps in the data, the total for each strategy is calculated here on the basis of the number of pairs found in individual languages (X/18). Therefore the total of percentages is below hundred. These results are then confronted with our predictions about the favored strategies according to typological profiles.

2.1. The favored strategies across families: first results

For Atlantic, directed or, more largely, derivational strategies (*i.e.* directed strategies plus equipollent strategy) were expected to be favored according to the typological profile of these languages. The quantitative study of the coding strategies for the 18 verb pairs in the 36 Atlantic languages confirms our prediction. As shown in Table 4, derivational strategies are by far the most common strategies used inside the family, be they directed (making use of causative or decausative affixes) or not (using equipollent strategy).

Table 4. Average values for directed and derivational strategies vs. others in Atlantic (% of pairs found)

	ATLANTIC		
< & >	41,65	51,93	derivational strategies
~	10,28		
=	8,61	24,20	non-derivational strategies
≠	15,59		

In contrast, lability was expected to be the favored strategy for the rather isolating Mande languages. However, this hypothesis is not confirmed here.

Table 5. Average values for each of the five possible strategies in the three families (% of pairs found)

	ATLANTIC	MANDE (sample)	MEL
>	29,25	36,11	19,91
<	12,40	8,33	18,06
~	10,28	0	13,89
=	8,61	32,99	7,54
≠	15,59	12,50	20,24

As visible from Table 5, in our sample, Mande languages display a more prominent use of causativization (>), lability (=) being only the second (important) one, also much more

frequent in Mande than in Atlantic and Mel. Noticeably, with the list of verb pairs that was used, transitivization (causativization in our terms) is the preferred strategy in the three families, confirming here the general trend evidenced by Nichols *et al.* (2004). It is worth noting that Mel has a coding profile closer to that of Atlantic. This is not surprising considering the previous classification of Mel languages as a sub-branch of Atlantic. As shown in Table 6, the various strategies display almost the same ranking in both families. However in Mel the scores for causativization (>) and suppletivism (≠) are almost equal (see Table 5).

Table 6. Ranking of the five strategies in Atlantic and Mel

Ranking	1	2	3	4	5
ATLANTIC	>	≠	<	~	=
MEL	≠	>	<	~	=

2.2. New results with a controlled list of verb pairs

Contrary to our predictions based on typological profiles, lability is not the favored strategy for Mande in our results, causativization is the preferred one. These contradictory results for Mande lead us to consider a possible bias in favor of causativization in the list of verbs we used for this study, resulting in an overrepresentation of causativization strategy. In their study on causal/noncausal verb alternations, elaborating on the general preference of languages for transitivization strategy, as pointed out above, Haspelmath *et al.* (2014) indicate that, crosslinguistically, causative strategy is almost always used for agentive and atelic core-events.

“In general when the core-event is itself agentive (i.e. when one participant is a volitional agent) and atelic, languages (virtually) never use anticausative, equipollent or labile coding.” (Haspelmath *et al.* 2014: 591).

Indeed, verbs virtually 01 to 09 in our list are prototypically used with an animate subject (as explicitly indicated by Nichols *et al.* 2004⁸), so they are often agentive, and also atelic. Thus, causative derivation might be overrepresented in our results because of this first half of verbs. On the other hand, verbs 10 to 18 in this list correspond almost perfectly to the noncausal verb types for which the cross-linguistic variation in the coding of causal-noncausal pairs is particularly important according to Haspelmath (1993) and Creissels (2018), that is for “monovalent verbs referring to a process (not a state) typically undergone by concrete inanimate entities, and easily conceived as occurring without the involvement of a clearly identified external instigator” in Creissels’ (*ibid.*) terms. Therefore, the study of these verbs is crucial to characterize the *preference* of individual languages for one of the possible strategies. For these two reasons, we have taken out verbs 01 to 09 from the list and calculated the average of the five strategies for verbs 10 to 18 in the three families. Henceforth, following Nichols *et al.* (2004), for brevity we will refer to the two sets of verbs in the list, as ‘animate’ and ‘inanimate’. It should be kept in mind, though, that in our corpus all the ‘inanimate verbs’ do not strictly correspond to the verb type described by Haspelmath *et al.* (2014) and Creissels (2018): Some are states and not processes (e.g. ‘be straight’ as a proxy of ‘become straight’), since the original list did not distinguish between stative and dynamic processes (see Appendix 1).

⁸ “Pairs 1-9 have varying degrees of agency and volition on the part of an animate S/O; 10-18 have varying degrees of independence, resistance to force, etc. on the part of an inanimate S/O. Henceforth for brevity we will refer to the two sets of verbs as ANIMATE VERBS and INANIMATE VERBS respectively » (Nichols *et al.* 2004: 155-6).

As visible from Table 7, with this restricted list of verb pairs controlling (in)animacy, the coding profile of Mande confirms our predictions based on typological profile: lability is the favored strategy. These new results also confirm the bias for causativization in the original list combining all verb types.

Table 7. Average of the 5 possible strategies for the verb pairs **10 to 18** (% of pairs found)

	ATLANTIC	MANDE	MEL
>	27,08	33,33	25,93
<	18,25	13,89	44,44
~	11,39	0	22,22
=	13,61	45,83	19,44
≠	8,02	5,56	8,33

Interestingly, when using the ‘inanimate’ verb list, the increase of lability in Mande parallels an increase of decausativization for Atlantic (from 12,40 to 18,25%) and Mel (from 18,06 to 44,44%), decausativization becoming even the favored strategy in Mel. This is in accordance with the general preference of Atlantic and Mel for directed strategies but the preference of Mel for decausative coding reaches here an outstanding proportion. For this family, four languages were removed from the sample because of data shortage (less than four verb pairs were found) when retrieving only verb pairs 10 to 18. Consequently, the new scores presented are calculated on the only three well documented languages for these verb pairs: Sherbro, Kisi and Landuma. Some remarkable points stand out for Atlantic when using this controlled list of verb pairs, which are crucial to characterize the preferences of languages: the coding profile of this family appears to be more evenly distributed among the various strategies compared to Mel and especially to Mande, directed strategies (> and <) standing ahead and all other ranking tightly together with a gradual decrease to the lowest score (8,02% for suppletion). The score of derivational strategies reaches 56,73% here. Lastly, the score for suppletion drops in the three families.

The comparative results with this controlled list, restricted to ‘inanimate verbs’, show that verb types are conditioning factors for the coding of valence alternations. As a selection of verbs displaying the greatest crosslinguistic variability for this coding, this restricted list is crucial to characterize the preference of individual languages. However, in the next parts of this study, we keep using the larger list as more appropriate for a cross-family comparison, in as far as it covers a greater and more representative sample of the various verb types used in languages.

2.3. Additional results: surprising scores for equipollent and suppletive strategies

In addition to the results confirming the correlations between typological profiles and favored strategies as we hypothesized, we found two unexpected results according to general assumptions.

2.3.1. Equipollent strategy: a surprisingly significant score in Atlantic and Mel

The equipollent strategy has received less attention in the typological studies on causal-noncausal alternation. In these studies, the focus is generally on the crosslinguistic prominence of the causative strategy over others. The typological trends of languages for coding this alternation show some exceptions on this point but in these counterexamples the equipollence is never the privileged strategy, even when augmented by the suppletivism measure, as proposed by some authors considering the supposedly rare use of these two strategies (see footnote 12). In Table 8, extracted from Haspelmath *et al.* (2014), the

equipollent strategy is merged with suppletion. The scores show that the causative strategy is indeed the preferred strategy of a majority of languages (four out of seven), the three diverging languages (Romanian, Russian and English) favoring either the decausative or the labile strategy, but none equipollent one. Due to the fusion of equipollent and suppletive strategies in this table, it is difficult to have a good preview of the proportion of verb pairs using only equipollent strategy, but the rates in this sample of languages already confirm its low use.

Table 8. Different coding type trends in the seven languages (Haspelmath et al. 2014: 591)

	Causatives	Anticausatives	Equipollents	Labiles	% of causatives
Turkish	12	7	1	0	63
Japanese	8	7	4	1	53
Maltese	9	9	1	1	50
Swahili	6	8	7	0	43
Russian	1	13	6	0	7
Romanian	0	20	0	0	0
English	0	0	2	18	0

By comparison, in our study, the score of use of equipollent strategy is remarkable both in Atlantic (10,28% with the full list of verbs in Table 5 and 11,39% with the restricted list in Table 7) and Mel (13,89% reaching 22, 22% with the restricted list), in particular when compared to Mande (0% in all cases). Two converging structural factors may explain these unexpected scores. Equipollent strategy consists of various subtypes. In a first subtype, the causal-noncausal alternation corresponds to voice oppositions encoded in the verbal inflection either through inflectional voices system or through conjugation classes. These two inflectional variants are recorded for a few languages in our survey. In Pulaar and Ful of Massina for instance, the verb system is organized around voice oppositions in the form of active, middle and passive inflections as illustrated in (4). In these languages, verbal inflections display steady markers for the different voices, and there is no decausative morpheme. So, there is no alternative derivational means for equipollent coding than the inflectional voice system.

Ful of Massina (Atlantic) (Breedveld 1995: 151)

(4)	<i>ɔudd-ude</i>	<i>ɔudd-aade</i>	<i>ɔudd-εede</i>
	open-INF.ACT	open-INF.MID	open-INF.PASS
	‘to open something’	‘to be open(-able) (of something)’	‘to be opened (by someone)’

In Balant (and probably in Landuma⁹, Mel family), the inflectional system takes the form of verb class changes (or conjugations classes), as illustrated in (5) below. Balant has three conjugation classes, visible through a set of final vowels¹⁰. These classes are regularly correlated with transitivity properties of the verb. Indeed, Class B consists almost exclusively of intransitive verbs, and a large number of them are paired with transitive verbs in the Class A. Thereby, in some cases, Class A and Class B display an alternation based on the active/mediopassive opposition.

⁹ In Kirk Rogers’ work in progress on Landuma verbal system (generously shared with us by the author), we have interpreted a problematic verb final vowel *a* as a detransitivizing suffix undergoing freezing under certain conditions.

¹⁰ For more details, see Creissels et al. (2016: 142–6).

Balant (Atlantic) (Creissels & Biaye 2016: 246)

(5)	Class A (causal)		Class B (non-causal)	
	<i>baŋ</i>	‘tell, say’	<i>baŋ.ε</i>	‘close oneself up’
	<i>bεεnθ</i>	‘sharpen’	<i>bεεnθ.ε</i>	‘be sharp(ened)’
	<i>bɔŋ</i>	‘injure’	<i>bɔŋ.ε</i>	‘be injured, injure oneself’
	<i>bɔn</i>	‘increase’	<i>bɔn.ε</i>	‘grow’
	<i>dag</i>	‘braid s.one’s hair’	<i>dag.ε</i>	‘braid oneself, be braided’
	<i>das</i>	‘cut’	<i>das.ε</i>	‘cut oneself, be cut’
	<i>fur</i>	‘dig (out)’	<i>fur.ε</i>	‘be dug (out)’
	<i>fɔr</i>	‘peel’	<i>fɔr.ε</i>	‘be peeled’

The Balant system differs from the voice system of Ful on several points. Firstly, in Balant there is no strict repartition of voices in each conjugation class. The causal-noncausal alternation can also be delivered by a Class C and B opposition, as in *jet.i* (‘straighten’, Class C) vs. *jet.ε* (‘be straight’, Class B); or by a Class C and A opposition, as in *mɔñ.i* (‘to wet’ (tr.), Class C) vs. *mɔñ* (‘to wet’ (intr.), Class A). Secondly, the alternation is not exclusively conveyed by the conjugation classes: For some verbs, the causal-noncausal alternation cannot be produced by this sole means, a decausative suffix needs to be associated to the Class B, as in *wubt-ul.ε* ‘to open’ (intr., Class B with the middle suffix *-ul*) vs. *wubut* ‘to open’ (tr., underived Class A). Note that in this last case, due to the presence of a middle suffix, the verb pair has been counted in the decausative coding in our study. In the two variants of inflectional coding illustrated by Ful and Balant, the use of equipollent strategy is induced by the verbal system, being incorporated in the verbal inflection, and structurally obligatory (a verb form is always inflected in one of the voices) or favored in the Balant mixed system (a verb form always belong to a conjugation class, requiring or not an additional suffix for the causal-non causal pairing).

The second structural feature explaining the high score recorded for equipollent strategy pertains to the typological profile of Atlantic family, which can be extrapolated to Mel. As indicated before, most Atlantic languages display a large set of productive verbal extensions. Consequently, this structural profile is expected to favor the second subtype of equipollence coded by “double derivation”. In most languages in our sample, the equipollence is actually coded by a suffix on each member (of the pair) of the causal-noncausal alternation. The two voice markers can be clearly analyzed as causative and decausative suffixes, either because the (underived) verbal root is also attested (6), or because, in spite of the absence of an identifiable verb root, the morphology of the affixes remains transparent. In example (7), in the absence of a root **lak* in Jóola Keeraak, it is impossible to give a meaning to the verb stem but the suffixes *-o* and *-en* are clearly the middle and causative markers of the language, found elsewhere in causal-noncausal alternations such as *kɔlli* / *kɔlli-en* ‘be afraid/frighten’ and *yɔh-ɔ/yɔh* ‘hide (oneself) / hide (something or someone)’.

Wolof (Atlantic)

(6)	<i>daan</i>	<i>daan-u</i>	<i>daan-e</i>	/ <i>daan-al</i>
	win	win-MID	win-CAUS1	/ win-CAUS2
	‘overcome / win’	‘fall’	‘drop’	

Jóola Keeraak (Atlantic)

(7)	<i>*lak</i>	<i>lak-o</i>	<i>lak-en</i>
	–	‘sit’	‘seat’

This correlation is confirmed by the coding profile of Swahili in Haspelmath *et al.*'s (*ibid.*) sample presented in Table 8. Swahili (another African language belonging also to the Niger-Congo phylum but to the Bantu family) displays the highest score for equipollence. It is also the only language displaying more or less the same rates of causatives and anti/decausatives as Mel and Atlantic languages do with the 'inanimate' list in our study, as illustrated in Table 9. For equipollence, the lower average shown here by Mel and Atlantic languages compared to Swahili can be explained by the presence of some verb pairs using labile strategy in our sample. The higher score for equipollence in Atlantic against Mel languages can be explained by a lesser usage of anti/decausative strategy due to the verbal inflections in Pulaar, Ful and Balant (Atlantic) described above. As Atlantic and Mel, Bantu languages are also known to have large inventories of productive verbal affixes, so the coding rates for this language confirm the correlation between typological profile and valence orientation evidenced by Atlantic and Mel, and the importance of equipollent strategy in this type of languages.

Table 9. Comparative scores for Swahili (Bantu) in Haspelmath *et al.* (2014) and for Mel and Atlantic families¹¹ in this study (verb pairs 10 to 18)

	Causatives	Anti/decausatives	Equipollents	Labiles
Swahili	30%	40%	35%	0%
Mel family	26%	44%	30%	19%
Atlantic family	27%	18%	19%	14%

2.3.2. Suppletion: a surprisingly significant score in the three families

According both to general assumptions¹² and to our predictions for the three families based on their typological profiles, we hypothesized that suppletive lexicalization should be rare in both Atlantic and Mande languages for opposite reasons. In Atlantic (and maybe Mel) because of the numerous derivational suffixes and the resulting preference for derivational strategies, in Mande because of the overall lability. However, this is not the case, when using the full list of verbs, suppletion is actually not negligible in all families, in particular in Atlantic languages where it is the second favored strategy (reaching 23,15%), and even more in Mel where suppletivism (20,24%) is the first one slightly above causativization (19,91%), as visible in Table 10.

Table 10. Average values for each strategy in the three families for verb pairs 1 to 18 (% of pairs found)

	ATLANTIC	MANDE (sample)	MEL
>	31,42	36,11	19,91
<	6,15	8,33	18,06
~	9,17	0	13,89
=	3,61	32,99	7,54
≠	23,15 (2^d)	12,50 (3 rd)	20,24 (1st)

Two factors may explain these scores. The first one pertains to the corpus. Among the eighteen pairs, two involve verbs referring to *frequent activities* which are known to favor suppletivism, namely 02 *die/kill* and 06 *see/show*. As shown by the scores for these two pairs in the next table, the languages of the three families do follow this universal tendency. Note

¹¹ In this table, suppletive and equipollent strategies are fused as to match with the procedure used in Haspelmath *et al.* (2014).

¹² "A fifth type, suppletion (e.g. *die/kill*, *learn/teach*) could be added but is quite rare. Where it occurs, we subsume it under the equipollent type" (Haspelmath *et al.* 2014: 591).

that in Mande, the relatively lower score of suppletive strategy is counterbalanced by the use of labiality again. Interestingly, these two pairs belong to the animate verbs that were removed in the restricted list for which the rates of use of suppletive strategy drop.

Table 11. Percentages of languages (per family) using suppletion for verb pairs 02 and 06

	02 die / kill		06 see / show	
ATLANTIC	nC ≠ C	97%	nC ≠ C	90%
MANDE	nC ≠ C	63%	nC ≠ C	87%
	nC = C	38%		
MEL	nC ≠ C	100%	nC ≠ C	100%

The second factor could be a bias due to our *incomplete data* and unbalanced sampling. For the languages for which we found only few pairs (because the causal member could not be found in the dictionaries), the pairs using suppletive coding were overrepresented because lexical causal verbs were always (by definition) in the dictionary whereas derived causatives are not always given in the lexical database (see section 1). However, in order to overcome possible biases due to incomplete data, the patterns of distribution of the five coding strategies have been recalculated based on a selection of the best documented languages, as presented next in section 3.1. Suppletion remains significant in all families with this optimized sample, as visible in Table 12 below, and is still the second favored (individual) strategy in Atlantic with an even higher score (raising from 15,59 to 17,31%). Thus our results contradict the general assumptions according to which suppletion is rarely used for causal-noncausal alternation. Considering that our language sample for the Mande family (which extends much further to the East) is mainly made of languages spoken in the contact area under study, this surprisingly strong representation of suppletion can be interpreted as an areal peculiarity of the region where Atlantic and Mel languages are spoken, that is the area extending from Senegal in the North to Sierra Leone in the South (see Map 1). Further investigations are needed for defining the full extension of this feature. This areal hypothesis is supported by the diverging results reported in Creissels' study (2018) based on a sample of a languages covering the whole Sub-Saharan Africa: At this larger scale, suppletive strategy show the standard low scores.

To conclude this section, our first hypothesis has been confirmed by this study on the distribution of coding strategies across these three families: The families' typological profiles correlate with valence orientation and can be used to predict the strategies favored by languages for coding causal-noncausal alternation. In the next section the family coding-patterns are used for identifying possible contact-induced changes in individual languages.

3. Sorting out contact-induced phenomena from families features

In order to identify contact-induced phenomena in causal-noncausal orientation, we have defined the following method. To prevent possible bias due to data shortage, the standard patterns of distribution of the five strategies for each family are first optimized by discarding too poorly documented languages when possible. These optimized patterns are then used to measure the deviation of individual languages from family pattern, using standard-deviation. Finally, we analyze the possible causes of deviation and argue whether the observed deviations can be attributed (i) to language specific features, (ii) to internal change or, eventually, after checking geographical contacts, (iii) to contact-induced changes. Moreover, for Atlantic languages, the deviations of individual languages against family-standard will be

used to investigate the variability inside Atlantic family and a possible genetic distribution of deviation according to subgroups.

3.1. Optimizing family patterns

The optimized family standards are calculated on the base of the eighteen verb pairs (Nichols et al. 2004), in accordance with the initial conditions laid down for this study. In order to balance the average number of documented pairs, for Atlantic ten languages with less than 9 pairs documented were removed (reducing the sample from 36 to 26 languages). For Mande, none was removed because in our small sample, the eight languages are all well documented. For Mel, again none was removed, this time because taking out the four languages with poor data would have made our sample (7) too small. Thus, Table 12. differs from Table 5 (original family standards in section 2) only for Atlantic.

Table 12. Standard patterns of distribution of the 5 strategies based on optimized samples of languages (% of pairs found)

	ATLANTIC ≥ 9 pairs	MANDE unchanged	MEL unchanged
>	33,01	36,11	19,91
<	12,78	8,33	18,06
~	11,11	0	13,89
=	8,77	32,99	7,54
≠	17,31	12,50	20,24

Table 12. gives a good overview of the distribution and ranking of the strategies inside the families and allows cross-families comparison. In the next sections devoted to the study of deviations inside families, standard patterns by *numbers of verb pairs* (rather than by percentages) will be added for facilitating the comparison with individual languages.

3.2. Mel

As visible from Table 12. , the standard pattern of the Mel family shows an overall preference for derivational strategies (equipollence being included here for the reasons presented in section 2.3.1.) but does not exhibit any really prominent strategy, suppletion being slightly ahead, closely followed by causative and next by decausative strategy. However with the selective list of ‘inanimate’ verbs (pairs 10 to 18), known to be good indicators of individual languages’ preferences, decausative strategy becomes by far the most preferred one (see Table 7 above). Deviations recorded inside Mel family are presented in Table 13.

In the deviation tables, the dark and grey boxes correspond to deviations. Dark boxes indicate values higher than the standard-deviation and grey boxes lesser values. In Mel, four languages display significant deviations from the standard pattern: Sherbro, Kisi, Baga Sitem and Landuma. All of them are positive¹³ (black boxes), indicating a greater use of these strategies in the languages.

¹³ The greater use of one strategy is not balanced here by a lesser use of another one. In general when deviations do not balance, it can be due either to small negative deviations (below standard deviation) scattered across different strategies, or to the high number of documented pairs for this language, exceeding the standard average of pairs.

Table 13. Deviations in Mel family (by numbers of verb pairs per strategy)

	>	<	~	=	≠	number of documented verb pairs (out of 18)
Standard pattern for 1 to 18¹⁴	3	3		1	4	12
<i>Standard deviation +/-</i>	<i>5/2</i>	<i>5/1</i>		<i>3/0</i>	<i>5/2</i>	
Sherbro	6	5		1,5	3,5	16
Kisi	3	4		4	5	16
Kim	1,5 ¹⁵	1		1	3,5	7
Mani	2	2		1	2	7
Temne	5	1,5		1	2,5	10
Baga Sitem				1	6	7
Landuma	4	6	5	0 ¹⁶	3	18

- (i) A higher use of causative strategy can be observed in *Sherbro*. Since this language has some contacts with Mande languages (on the eastern edge of the Sherbro area), this deviation from Mel standard could be attributed to contact with the Mande family which shows a stronger preference for causativization than Mel (36,11 vs. 19,91% in Table 12.). Another hypothesis would be to consider this to be a *language specific* feature of Sherbro, maybe witnessing a former standard of the Mel family with a more drastic preference for directed strategies than the current one, as it will be also argued next about Landuma (iv). It is worth noting that, in our sample, these two languages show the highest rates of directed strategies inside Mel family, with 10 pairs out of 18 for Landuma and 11 out of 16 for Sherbro.
- (ii) *Kisi* displays a surprisingly important usage of labile strategy compared to the standard pattern (4 verb pairs against one pair in the standard pattern, and among these pairs, 3 belong to the critical list restricted to ‘inanimate verbs’). Considering the geographical contacts with Mande (*Kisi* is surrounded by Mande languages) and the clear preference for lability in Mande (32,99% vs. 7,54% in Mel), a contact-induced change is very plausible here, with a convergence of *Kisi* towards Mande.
- (iii) *Baga Sitem* displays a much higher usage of suppletive strategy than standard (6 verb pairs against 4, half of them belonging to the restricted list). This distribution is all the more noteworthy considering that only seven pairs out of eighteen have been found for this language. As noted before (in 2.3.2.), the unusually high use of suppletion for coding valence alternation seems to be an areal feature of the languages under study. Accordingly, this specific configuration of *Baga Sitem* may be attributed either to a bias due to the use of a single dictionary, which could not be supplemented by additional documentation when collecting data (*cf.* section 1) or to a *specific feature* of this language pushing further the unusually high use of suppletion evidenced for the languages spoken in this area. This specificity could be due, for instance, to borrowings or to a propensity of the language for polysemy and semantic shifts generating suppletive pairs.

¹⁴ Standard pattern and standard deviation are not indicated here for equipollent strategy because this strategy is attested only in one language (Landuma) and could not be scored in the other languages because all the pairs were not documented (*cf.* empty box rather than a zero).

¹⁵ When two possible strategies were found for the same verb pair, a score of 0,5 has been assigned to each of them. So, for a given strategy, a score of 0,5 in a language indicates that this strategy is used one time (1) in this language. In this view, with a score of 1,5 for causative strategy, Kim remains inside standard deviation (2/5).

¹⁶ A zero indicates that the strategy is not used in the language when all verb pairs have been documented.

- (iv) Lastly, two positive deviations can be observed for *Landuma*. The first one pertains to the decausative strategy. *Landuma* is surrounded by five Atlantic languages, therefore this deviation can be analyzed as a contact-induced change because the proportion of use of decausative strategy is higher in Atlantic (12,78 %) than in Mel (8,33%). Another plausible explanation would be that a greater usage of directed strategies was the original standard for Mel, other Mel languages having undergone changes and *Landuma* being more conservative on this point. Concerning the second deviation, Table 13 indicates that *Landuma* is the sole Mel language making use of equipollence (within the limits of our data), and so to a remarkable extent. Although the standard deviation could not be properly calculated here (see footnote 14), the score of 5 has been counted as a positive deviation because, if this strategy was frequently used in the other languages for which some pairs are missing (cf. empty box rather than a zero), it should appear at least in some cases. This important deviation may be attributed either to a specific evolution of *Landuma* (more information is needed for this interpretation) or to contact with Atlantic languages, for which the use of equipollent strategy is attested not only in the standard pattern (11,11%) but also across most of the languages as visible in Table 15 below (17 languages out of 26, be they fully documented or not), contrasting with the null score recorded for Mande languages (Table 14). Note that among the numerous Atlantic languages in contact with *Landuma* (namely Pulaar, Biafada, Nalu, Baga Mboteni and Baga Fore), Pulaar is the vehicular language of the area (Guinea-Conakry). So, considering the specific usage of equipollent alternation made by this language, as discussed in section 2.3.1., the higher usage of equipollence in Mel may be induced by the contact with this language playing a very influential role in the area. A converging evidence of the influence of Pulaar on *Landuma* could be seen in our analysis of the final *Landuma* suffix -ʌ as a voice suffix probably undergoing freezing (see section 3 about *Landuma* in Appendix 3 on data).

3.3. *Mande*

First, it should be stressed that the standard pattern proposed here cannot be seen as the standard of the whole Mande family, since it is built on a convenience sample of eight languages and we do not know to which extent this sample can be representative of the seventy or so recorded languages for the family¹⁷. This convenience sample was made of the six languages in contact with Atlantic and Mel and two other languages with no contact (Bobo and Bambara) that were added for balancing somehow a possible effect of contact in the emerging coding profile. For this investigation on possible contact-induced changes in valence orientation, the measure of deviation is logically applied only to the formers. As visible from Table 12. , this (selective) family pattern exhibits a contrasted profile for Mande with two prominent strategies, causativization (36,11%) and lability (32,99%) and two strategies with a very low or null rate of use: decausativization (8,33%) and equipollence (0). Based on the critical list of ‘inanimate’ verbs, lability becomes clearly the favored strategy (45,85% in Table 7). As can be seen from Table 14, two languages in contact with Mel or Atlantic show significant deviations.

¹⁷ A positive sign about the representativeness of our small sample can be seen in Creissels’ indication (2018) about his own sample: This author indicates that the five Mande languages studied in his sample, which are all included in ours except one (Mano), “seem to be representative of the diversity across Mande languages” for his study, more focused, though, on ‘inanimate verbs’.

Table 14. Deviations in the Mande family (by numbers of verb pairs per strategy).

	>	<	~	=	≠	Number of documented verb pairs (out of 18)
Standard pattern for 1 to 18	6	2	0	6	2	16
<i>Standard deviation +/-</i>	10/3	3/0	0/0	8/4	4/1	
Maninka	4			7	1	12
Mandinka	10	0	0	7	1	18
Kakabe	6,5			8,5	1	16
Soso	10	1,5		3,5	1	16
Soninke of Bakel	9,5	2	0	4,5	2	18
Soninke of Kingi	1	3		5	3	12

- (i) For *Kakabe*, a significantly increased usage of lability can be observed. Since lability is the favored strategy in Mande according both to our results for the critical list of ‘inanimate verbs’ (Table 7) and to other studies (e.g. Katchaturyan 2014 and Creissels 2018), we conclude that *Kakabe* is most likely closer to the general Mande standard, or displays a language specific evolution towards an increased use of this strategy.
- (ii) Lastly, *Soninke of Kingi* displays a lesser use of causative strategy compared to standard. The negative gap for causativization may be due to the unbalanced data for this language. In contrast to the other languages from the sample, most of the verb pairs found for *Soninke of Kingi* belong to the ‘inanimate list’, and most of the missing ones to the ‘animate’ list. Since the ‘animate verbs’ favor the causative strategy, the lack of several such pairs would be an explanation for the negative gap concerning causative strategy in *Soninke of Kingi*¹⁸.

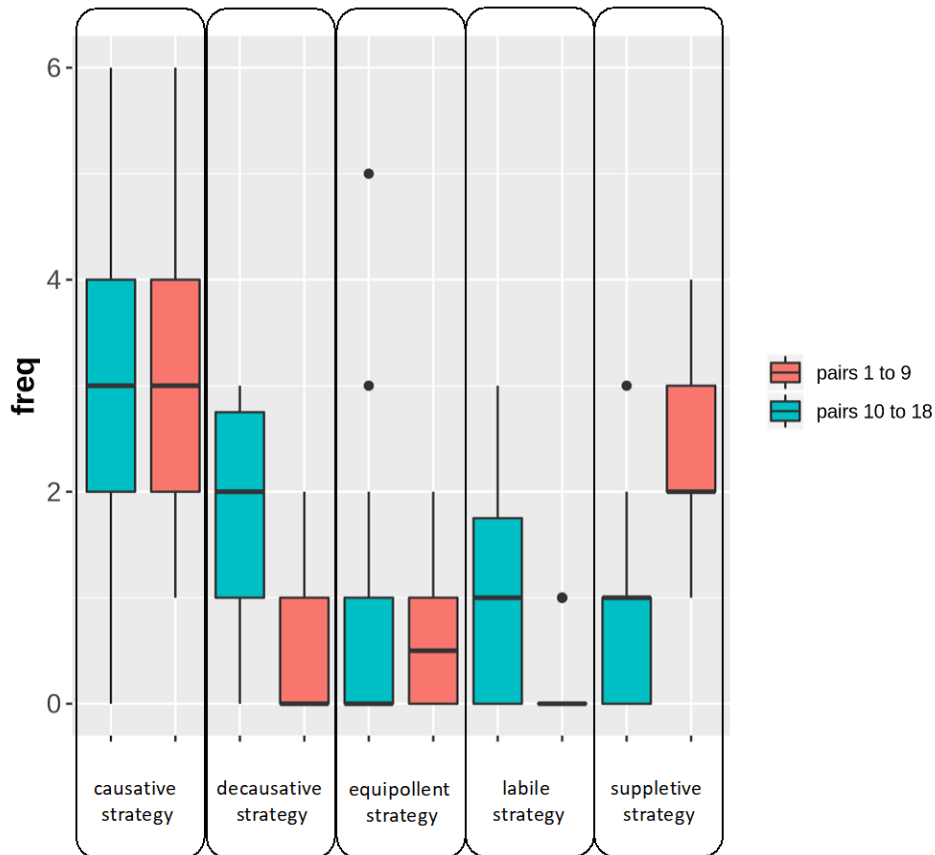
3.4. Atlantic

Based on the full list of verb pairs and the optimized sample of (26) languages, the standard pattern for Atlantic languages in Table 12 indicates an overall preference for derivational strategies (including equipollence among them) and exhibits one prominent strategy, causativization (33,01%). When using the crucial list of ‘inanimate verbs’ for the original standard (Table 7), the score for decausativization increases, and the coding profile of this family appears to be quite evenly distributed among the various strategies, directed strategies (> and <) standing ahead and all other ranking tightly together with no really low scores (8,02% for suppletion being the lowest one). A comparison between the scores in the two lists of verb, ‘animate’ vs. ‘inanimate’ verbs allows us to refine the picture.

Figure 1 below makes it possible both to compare the various uses of each strategy in the two lists and to visualize the deviations in each case: The size of the boxes shows the spread of scores around the average (indicated by the bolded horizontal line crossing the boxes). Dots point to atypical scores recorded in only one or a very few languages. A first remark can be drawn from this figure. Causativization strategy shows the same highest use with the two sets of verbs. However, the standard pattern for the list restricted to ‘inanimate verbs’ (blue boxes) displays *two* prominent strategies, causative and decausative. The three remaining strategies show lower scores in the two lists but differences are visible in some cases. The use of equipollence is equivalent in both cases (same scores but different deviations).

¹⁸ For the record, all the missing verb pairs in *Soninke of Kingi* do have a causative coding in *Soninke of Bakel*.

Figure 1. Overview of the causal-noncausal coding in the two lists of verbs for Atlantic family (average number of pairs used per strategy in optimized sample)



The use of labile strategy is quasi null¹⁹ with the animate list. Concerning the greater use of suppletion in the ‘animate’ list, two remarks can be made. The first one pertains to the role of the two pairs favoring suppletion, *die/kill* and *see/show*, as explained in section 2.3.2. These two verbs do belong to the ‘animate’ list, and all Atlantic languages but one (Bijogo) use suppletion for coding *die/kill* and most of them for *see/show* (23 out of 26). Furthermore, Figure 1 shows that the higher use of suppletion in ‘animate’ list is counterbalanced by a lower use of decausativization and lability. Altogether, this new point of view on the data confirms the focused conclusion in section 2, namely that the favored strategies in Atlantic are the directed ones (causative and decausative).

Coming to deviations of individual languages, a striking point is readily visible in Table 15: A great number of Atlantic languages display small deviations from the family standard, pointing to a *strong internal variation*. For convenience, the languages are ordered in this table according to the internal organization of Atlantic family, as presented in Figure 2 below (section 3.4.2).

¹⁹ The points in the figure represent deviating scores recorded only for one or a very few languages.

Table 15. Deviations in Atlantic family (by numbers of verb pairs per strategy)

	>	<	~	=	≠	Number of documented verb pairs (out of 18)	
standard pattern for 1 to 18	6	2	1	1	3	13	
<i>standard deviation +/-</i>	8/3	4/1	4/0	2/1	4/2		
NORTH branch	Wolof	9	4	1	2	2	18
	Nyun Guñaamolo	8	4	1,5	0,5	3	17
	Nyun Gubëeher	4	4	1		3	12
	Nyun Gujaher	5	2	2		2	11
	konyagi	3	3		2	4	12
	Bedik	6	1		1	3	11
	Basari	5	2		1	1	9
	Pajaade	5	1		1	3	10
	Sereer	9,5	3	1	2,5	2	18
	Pulaar (Ful of Futa Toro)	8	0	3	2	5	18
	Ful of Massina	9		1	2	3	15
	Laalaa	9	4	0	1	4	18
	Palor	2	1	1		5	9
	Saafi	4	2			4	10
	Nalu	6	2		1	6	15
	BAK branch	Balant Kəntohe	3	5	3		1
Balant Ganja		4	2	7	2	2	17
Jóola Keeraak		4	3	2	4	3	16
Jóola Fóoñi		5	3,5	0,5	1	5	15
Jóola Banjal		5	2	4	2	3	16
Jóola Kasa		9		2	1	2	14
Jóola Kwaatay		2	1	3	1	4	11
Jóola Karon		4	4	2		4	14
Manjaku of Bassarel		10	1		1	1	13
Pepel		9	2		1	3	15
Bijogo Kagbaaga		7	1	1	3	3	15

A first overview of this table shows an interesting distribution of deviance among strategies. Labiality shows only a few positive deviations and so against a very low average of use, confirming the low use of labiality as a distinctive feature of this family. Two strategies display a strong variation with many languages both below and above standard deviation, namely causative and suppletive strategies. While most of the time quite high, the scores for causativization vary significantly across languages compared to the standard average, seven language standing above standard deviation and two below. For decausativization, the pattern is different: one language is above standard deviation (Balant Kəntohe) and one (Pulaar) is below, and so for structural reasons (as it will be explained in 3.4.1.). It is also worth noting that, despite the missing data, this strategy is recorded in almost all languages. Thereof, beyond a variable partition across languages, the use of decausative strategy seems to be a stable feature of this family and, combined with high scores for causativization, confirms the preference for directed strategies in Atlantic.

In order to account for these numerous scattered deviations and identify possible contact-induced phenomena, our study proceeds as follows, due to the large number of languages. We first sort out the languages for which the deviation from standard can be attributed to language-specific features (3.4.1), then we investigate the possible distribution of deviance along genetic sub-groups of the family (3.4.2), before tackling contact-induced phenomena and sorting these out from the various factors accounting for the deviances (3.4.3).

3.4.1. Deviance due to language-specific features

The types of deviance attested for Pulaar and Balant Ganja can be accounted for by specific structural features of these languages, as mentioned previously (2.3.1.). For Pulaar²⁰, the absence of use of decausative strategy (0/2) is, in all probability, induced by the voice oppositions grammaticalized in the verb system (with active, middle and passive voices). In this language, the decausative meaning being conveyed by the middle voice in the verb system, there is no decausative suffix in this language. When the base verb is a causal one, the causal-noncausal alternation is always coded by an opposition between the active and the middle inflectional forms of the same verb, that is say by an equipollent strategy. For this very reason, a decausative coding is structurally impossible. Thereof, the inflectional voice system both favors equipollence (*cf.* the high score for Pulaar with 3 pairs vs. 1 in the standard) and precludes decausativization (*cf.* null score). The Balant Ganja case is slightly different. This language has developed conjugation classes, occasionally involving causal-noncausal alternation, while keeping a decausative suffix. This double system does not exclude the decausative coding but favors equipollence, as attested by the positive deviation for equipollence in Balant Ganja (7 pairs against 1 in the average standard). The comparison with another Balant dialect, namely Balant Kəntohe, confirms the important role of decausative suffix in Balant: Kəntohe displays a largely higher use of decausative strategy compared to standard (5 vs. 2).

The comparison between the two Balant dialects also opens up interesting hypotheses about the diachronic evolution of these languages and the grammaticalization processes leading to the emergence of inflectional voice systems²¹, like those of Pulaar and Ful. In Kəntohe, the grammaticalization of the voices *suffixes* in a system of *conjugation classes* has not begun, as it is the case in Ganja, but is on its premises. That is why Kəntohe has more decausative (5) than equipollent (3) pairs, in contrast to Ganja (2 vs. 7). In the scenario we hypothesize, at the beginning of the evolution leading either to conjugation class systems (stade 2) or to diathesis system (stade 3), there is first a tendency of a language to favor decausative strategy (*cf.* Kəntohe): both bare verb stems and verbs with causative extensions require a decausative suffix to form the noncausal member of a causal-noncausal pair. When this use of decausative suffix is systematized, conjugation classes coexisting with the plain decausative suffix can emerge by grammaticalization of this suffix (*cf.* Ganja). That is why, in Balant, (i) the causal-noncausal alternation can be realized by a change of conjugation class for some verbs while for some other verbs, a voice suffix is needed, and (ii) for one class, the conjugation marker is zero (as class A in Ganja) while there is a final vowel for other conjugation classes: the zero class pertains to root verbs with a causal meaning, and the vocalic endings correspond to frozen suffixes. This scenario also explains why Kəntohe displays a larger use of decausative than Ganja (where the decausative suffix is frozen in some cases) but this ongoing evolution does not impact the use of causative strategy, which remains inside standard deviation in both languages as visible in Table 15. When the merging of decausative suffix goes further, the language ends up with a diathesis system (with active, middle (and passive) inflections) where most verbs can inflect with active inflection but some are deponent and some cannot inflect with passive, depending on the meaning of the root: there is no more decausative verb suffix in such systems inducing equipollent strategy where the original system would have

²⁰ Ful of Massina should appear in the list since this language has the same voice system as Pulaar and show the same absence of decausative strategy. However due to incomplete data, this null score does not show off in the table.

²¹ For clarity in the argumentation, a conjugational or inflectional voice system will be labelled “diathesis system”, following the traditional usage concerning the inflectional verbal category encoding active, middle and passive functions in ancient Greek.

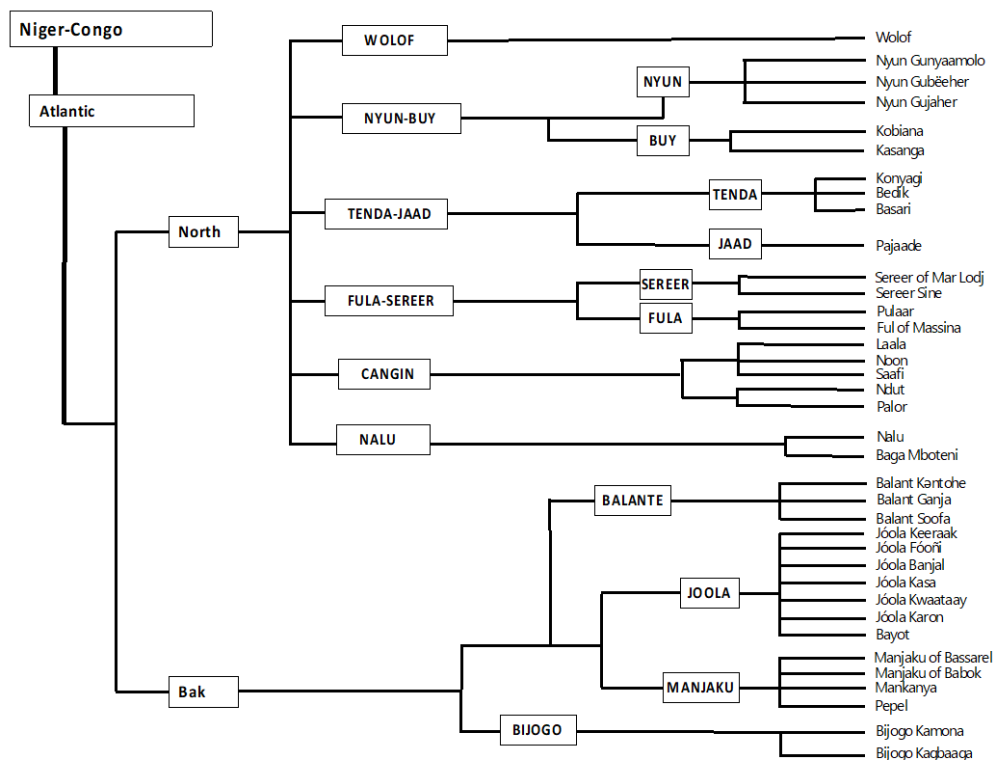
decausative marker for causal-noncausal alternation. A last case deserves to be mentioned in this picture, that of Sereer. In this language, closely related to Pulaar, a restructuring of the derivational system into an inflectional voice system (diathesis system) is still under way. In Sereer, the passive suffix has already merged with TAM markers, producing a passive diathesis, and a middle diathesis is emerging but the decausative marker is still clearly identifiable as a specific morpheme most of the time, explaining the low score of equipollence strategy (1).

It is worth noting that, after removing Pulaar and Balant Kəntohe, for which the deviation from standard has been explained by structural features or ongoing internal evolution, no Atlantic language deviates from the standard pattern concerning the use of decausative strategy. Thus, this use of decausative strategy seems to be a stable feature in the family.

3.4.2. Study of deviance of individual languages along genetic subgroups

As can be seen from Figure 2, the Atlantic family is organized in two main branches, North and Bak. These two branches are in turn subdivided into various levels (up to three) of subgroupings. On a phylogenetic point of view, this splitted internal organization points to an important historical depth for this family, which could play a role in the strong internal variation and rather distributed profile of this family concerning valence orientation.

Figure 2. The Atlantic family: the affiliation of the Atlantic languages of the sample - adapted from Pozdniakov and Segerer (to appear)



In order to investigate the possible role of group features in the internal variation of Atlantic for coding causal-noncausal pairs, we have studied the deviations along the North and Bak groups, that is, the deviations recorded in Table 15 have been reorganized according to the affiliation of individual languages in Table 16. As visible from this table, higher usages and lesser usages of the various strategies are recorded for languages belonging to the two

branches: For each type of deviation both North and Bak columns are filled in with at least one language. Therefore, deviations of individual languages cannot be explained by a mere opposition between North and Bak branches. In Table 16, Balant Ganja, Balant Kəntohe and Pulaar are given in brackets because their deviating usage has been previously explained by specific structural features (3.4.1).

Table 16. Deviations according to North vs. Bak branches

	Usage	NORTH languages	BAK languages
>	Higher	Wolof, Sereer, Ful of Massina, Laalaa	Jóola Kasa, Manjaku of Bassarel, Pepel
	Lesser	Palor	Jóola Kwaatay
<	Higher		(Balant Kəntohe)
	Lesser	(Pulaar)	
~	Higher		(Balant Ganja)
=	Higher	Sereer	Jóola Keeraak, Bijogo Kagbaaga
≠	Higher	Pulaar, Palor, Nalu	Jóola Fóoñi
	Lesser	Basari	Balante Kəntohe, Manjaku Bassarel

Going further into significant details, for causative strategy both higher and lesser usages of the strategy are recorded in the two language groups pointing to a remarkable variation inside the family for this coding strategy.

Table 17. Deviations for causative coding according to North vs. Bak branches in the whole list

Average of causative coding for verbs 1 to 18			6
Higher usage of causative coding: - 7 languages out of 26 - nearly equal partition between North and Bak	NORTH	Wolof	9
		Sereer	9,5
	BAK	Ful of Massina	9
		Laalaa	9
Lesser usage of causative coding: - 2 languages out of 26 - equal partition between North and Bak	NORTH	Jóola Kasa	9
		Manjaku of Bassarel	10
	BAK	Pepel	9
		Palor	2
BAK	Jóola Kwaatay	2	

However, the study of the results obtained with the restricted list of ‘inanimate verbs’ reveals two remarkable points, as visible from Table 18. First, the deviations concerning the use of causative strategy are largely reduced when using the ‘inanimate verbs’, so the presence of nine ‘animate verbs’ can account for the higher uses of the causative strategy when using the whole list (Table 15). Second, in general, the variation can be considered to be more specific to the Bak branch since with the critical list of ‘inanimate verbs’, the deviation is more persistent for this group, not only for causative strategy (for which no North language deviates from standard average), but also to a certain extend for the other strategies: all in all, in the Bak group 7 languages out of 11 show deviations, and only 3 out of 15 in the North group. So, when using the restricted list of verbs, the deviations become less, and are clearly more important inside the Bak group.

Table 18. Deviations in Atlantic family for verb pairs 10 to 18

	>	<	~	=	≠	Number of documented verb pairs (out of 9)	
standard pattern for 1 to 18	3	2	1	1	1	7	
<i>standard deviation +/-</i>	4/1	3/1	2/0	2/1	2/0		
NORTH branch	Wolof	3	3	1	2	0	9
	Nyun Guñaamolo	4	3,5		0,5		8
	Nyun Gubëcher	2	3				5
	Nyun Gujaher	4	1	1			6
	konyagi	2	2		1	1	6
	Bedik	4	1		1	1	7
	Basari	3	1		1		5
	Pajaade	2	1		1	1	5
	Sereer	3	3	1	2	0	9
	Pulaar (Ful of Futa Toro)	4	0	2	2	1	9
	Ful of Massina	3	1		2	1	7
	Laalaa	3	3	0	1	2	9
	Palor	1				1	2
	Saafi		2			2	4
Nalu	4	1	0	1	3	9	
BAK branch	Balant Kəntohe	1	3	2			6
	Balant Ganja	0	2	5	2	0	9
	Jóola Keeraak	3	2	0	3	1	9
	Jóola Fóoñi	4	2,5	0,5	0	2	9
	Jóola Banjal	2	2	3	1	1	9
	Jóola Kasa	5		1			6
	Jóola Kwaatay	1	1	2		1	5
	Jóola Karon	1	2	1		1	5
	Manjaku of Bassarel	6	1		1		8
	Pepel	3	2		1	1	7
	Bijogo Kagbaaga	3	1	0	3	2	9

With these considerations in mind, some initial conclusions can be drawn from the analysis of the individual deviations in the whole list of verb pairs (Table 17). The use of decausative strategy seems to be a stable feature inside the Atlantic family, and the higher uses of causative coding is explained by the presence of animate verbs. For equipollent strategy, only one Bak language deviates from standard (Balant Ganja, displaying a higher rate of use), and this has been explained by a structural feature of this language. Concerning labile strategy, only a few languages belonging to each group (Sereer on the one hand, Jóola Keeraak and Bijogo Kagbaaga on the other hand) deviate from standard, none displaying a lesser usage of lability than (the quite low) standard average in both groups. We have no explanation for the increased use of lability in Sereer and Bijogo but for Jóola Keeraak, which shows the largest deviation with the whole list of verb pairs, this increased use of labile strategy can be explained by contact (see next section). It is worth noting also that Jóola Keeraak becomes the only deviating language when using the restricted list (Table 18). Lastly, for suppletion, deviating usages are attested in both groups, and with both negative and positive deviations, as visible from Table 19.

Table 19. Deviations for suppletive coding according to North vs. Bak branches in the whole list

Average of suppletive coding for verbs 1 to 18			6
Higher usage of suppletive coding: - 4 languages out of 26 - more frequent in North branch	NORTH	Pulaar Palor Nalu	5 5 6
	BAK	Jóola Fóoñi	5
Lesser usage of suppletive coding: - 3 languages out of 26 - nearly equal partition between North and Bak	NORTH	Basari	1
	BAK	Balant Kəntohe Manjaku of Bassarel	1 1

Here again, for suppletion, when using the restricted list, the number of deviating languages drops to one, Nalu, for which the increased use of suppletion can be explained by contact (see next section).

3.4.3. Tackling contact-induced phenomena inside the genetic delineations

So, from a global perspective, the internal variation of Atlantic family in the coding of causal-noncausal alternation does not follow the genetic split between North and Bak groups. However, a more detailed observation using the restricted list of verb pairs shows that the variation in Atlantic languages is mainly due to deviations in the Bak branch. The specific features of the Jóola group need to be further investigated on this issue but we hypothesize here a very likely role of contact. According to our general knowledge on these languages, Jóola languages (Atlantic-Bak) have clearly undergone various influences from the surrounding Nyun languages (Atlantic-North) and also from Mande languages spoken in the same area. For instance, the contact with Mande could explain the higher use of lability in Jóola Keeraak (for which almost all pairs have been documented), and the higher use of causative coding in Jóola Kasa (in the restricted list). This specific situation of Jóola languages may explain the current diversity inside the Bak group for valence orientation. The same hypothesis can be put forward for the Manjaku group (e.g. for explaining the increased use of causative strategy in Manjaku of Bassarel and Pepel) but a detailed study of the area where they are spoken is needed here. The languages of this group are more scattered and the more influential languages may differ in each case, depending on the zone. By contrast, in North group none conclusion is possible in affiliation terms: the deviations do not follow subgroupings. Wolof is an isolate, classified as a subgroup on its own. In the Fula-Sereer subgroup, Sereer is not at the same stage of evolution as Pulaar, since the merging of voice markers into the verbal system is not as completed in Sereer it is in Pulaar (see 3.4.1). In an interesting way, the coding profile of Sereer for valence alternation is closer to that of Wolof than to that of Pulaar at this point in time, but we can expect Sereer to end up with the same deviations as Pulaar. Concerning Cangin languages, in Table 16, Laalaa and Palor show opposite deviances that are not encountered in other languages of this subgroup within the limits of our sample. A better documentation of Cangin languages is clearly needed for definitive conclusions: Noon and Ndut have been discarded because of data shortage. Note that the increase of suppletism in Palor (5/3) can be related to the erosion of the morphology already described for the noun class system in this language (Diagne 2015). The need for a better documentation holds true for most of the Atlantic subgroups: too many Atlantic languages had to be discarded or ignored because they were too poorly documented. Nevertheless, this study of valence orientation has already singled out specific subgroups for remarkable divergences inside the family, and one contact-induced deviation can be very plausibly identified for Nalu. Nalu shows a largely higher use of suppletion in both the complete and restricted lists of verb pairs. As shown by Haspelmath (2008) and Wohlgemuth (2009), verbs are rarely borrowed, they are therefore good indices of intense and long lasting contacts between languages, as evidenced by Benítez-Torres (2009) for Tagdal, a Songhay

language in which causal-noncausal alternation is often achieved by the pairing of Songhay vs. Berber verbs. This is actually the case for the languages spoken in Senegal and the surrounding areas on which this article focuses. In the present case, Nalu is surrounded by various Mel languages, such as Landuma, and also Baga Maduri, Baga Sitemu, Baga Sobane which could not be included in this study because of their poor documentation. Therefore the deviation of Nalu, as well as the unusually high rate of use of suppletion for coding causal-noncausal alternation in the three families studied here, can be attributed to the long lasting contacts between these languages.

Conclusion

These investigations on Atlantic, Mel and Mande families were conceived as a case study for evaluating the correlation between typological profiles and valence orientation in different families, and for identifying possible contact-induced changes. A specific methodology was designed for this, combining family standard-patterns and measure of deviation focused on the contact area. Various interesting results have emerged from this study. First, the typological profiles of the families have proved to predict their valence orientation. However, due to the general trend toward causativization, the favored strategies of families are better defined in combination, in order to bring out their distinctive coding patterns. In this perspective, Atlantic and Mel share a preference for directed strategies, and Mande combines a strong propensity for lability with a prevalence of causative coding. Nevertheless, lability is confirmed as the favored strategy of this family for the ‘inanimate verbs’ which are known to be good indicators of individual languages’ preferences.

As for contacts, several cases have been identified inside Mel and Mande sample thanks to the standard patterns. Deviations from standard pattern can be plausibly attributed to contact-induced changes for Kisi (shaped by Mande), and possibly for Sherbro (shaped again by Mande) and Landuma (shaped by Atlantic), in the Mel family. Contact-induced phenomena were more difficult to identify inside Atlantic family due to the strong internal variation recorded for this family for the coding of causal-noncausal alternation but one case was identified for Nalu (shaped by Mel), witnessing the role of long lasting contacts in the unusual rate of use of the suppletion. This internal variation doubtlessly reflects the historical depth of the family (around 8 000 years *vs.* 5 000 for Mande). So, individual languages have undergone more changes through time, leading to more drastic (internal) divergences than in more recent families, as evidenced by the very splitted internal organization of the family. In addition, a structural characteristic of Niger Congo phylum assuredly contributes to increase the variability for coding valence alternation in this Atlantic family specifically favoring derivational strategies. The current knowledge on Niger-Congo suggests that verbal derivation is an old system - this system has been reconstructed for proto-Niger Congo²² (Meeussen 1967, Voeltz 1977) - undergoing constant renewal. So, unlike other languages, which develop their verbal morphology mostly through the grammaticalization of lexical items, Niger-Congo languages (and especially Atlantic ones) also constantly renew a former system of affixes through the reanalysis of freezing suffixes into stacking suffixes (Hyman 2011) or into verbal inflections, as evidenced here by Pulaar and Ful for inflectional voices, or for Balant (and maybe Landuma) for conjugation classes. Due to the developing of this structural feature through time, the internal variation of Atlantic family for valence orientation does not strictly follow the genetic split between North and Bak branches, and not even the

²² Verbal derivation still has to be reconstructed for proto-Atlantic, for a first attempt at reconstructing causative suffix in Atlantic, see Voisin (to appear).

subgroups delineations, as evidenced by the numerous and scattered deviations recorded for this family. This diachronic evolution of verb systems and its historical depth also resulted in contact-induced changes shaped not only by contacts with Mel and Mande families but also by contacts inside diverging subgroups of Atlantic: An in-depth analysis of deviations has revealed that the variation inside this family is mainly due to the Jóola languages and Jóola languages (Atlantic-Bak) have clearly undergone various influences from Mande languages.

Finally, this contrastive study of valence orientation has brought several additional results. First, the study has revealed that structural features (such as inflectional voices or conjugation classes) may favor or preclude specific coding strategies (namely equipollence and decausativization). This point opens up new avenue for typological studies. Focusing primarily on the distribution of directed *vs.* non-directed strategies and on the general preference for causativization, most typological studies on valence alternation relegates equipollence and suppletion into a kind of opaque trash can for rarely used strategies. However in this study, the various subtypes covered by equipollence in typological studies have been shown to play distinctive roles when it comes to predict preferences for coding causal-noncausal alternation according to typological profiles. For this reason, equipollent strategy appeared to be usefully included (along with causativization and decausativization) into a new cluster of *derivational strategies*, for some languages. In addition, despite data shortage, the study of deviations has confirmed some internal subdivisions inside Atlantic family. Moreover, the surprisingly large use of suppletion was shown to be an areal feature. Further investigations are needed about its full extension but this areal feature already points to Senegal and the surrounding countries as an interesting region for studying contact and areal linguistics. The cross-family comparison also allowed us to propose new hypotheses for possible evolution of the families in the past or in the future. For Mel family, the Sherbro and Landuma profiles convergingly suggest a former standard pattern for this family with an even more drastic preference for directed strategies than the current one, and various ongoing evolutions inside the family. In contrast, inside Atlantic family, an evolution toward an increased use of equipollent strategy can be predicted for Seereer, considering the ongoing restructuring of its verbal system converging with the Pulaar and Ful system. This evolution may create a specific coding pattern for the Fula-Seereer subgroup. The same holds true for the Balant subgroup, considering the high rate of use of decausative strategy in Balant Kəntohe indicating an incipient evolution towards the same system as the one already achieved in Balant Ganja. As for Mande, the prominent use of causativization, outpacing lability in our sample when using the complete list of verbs, may be induced by contact with Atlantic and Mel or reflect a possible evolution of Mande but this needs to be confirmed by a study on the whole family. Several arguments suggest that lability should be a more prevalent strategy in the general standard-pattern of Mande. Eventually, the comparative investigations on controlled verb lists required for our analyses have confirmed that (in)animacy is a conditioning factor in the coding of causal-noncausal verb pairs. For instance, in Mande, some deviations from standard pattern appeared to be plausibly due to unbalanced documentation between ‘animate’ and ‘inanimate’ verbs. These results highlight the key role played by the types of verbs selected when studying valence orientation, and suggest a more systematic and more refined control of Aktionsarten and verb semantic subtypes in the next studies on valence orientation.

This outcome stems from the assumption that the respective typological profiles of the families may account for the preferences of the families in coding causal-noncausal alternation. The family trends were refined by an in-depth observation of the structural features of both families and individual languages, and the family standard-patterns have been

used to sort out contact-induced changes inside families. Altogether, through the analysis of divergence and convergence both within and between families, this in-depth case study focusing on a micro-area in western Africa has brought a specific contribution and a new methodology, opening new avenues for a general account of crosslinguistic diversity in the coding of causal-noncausal alternation.

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Appendix 1. The 18 pairs of verbs sought in the survey, and their proxies (Nichols *et al.*, 2004: 186)

	<i>Non-causative</i>	<i>Causative</i>	<i>Proxies</i>
1	laugh	make laugh, amuse, strike as funny	cry
2	die	kill	
3	sit	seat, have sit, make sit	lie down; go to bed, put to bed
4	eat	feed, give food	drink, give to drink
5	learn, know	teach	understand, find out, grasp
6	see	show	
7	be/become angry	anger, make angry	annoy(ed)
8	fear, be afraid	frighten, scare	
9	hide, go into hiding	hide, conceal, put into hiding	
10	(come to) boil	(bring to) boil	cook
11	burn, catch fire	burn, set fire	be aflame; char
12	break	break	split, shatter, smash
13	open	open	close
14	dry	make dry	wet, clean; black, white
15	be/become straight	straighten, make straight	crooked, long, round, flat
16	hang	hang (up)	lean (incline), extend, project, protrude
17	turn over	turn over	turn, turn around, rotate, revolve, roll; shake, tremble, vibrate
18	fall	drop, let fall	fall down, fall over, etc.; sink

Appendix 2. The language samples

(In Atlantic * indicates the poorly documented languages that were removed from the original sample for calculating the optimized standard patterns; In Mel # indicates languages that are discarded because of data shortage in the deviation study)

ATLANTIC (36)		
Wolof	Ful of Massina	Jóola Fóoñi
* Kasanga	Laalaa	Jóola Banjal
* Kobiana	* Noon	Jóola Kasa
Nyun Guñaamolo	* Ndut	Jóola Kwaatay
Nyun Gubëeher	Palor	Jóola Karon
Nyun Gujaher	Saafi	* Bayot
Konyagi	Nalu	Manjaku of Bassarel

Bedik	* Baga Mboteni	* Manjaku Babok
Basari	Balant Kəntohe	* Mankanya
Pajaade	Balant Ganja	Pepel
Sereer	* Balant Sofa	Bijogo Kagbaaga
Pulaar (Ful of Futa Toro)	Jóola Keeraak	* Bijogo Kamona

MANDE (8)	MEL (7)
Bobo	Sherbro
Bambara	Kisi
Maninka	# Kim
Mandinka	# Mani
Kakabe	# Temne
Soso	Baga sitem
Soninke of Bakel	Landuma
Soninke of Kingi	

Appendix 3. The data

This appendix gives the list of the verb pairs²³ in all the analyzed languages. The languages are sorted by families and ordered as indicated in the table below. For each language, the 18 verb pairs are listed in a table (following the orthographic or phonological transcription used by the source authors), along with the source(s) from which they have been retrieved, and the position of the language in the family. The complete references of the sources are presented in the Appendix 4.

In these tables, the segmentation has been added by us most of the time (after checking in the available grammars of the language), since it was seldom given in the sources. The dash in the table indicates that the verb pair could not be found, either because it was missing in the sources (e.g. for Kasanga) or because the language makes use of an auxiliary for the causal member the pair or of periphrastic means for one or the two members (e.g. Keeraak). For Atlantic (section 1), the symbol * after the language names signals the poorly documented languages that were removed from the original sample for calculating the optimized standard patterns. For Mel (section 3), # indicates languages that are discarded in the deviation study because of data shortage.

1. Atlantic

1.1. Wolof

Position into the Atlantic family north > wolof

Source Diouf 2013

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	ree	ree-loo
2. die; kill	dee	rey
3. sit; seat	toog	toog-al
4. eat; feed	lekk	lekk-le
5. learn; teach	jàng	jàng-al
6. see; show	gis	won
7. be angry; anger	mer	mer-loo

²³ For space reasons, the pair's meaning has been simplified in these tables. For details about alternate meanings (proxies) that could have been searched when needed, see the full table in Appendix 1.

8. fear; frighten	tiit	tiit-al
9. hide; hide	làq-u	làq
10. boil; boil	bax	bax-al
11. burn; burn	lakk	lakk
12. break; break	toj	toj
13. open; open	ubbi-ku	ubbi
14. dry; make dry	wow	wow-al
15. be straight; straighten	taxaw	taxaw-al
16. hang; hang	aj-u	aj
17. turn over; turn over	jalgandi-ku	jalgandi
18. fall; drop	daan-u	daan-al daan-e

1.2. Kasanga*

Position into the Atlantic family north > nyun-buy > buy

Sources Wilson 2007, 2008

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	—	—
2. die; kill	nis	mok
3. sit; seat	—	—
4. eat; feed	—	—
5. learn; teach	—	—
6. see; show	—	—
7. be angry; anger	—	—
8. fear; frighten	—	—
9. hide; hide	—	—
10. boil; boil	pej	pej-n
11. burn; burn	—	—
12. break; break	—	—
13. open; open	—	—
14. dry; make dry	—	—
15. be straight; straighten	—	—
16. hang; hang	—	—
17. turn over; turn over	—	—
18. fall; drop	—	—

1.3. Kobiaana*

Position into the Atlantic family north > nyun-buy > buy

Sources Wilson 2007, 2008

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	keeh	—
2. die; kill	nis	mak
3. sit; seat	yed	yed-en
4. eat; feed	—	—
5. learn; teach	—	—
6. see; show	—	—
7. be angry; anger	—	—

8. fear; frighten	—	—
9. hide; hide	—	—
10. boil; boil	paz	paz-n
11. burn; burn	dεβ	nok
12. break; break	—	—
13. open; open	—	—
14. dry; make dry	—	—
15. be straight; straighten	—	—
16. hang; hang	—	—
17. turn over; turn over	—	—
18. fall; drop	—	—

1.4. Nyun Guñaamolo

Position into the Atlantic family north > nyun-buy > nyun
Sources Bao Diop 2013; Bodian 2014

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	kul	pɔlulun
2. die; kill	niiro	boɟ
3. sit; seat	nooh	nooh-un
4. eat; feed	yaah	yaah-un
5. learn; teach	lunn-a	lunn-un
6. see; show	feg	jɔhɔn
7. be angry; anger	hóojár ñuumul	hóojár-iin ñuumul-iin
8. fear; frighten	juhul	juhul-iin
9. hide; hide	kubb-a ɲɔɔb-a	kubb-un ɲɔɔb
10. boil; boil	dɔcc	dɔcc-un
11. burn; burn	jaak	jaak-liin
12. break; break	mɔɲ fili-ya	mɔɲ fili
13. open; open	kímbál-a	kímbúl
14. dry; make dry	laal	laal-en
15. be straight; straighten	wuuh keng wonn	wuuh-un keng-un wonn-un
16. hang; hang	—	—
17. turn over; turn over	hupp-a	hupp
18. fall; drop	cig-a	cig

1.5. Nyun Gubëeher

Position into the Atlantic family north > nyun-buy > nyun
Source Cobbinah 2013

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	ciil	liitin
2. die; kill	—	—
3. sit; seat	—	—

4. eat; feed	yaax	yaax-un
5. learn; teach	liin-a	liin-diin
6. see; show	wul	gəən
7. be angry; anger	leetin	dəh
8. fear; frighten	bənk	bənk-liin
9. hide; hide	noop-a	noop
10. boil; boil	—	—
11. burn; burn	jaak	jaak-lin
12. break; break	bajil-a	bajil
13. open; open	—	—
14. dry; make dry	—	—
15. be straight; straighten	lik	lik-riin
16. hang; hang	rakk-a	rakk
17. turn over; turn over	fip-a	fip
18. fall; drop	—	—

1.6. *Nyun Gujaher*

Position into the Atlantic family north > nyun-buy > nyun

Source Goudiaby 2017

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	—	—
2. die; kill	cíid	kof
3. sit; seat	—	—
4. eat; feed	káb	káb-álín
5. learn; teach	liih-ina	liih-idin
6. see; show	wúl	seetind seetin
7. be angry; anger	—	—
8. fear; frighten	—	—
9. hide; hide	ñomp-a	ñomp
10. boil; boil	faj	faj-in
11. burn; burn	duh	dúh-ú-dín
12. break; break	fil	filiiy ²⁴
13. open; open	—	—
14. dry; make dry	yir	yir-in
15. be straight; straighten	—	—
16. hang; hang	rakk-a	rakk
17. turn over; turn over	—	fúb lúkítín
18. fall; drop	fəŋk	fəŋk-án

1.7. *Konyagi*

Position into the Atlantic family north > nyun-buy > nyun

Sources Ferry 1991; Santos 1996; Wilson 2008

²⁴ According to documentation, there is no identified suffix -*iiy in Balant, so this pair was counted as a suppletive one.

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	dàès tíká	nàxár
2. die; kill	cóm	dàèw̃
3. sit; seat	dányá	—
4. eat; feed	—	—
5. learn; teach	nàèhénd	nàèhénd-él̃
6. see; show	nù	tùf
7. be angry; anger	—	—
8. fear; frighten	ḃáel	ḃáel
9. hide; hide	còw̃-á	còw̃
10. boil; boil	ciw̃	ciw̃-ən
11. burn; burn	hæg	pədf
12. break; break	nixə	nixə
13. open; open	—	—
14. dry; make dry	kænk	kænk-ən
15. be straight; straighten	—	—
16. hang; hang	gwàk-á	gwàk
17. turn over; turn over	—	—
18. fall; drop	kóf-á	kóf

1.8. *Bedik*

Position into the Atlantic family north > tenda-jaad > tenda
Source Ferry 1991

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	—	—
2. die; kill	fás	dám nák
3. sit; seat	—	—
4. eat; feed	—	—
5. learn; teach	hìnè	hìnè-n
6. see; show	fàn	fìn-ìn
7. be angry; anger	—	—
8. fear; frighten	—	—
9. hide; hide	fòl	yóm
10. boil; boil	γódf	γódf-àn
11. burn; burn	ḃodf	ḃodf
12. break; break	—	—
13. open; open	—	—
14. dry; make dry	yàr	yàr-àn
15. be straight; straighten	kàl	kál-ìn
16. hang; hang	làn	hàn
17. turn over; turn over	déh-ú	déh
18. fall; drop	dat	dat-àn

1.9. *Basari*

Position into the Atlantic family north > tenda-jaad > tenda
Source Ferry 1991; Winters 2004; Perrin pc

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	láf fêrus	—
2. die; kill	nêm	ďáw râng
3. sit; seat	ỹípa (s'asseoir) fid' (être assis) fid'-òrá (s'asseoir)	—
4. eat; feed	yâmb	yâmb-ën
5. learn; teach	sàfâ	—
6. see; show	yât	yât-án
7. be angry; anger	—	—
8. fear; frighten	—	—
9. hide; hide	fłď-ayá	fłď
10. boil; boil	fótyó	—
11. burn; burn	łk	łk-án
12. break; break	həb-i	həb
13. open; open	—	fłrát
14. dry; make dry	fêr	fêr
15. be straight; straighten	fłr	fłr-án
16. hang; hang	—	—
17. turn over; turn over	—	ďéx xób
18. fall; drop	win	win-in

1.10. *Pajaade*

Position into the Atlantic family north > tenda-jaad > jaad

Sources Ducos 1971; Meyer 2001; Wilson 2008; Cover 2010

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	—	—
2. die; kill	sadd	dam
3. sit; seat	—	—
4. eat; feed	jaa	jaa-ndaan
5. learn; teach	kuda karaŋə	kuuda-an karaŋə-ndaan
6. see; show	jeen	cund
7. be angry; anger	—	—
8. fear; frighten	—	—
9. hide; hide	yam	yam-əna
10. boil; boil	jaak	jaak
11. burn; burn	—	—
12. break; break	—	—
13. open; open	—	—
14. dry; make dry	ŋaap	fuur
15. be straight; straighten	cidd	cidd-əndaan
16. hang; hang	yoor-a	yoor

17. turn over; turn over	—	—
18. fall; drop	day(o)	day-ndaan

1.11. Sereer

Position into the Atlantic family north > fula-sereer > sereer
 Source Crétois 1973, Renaudier 2012

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	jal	jal-nor
2. die; kill	xon	war
3. sit; seat	moof	moof-in
4. eat; feed	naam	naam-in
5. learn; teach	jang	jang-in
6. see; show	ga	jooxod
7. be angry; anger	fuux	fuux-and
8. fear; frighten	diid diid'	diid-l-and diid-and
9. hide; hide	das	das das-in
10. boil; boil	waj	waj-in
11. burn; burn	dox	dox-in
12. break; break	gef	gef
13. open; open	wegt-ox	wegit
14. dry; make dry	weer	weer
15. be straight; straighten	geen-ox	geen-in
16. hang; hang	daaj-ox dag-ox	daaj dag
17. turn over; turn over	gird-ox lipt-ox maaf-el saag-el sag-ox	girid lipit maaf sag
18. fall; drop	sam yen	sam-and sam-nor yen-and

1.12. Pulaar (Ful of Futa Toro)

Position into the Atlantic family north > fula-sereer > fula
 Source Amadou Sow (p.c.)

NB. In Pulaar, the verb system is organized around voice oppositions in the form of active, middle and passive inflections. A causal-noncausal alternation realized by a sole voice opposition (cf. 9 and 16) has been treated as an equipollent strategy (see 2.3.1. and 3.4.1. in the article). For clarity reasons, the derivational suffixes have been separated (by us) from the stem by an hyphen, and the infinitive marker by a dot (active: *.de* ~ *.ude*, middle: *.aade*, passive: *.eede*)

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	jal.de	jal-n.ude
2. die; kill	maay.de	ward.de

3. sit; seat	jood.aade	jayý/-in.de
4. eat; feed	ñaam.de	ñamm ²⁵ -in.de
5. learn; teach	jaŋng.ude	jaŋng-in.de
6. see; show	yii.de	holl.ude
7. be angry; anger	sek.de	sek-n.ude
8. fear; frighten	hul.de	hulbin.de
9. hide; hide	suudf.aade	suudf.de
10. boil; boil	fas.de	fas-n.ude
11. burn; burn	sum.de	sum.de
12. break; break	hel.de	hel.de
13. open; open	uddit.aade	uddit.de
14. dry; make dry	yoor.de	yoor-n.ude
15. be straight; straighten	feew	feew-n.ude
16. hang; hang	ligg.aade	ligg.ude
17. turn over; turn over	leyý-it.aade	hippi.de
18. fall; drop	yannd.(d)e	yaand-in.de

1.13. Ful of Massina

Position into the Atlantic family north > fula-sereer > fula

Sources Seydou 2014, (supplemented by) 1998

NB. Ful of Massina has the same voice system as Pulaar and was handled similarly in this study: A causal-noncausal alternation realized by a sole voice opposition has been treated as an equipollent strategy (see 2.3.1. and 3.4.1. in the article). Following Seydou 1998, the lemma presented here are simplified forms made of the stem (not the full infinitive forms with their *-gol* ending) and the conventional voice marker separated by a dot. Here the infinitive markers are *.a* for active, *.oo* (~.o in Seydou 1998) for middle voice and *.e* for passive voice. When present, the derivational suffixes have been again separated from the stem by a hyphen.

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	jal.a	jal-n.a
2. die; kill	maay.a	war.a
3. sit; seat	jood.o	—
4. eat; feed	namm.a	namm-n.a
5. learn; teach	janng.a	janng-in.a
6. see; show	yi?.a	holl.a
7. be angry; anger	ber-n.a	ber-n-in.a
8. fear; frighten	ru?b.a	ru?b-in.a
9. hide; hide	mogg.o(o) mogg-it.o(o)	mogg-in.a
10. boil; boil	fat.a	fat-in.a
11. burn; burn	sum.a	sum.a
12. break; break	fus.a	fus.a
13. open; open	muβbit-o	muβbit.a
14. dry; make dry	beeb.a	beem-n.a
15. be straight; straighten	dar.o	dar-n.a
16. hang; hang	—	—
17. turn over; turn over	—	—

²⁵ The gemination of the verb stem is a result of the causative suffixation in this phonological context.

18. fall; drop	saam.a	saam-in.a
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1.14. Laalaa

Position into the Atlantic family north > cangin

Source Dieye 2011

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	yĕn	yĕn-elok
2. die; kill	kaan	ʔap
3. sit; seat	muk	miik-íd miik-elok
4. eat; feed	ñam	ñam-íd
5. learn; teach	yood	yood-íd
6. see; show	hot	teew
7. be angry; anger	ñaad	ñaad-íd
8. fear; frighten	yĕec	yĕec-íd
9. hide; hide	d̄aak-ok	d̄aak
10. boil; boil	way	way-el
11. burn; burn	tak	tĕk-iʔ
12. break; break	pɔk	pɔk
13. open; open	lĕgís-uk	lĕgís
14. dry; make dry	súu	wíñ
15. be straight; straighten	yoloh	yoloh-íd
16. hang; hang	kadĕeg-ok	kadĕeg
17. turn over; turn over	d̄ap-uk	d̄ap
18. fall; drop	keen dĕeg-ís-uk	ḅúuk

1.15. Noon*

Position into the Atlantic family north > cangin

Source Wane 2017

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	—	—
2. die; kill	kaan	ap
3. sit; seat	jõŋ	—
4. eat; feed	—	—
5. learn; teach	yɔnd yɔɔn	yodir yɔɔd-id
6. see; show	—	—
7. be angry; anger	—	—
8. fear; frighten	—	—
9. hide; hide	—	—
10. boil; boil	—	—
11. burn; burn	—	—
12. break; break	—	—
13. open; open	—	—
14. dry; make dry	—	—
15. be straight; straighten	—	—

16. hang; hang	—	—
17. turn over; turn over	—	pél
18. fall; drop	—	—

1.16. *Ndut**

Position into the Atlantic family north > cangin

Source Pichl 1979, Doneux sd

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	yɛn	—
2. die; kill	hul	hap
3. sit; seat	took	tëëk-idʼ
4. eat; feed	—	—
5. learn; teach	yud	yud-it
6. see; show	yɛɛl ɔt	tɛɛb
7. be angry; anger	—	—
8. fear; frighten	—	—
9. hide; hide	dɔp-ɔh	dɔp
10. boil; boil	—	—
11. burn; burn	—	—
12. break; break	—	pooʔ
13. open; open	—	—
14. dry; make dry	—	—
15. be straight; straighten	cang	cangur ²⁶
16. hang; hang	—	—
17. turn over; turn over	—	—
18. fall; drop	—	—

1.17. *Palor*

Position into the Atlantic family north > cangin

Source Lopis 1980; d'Alton 1987; Thornell et al. 2016

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	yɛn	heylaʼ
2. die; kill	kaan	ap
3. sit; seat	leelo	—
4. eat; feed	ñam	ñam-ëʔ ñəm-ər
5. learn; teach	yoon	yɛɛd-idʼ
6. see; show	ɔt wa	tɛɛb
7. be angry; anger	hayl-ɔh	həyl-idʼ
8. fear; frighten	—	—
9. hide; hide	dɔp-ox	dɔp
10. boil; boil	—	—

²⁶ Since there no identified suffix *-ur* in *Ndut*, this verb pair could not be interpreted and has been removed from the sample.

11. burn; burn	—	—
12. break; break	—	—
13. open; open	—	—
14. dry; make dry	soux	—
15. be straight; straighten	sil	sil-əl
16. hang; hang	—	keʔ
17. turn over; turn over	—	lix pél
18. fall; drop	keen	kin-idʔ

1.18. *Saafi*

Position into the Atlantic family north > cangin

Source Mbodj 1983; Wilson 2007; Stanton 2011; Pouye 2015

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	—	—
2. die; kill	kan	ʔap
3. sit; seat	boof	boof-idʔ
4. eat; feed	njaam	njaam-idʔ
5. learn; teach	yoon djung	yood-idʔ djung-idʔ
6. see; show	hot	nuhun
7. be angry; anger	—	—
8. fear; frighten	neek	neek-idʔ
9. hide; hide	—	—
10. boil; boil	—	—
11. burn; burn	—	—
12. break; break	pook-uudʔ pokk-a	pook
13. open; open	kuns-uk	kunis
14. dry; make dry	sujidʔ	wiñ
15. be straight; straighten	—	—
16. hang; hang	—	—
17. turn over; turn over	—	aam
18. fall; drop	keen	fol fol-idʔ

1.19. *Nalu*

Position into the Atlantic family north > nalu

Source Seidel 2013

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	yuw	yuw-n-ah
2. die; kill	ref	ram
3. sit; seat	—	—
4. eat; feed	reb	—
5. learn; teach	siknit	harjen
6. see; show	kot	mañlen
7. be angry; anger	—	—

8. fear; frighten	yaah	yaah-nah
9. hide; hide	luul-ah	luul
10. boil; boil	fad	fad-en
11. burn; burn	θab	nɔɔmp
12. break; break	bit	bit
13. open; open	baant-ah	baant
14. dry; make dry	kaθ	kaθ-en
15. be straight; straighten	romp toot	romp-en toot-en
16. hang; hang	war	liiŋ
17. turn over; turn over	cepen	litkin
18. fall; drop	yɔɔŋ row	yɔɔŋ-en row-en

1.20. *Baga Mboteni**

Position into the Atlantic family north > nalu

Source Wilson 2007, Ferry sd

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	yàlà	—
2. die; kill	lɔ̀bɔ̀l	lɔ̀mɔ̀
3. sit; seat	—	—
4. eat; feed	—	—
5. learn; teach	fánáfàn	kùʂàr yood-id' ɖjɔ̀ŋ-id'
6. see; show	vərafɔ vʌrafɔ	vɔ̀gɔ̀sɔ̀l
7. be angry; anger	—	—
8. fear; frighten	—	—
9. hide; hide	—	mfɔ̀lɔ̀
10. boil; boil	—	—
11. burn; burn	—	—
12. break; break	—	—
13. open; open	—	—
14. dry; make dry	—	—
15. be straight; straighten	—	—
16. hang; hang	—	—
17. turn over; turn over	—	—
18. fall; drop	—	—

1.21. *Balant Kəntohe*

Position into the Atlantic family bak > balante

Sources Doneux et al. 1984, Wilson 2007

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	—	—
2. die; kill	lɔ̀ɔ̀d	hɔ̀b
3. sit; seat	mees-e	mees-ti

4. eat; feed	wom	wom-ti
5. learn; teach	—	—
6. see; show	buk	buk-ti
7. be angry; anger	hupana	—
8. fear; frighten	kpem-ek	kpem
9. hide; hide	sòh-e	sòh
10. boil; boil	wel	wel-n
11. burn; burn	θed-e	θed
12. break; break	ham-e	ham
13. open; open	—	hubut
14. dry; make dry	—	dak-n
15. be straight; straighten	cet-e	cet-n
16. hang; hang	res-e	res-n
17. turn over; turn over	—	—
18. fall; drop	kob-e	kob

1.22. *Balant Ganja*

Position into the Atlantic family bak > balante

Source Creissels & Biaye 2016

NB. Balant Ganja has three conjugation classes (A, B and C) visible through a set of final vowels. These endings are ∅ for class A, e/ε for class B, and i/t for class C in the lexical entries quoted of the list. The class endings are indicated by a dot (the absence of dot in the lexeme signals a verb belonging to class A) while suffixes are indicated by an hyphen. In this language, the causal-noncausal alternation may be realized by a change of conjugation class while for some other verbs, a voice suffix is needed. For this mixed system (a verb form always belong to a conjugation class, requiring or not an additional suffix for the causal-noncausal pairing), a causal-noncausal alternation realized by a sole conjugation-class change (e.g 5, 15, 17) has been counted as an equipollent strategy (see 2.3.1. and 3.4.1. in the article), while an alternation implying an extra suffix or a stem reduplication (with or without class change) has been counted as a derivational strategy (e.g. 1, 3, 13).

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	θɔ	θɔθ-θɔy.i
2. die; kill	lód	hâb
3. sit; seat	mɛɛs.ɛ	mees-ir
4. eat; feed	wɔm	wɔm-ir
5. learn; teach	hiil.e	hiil
6. see; show	buθa	ged.i
7. be angry; anger	—	—
8. fear; frighten	fur	fur-ut
9. hide; hide	sow.ɛ	so(w)
10. boil; boil	wel	wel
11. burn; burn	θed.e	θed
12. break; break	ham.ɛ	ham
13. open; open	wubt-ul.e	wubut
14. dry; make dry	sɔl	sɔl
15. be straight; straighten	jet.e	jet.i
16. hang; hang	laga-l.e	laga
17. turn over; turn over	waas.ɛ	waas

18. fall; drop	gob.e	gob
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1.23. Balant Sofa*

Position into the Atlantic family bak > balante

Source Mbodj 2009

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	—	—
2. die; kill	looda	hab
3. sit; seat	mees.e	mees-n
4. eat; feed	woma	—
5. learn; teach	—	—
6. see; show	biik	kedn
7. be angry; anger	—	—
8. fear; frighten	—	—
9. hide; hide	—	—
10. boil; boil	kpeθ	kpeθ-n
11. burn; burn	—	—
12. break; break	—	—
13. open; open	—	—
14. dry; make dry	yooH dak	yooH-n dak-n
15. be straight; straighten	—	—
16. hang; hang	—	—
17. turn over; turn over	—	—
18. fall; drop	—	kob

1.24. Jóola Keeraak

Position into the Atlantic family bak > jóola-manjaku > jóola

Source Robert, ms

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	tu	—
2. die; kill	raagu	ɲaal
3. sit; seat	lak-ɔ	lak-en
4. eat; feed	ñɔɔf-ɔ	ñɔɔf-en
5. learn; teach	ɲiken	ɲiken
6. see; show	hej	əs
7. be angry; anger	ɲit	—
8. fear; frighten	kɔlli	kɔlli-en
9. hide; hide	yɔh-ɔ	yɔh
10. boil; boil	lab	lab-en
11. burn; burn	rɛem	rɛem-en
12. break; break	tɔj	tɔj
13. open; open	tɔnjul-ɔ	tɔnjul
14. dry; make dry	say	say-en
15. be straight; straighten	jɔlen	jɔlen
16. hang; hang	rɛɛy-i	rɛɛy
17. turn over; turn over	ɲiwəɛy	ɲiwəɛy

18. fall; drop	lo	halab
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1.25. Jóola Fóoñi

Position into the Atlantic family bak > jóola-manjaku > jóola

Sources Weiss 1939; Sapir 1970

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	—	—
2. die; kill	cet	boj
3. sit; seat	lak-o	—
4. eat; feed	—	—
5. learn; teach	luken	luken
6. see; show	jok	is
7. be angry; anger	bolen	rten
8. fear; frighten	woll-o	woll-en
9. hide; hide	yof-o	yof
10. boil; boil	lab	lab-en
11. burn; burn	reem	reem-en
12. break; break	saat-o	saat saat-en
13. open; open	wetul-o	wetul
14. dry; make dry	say yond	say-en yond-en
15. be straight; straighten	juum	juum-en
16. hang; hang	noon	gand
17. turn over; turn over	fim-o yú-o	fim yú
18. fall; drop	lo bafúl-o	bet pakal yoŋ

1.26. Jóola Banjal

Position into the Atlantic family bak > jóola-manjaku > jóola

Sources Bassène 2006; Sambou 2014

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	ber	—
2. die; kill	cet	mux
3. sit; seat	rob-o	rob-en
4. eat; feed	tij	tij-en
5. learn; teach	lligen	lligen
6. see; show	juk	gitten
7. be angry; anger	—	—
8. fear; frighten	xoli	xóll-en
9. hide; hide	kkop	kkop-en
10. boil; boil	lab sup	lab-en sup-en
11. burn; burn	sa	sa-en
12. break; break	fum-o	fum

13. open; open	ppégul-o	ppégul
14. dry; make dry	xay	xay
15. be straight; straighten	il-o	il-en
16. hang; hang	lag-o	lag-en
17. turn over; turn over	bak-o	bak-en
18. fall; drop	lo	bel

1.27. Jóola Kasa

Position into the Atlantic family bak > jóola-manjaku > jóola
Source Wintz 1909

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	ber	ber-en
2. die; kill	ket	muk
3. sit; seat	lak.o	lak.o-en
4. eat; feed	—	—
5. learn; teach	liken	liken
6. see; show	juk	is
7. be angry; anger	łet	łet-en
8. fear; frighten	koli	koli-en
9. hide; hide	yoh-o	yoh-en
10. boil; boil	lab	lab-en
11. burn; burn	rokot sow	rokot-en sow-en
12. break; break	—	—
13. open; open	kułul	kułul-en
14. dry; make dry	—	—
15. be straight; straighten	nab	nab-en
16. hang; hang	—	—
17. turn over; turn over	wub-o yuw-o	wub-en yuw-en
18. fall; drop	bet lo	bet-en lo-en

1.28. Jóola Kwaatay

Position into the Atlantic family bak > jóola-manjaku > jóola
Sources Payne 1992, Coly 2010

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	—	—
2. die; kill	ketu	yoolu
3. sit; seat	—	—
4. eat; feed	teŋ-u	teŋ-an
5. learn; teach	liiken	liiken
6. see; show	juk	wufoor
7. be angry; anger	hiiga.at	—
8. fear; frighten	kol-ey-i	koli-n-ən
9. hide; hide	mefu	nuusu
10. boil; boil	lab	lab-n

11. burn; burn	sufo	seeyu
12. break; break	welej-o	welej
13. open; open	—	paŋkín kulin
14. dry; make dry	say-o	say-an
15. be straight; straighten	siin-o	siin-an
16. hang; hang	langatan	—
17. turn over; turn over	—	—
18. fall; drop	ney	—

1.29. Jóola Karon

Position into the Atlantic family bak > jóola-manjaku > jóola

Sources Sambou 2007, 2014

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	hep	hep-an
2. die; kill	ket	muk
3. sit; seat	yen-o	yen-an
4. eat; feed	li	li-an
5. learn; teach	yipan	yipan-an
6. see; show	cuku	yísan
7. be angry; anger	fe	—
8. fear; frighten	feyu	suc
9. hide; hide	noos-o	noos
10. boil; boil	lab	lab-en
11. burn; burn	sow-o	—
12. break; break	hum-o	hum
13. open; open	—	—
14. dry; make dry	—	—
15. be straight; straighten	siin-o	siin-an
16. hang; hang	faak-o	faak
17. turn over; turn over	niis-o	niis
18. fall; drop	now	tah

1.30. Bayot*

The list in this table is a merge of the data from Bayot Kugere (Senegal), described by Diagne (2009), and another dialect, Bayot Édammé (Dabo 2009), spoken in Guinea-Bissau by people originating from the same area as Kugere speakers.

Position into the Atlantic family bak > jóola-manjaku > jóola

Sources Diagne 2009; Dabo 2013

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	zó	zó-nen
2. die; kill	—	ho
3. sit; seat	lal	—
4. eat; feed	eɲ	eɲ-en
5. learn; teach	cen	cen-en
6. see; show	zún zoo	kedén

7. be angry; anger	—	—
8. fear; frighten	—	—
9. hide; hide	mɛφ-o	mɛφ-ɛn
10. boil; boil	—	bay-en
11. burn; burn	βe	—
12. break; break	—	—
13. open; open	piyal-u	—
14. dry; make dry	lee	lɛ-n
15. be straight; straighten	—	—
16. hang; hang	eele	—
17. turn over; turn over	—	—
18. fall; drop	—	—

1.31. Manjaku of Bassarel

Position into the Atlantic family bak > jóola-manjaku > manjaku
Source Buis 1990

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	ju	—
2. die; kill	—	—
3. sit; seat	tɛf	tɛf-an
4. eat; feed	—	—
5. learn; teach	jok	jok-an
6. see; show	win	yɛt
7. be angry; anger	riɫbaɫ	riɫbaɫ-an
8. fear; frighten	lɔnk	lɔnk-an
9. hide; hide	—	—
10. boil; boil	cap	cap-an
11. burn; burn	tɔr	tɔr
12. break; break	—	—
13. open; open	wanɫ	wanɫ-an
14. dry; make dry	kɫi	kɫi-an
15. be straight; straighten	naɫ col	naɫ-an col-an col-ɛs
16. hang; hang	riɫng	riɫng-an
17. turn over; turn over	tul-a	tul
18. fall; drop	ier	ier-an

1.32. Manjaku Babok*

Position into the Atlantic family bak > jóola-manjaku > manjaku
Source Doneux 1975, Wilson 2007

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	—	—
2. die; kill	cätʃ	fɪŋ
3. sit; seat	—	—
4. eat; feed	—	—
5. learn; teach	—	—

6. see; show	—	—
7. be angry; anger	—	—
8. fear; frighten	—	—
9. hide; hide	kab	bek
10. boil; boil	—	—
11. burn; burn	—	—
12. break; break	—	—
13. open; open	niɣəs-a	niɣəs
14. dry; make dry	kɔy	kɔy-an
15. be straight; straighten	—	—
16. hang; hang	diɔng	riɔng-an ²⁷
17. turn over; turn over	—	—
18. fall; drop	iər	wat

1.33. *Mankanya**

Position into the Atlantic family bak > jóola-manjaku > manjaku

Sources Trifkovic 1969; Gaved 2007; Wilson 2008

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	—	—
2. die; kill	keɽ	fiŋ
3. sit; seat	—	—
4. eat; feed	—	—
5. learn; teach	—	—
6. see; show	win	diiman
7. be angry; anger	—	—
8. fear; frighten	—	—
9. hide; hide	—	—
10. boil; boil	—	—
11. burn; burn	yek	yek
12. break; break	—	—
13. open; open	—	phaabëʂ pdëɽëʂ
14. dry; make dry	—	—
15. be straight; straighten	—	—
16. hang; hang	—	—
17. turn over; turn over	—	—
18. fall; drop	—	—

1.34. *Pepel*

Position into the Atlantic family bak > jóola-manjaku > manjaku

Source Ndao 2010

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	ju	ju-ju-nu
2. die; kill	keʂ	fiŋ
3. sit; seat	ʂo	ʂo-r-uŋ

²⁷ The stem variation corresponds due different degrees of mutation (or consonant alternation) for the same root.

4. eat; feed	de	de-pə-den-ɔ
5. learn; teach	jok	jok-jok-ɔ
6. see; show	yi	dək
7. be angry; anger	deus	—
8. fear; frighten	kalɔ	kalɔ-wɔŋ
9. hide; hide	men	men-u
10. boil; boil	sat	sat-ɔ
11. burn; burn	tur	tur
12. break; break	taw-ɔ	taw
13. open; open	aw-ul	aw
14. dry; make dry	kaya	kay- ɔŋ
15. be straight; straighten	jaanı	sun̄kəla naʃun̄
16. hang; hang	—	wɔgɔl
17. turn over; turn over	—	—
18. fall; drop	jɛt	jɛt-ɔŋ

1.35. Bijogo Kagbaaga

Position into the Atlantic family bak > bijogo

Source Segerer 2002

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	dɛs	dɛs-ak-i
2. die; kill	kpe	kpe-i-(ak)
3. sit; seat	ok(a)	ok-i
4. eat; feed	deŋ	—
5. learn; teach	mɛnd-ak-(i)	mɛnd-ɛk-am
6. see; show	joŋ	jom
7. be angry; anger	—	—
8. fear; frighten	nakpaŋ	nakpaŋŋ-i
9. hide; hide	—	—
10. boil; boil	e	e-i
11. burn; burn	got	[ɔj
12. break; break	ɔm nɔk	ɔm nɔk
13. open; open	kpas	kpas
14. dry; make dry	dan(nɛ)	dan(nɛ)
15. be straight; straighten	te	te-am
16. hang; hang	raʃ-ɔk	raʃ(ɛ)
17. turn over; turn over	kun(ni)	pet pet-ak
18. fall; drop	dim	dim-i

1.36. Bijogo Kamona*

Position into the Atlantic family bak > bijogo

Source Segerer 1998

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	—	—

2. die; kill	—	—
3. sit; seat	—	—
4. eat; feed	—	—
5. learn; teach	—	—
6. see; show	—	—
7. be angry; anger	—	—
8. fear; frighten	—	—
9. hide; hide	ɲoront-ok	ɲoront
10. boil; boil	—	—
11. burn; burn	tək	[ɔj]
12. break; break	—	—
13. open; open	—	—
14. dry; make dry	dan	gay
15. be straight; straighten	teβ-ε	teβ.a
16. hang; hang	ɲoraɥ-i	ɲoraɥ
17. turn over; turn over	—	—
18. fall; drop	—	—

2. Mande

2.1. Bobo

Position into the family Mande West, Northwest, ... Soninke-Bobo

Source Le Bris & Prost 1981

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	zi	zi
2. die; kill	siri	ye
3. sit; seat	tanga	tanga-be
4. eat; feed	zon	woro
5. learn; teach	səma	səma
6. see; show	za	dərə
7. be angry; anger	—	—
8. fear; frighten	kpan	kpan-be
9. hide; hide	yərə	yərə-be
10. boil; boil	—	—
11. burn; burn	daga	daga-be
12. break; break	yɔ	yɔ
13. open; open	kibe	kɔba
14. dry; make dry	kwīē	kwiē-bē
15. be straight; straighten	tà	tà-bē
16. hang; hang	zòló	zòló
17. turn over; turn over	vunu	vunu
18. fall; drop	bere	bere

2.2. Bambara

Position into the family: Mande West, Central-Southwestern ... North-Eastern Manding

Source Dumestre 2011

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	yélé	lá-yélé

2. die; kill	bá	fàgá
3. sit; seat	sìgí	sìgí lá-sìgí
4. eat; feed	dú	dúmúní lá-dúmúní
5. learn; teach	dègé	lá-dègé
6. see; show	yé	jìrá
7. be angry; anger	ṣémó	màdímí
8. fear; frighten	jàbó	sírà
9. hide; hide	kǔ-dògó	dògó
10. boil; boil	wuli bàlàbálá	wuli bàlàbálá
11. burn; burn	jèní	jèní
12. break; break	—	—
13. open; open	yèè	yèè
14. dry; make dry	jà	là-jà
15. be straight; straighten	jò	là-jò
16. hang; hang	yèbèyábá	yèbèyábá
17. turn over; turn over	firi	firi
18. fall; drop	bi	bi là-bi

2.3. Maninka of Niokolo

Position into the family: Mande West, Central-Southwestern, Central... Manding-Mokole
Source Creissels & Camara 2013

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	jèlè	jèlé-ndiŋ
2. die; kill	fáya	fáya
3. sit; seat	—	—
4. eat; feed	dòmò	dòmò-rí-ndiŋ
5. learn; teach	káraŋ	káraŋ
6. see; show	jè	yítà yítà-ndiŋ
7. be angry; anger	—	—
8. fear; frighten	silà	silà
9. hide; hide	máábò núyùŋ	máábò núyùŋ
10. boil; boil	dómó	dómó-ríndi
11. burn; burn	—	—
12. break; break	téyi	téyi
13. open; open	—	—
14. dry; make dry	jàà	là-jàà
15. be straight; straighten	—	—
16. hang; hang	déŋ	déŋ
17. turn over; turn over	—	—
18. fall; drop	jólon	jólon

2.4. Mandinka

Position into the family: Mande West, Central-Southwestern, Central ... Manding-Mokole
Source Creissels 2011

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	jélè	jélé-ndì
2. die; kill	fãa	fãa
3. sit; seat	sii	sì-ndì
4. eat; feed	dómo	dómó-ríndi
5. learn; teach	nikìŋ nìŋ	nikì-ndì nì-ndì
6. see; show	jé	yita
7. be angry; anger	kámfàà	kámfá-ndì
8. fear; frighten	sílà	sílá-ndì
9. hide; hide	nùkùŋ	nùkùŋ
10. boil; boil	fáji	fájí-ndì
11. burn; burn	jàni	jàni
12. break; break	téyi kátí	téyi kátí
13. open; open	yèlè	yèlè
14. dry; make dry	jàà	jà-ndì
15. be straight; straighten	lòò	lò-ndì
16. hang; hang	déŋ	déŋ
17. turn over; turn over	yelemá	yelema-ndí
18. fall; drop	jólon	jólon

2.5. *Kakabe*

Position into the family: Mande West, Central-Southwestern, Central... Manding-Mokole
Sources Vydrina 2011, 2017

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	jéle	la-jéle
2. die; kill	fàgà	fàgà
3. sit; seat	sìgi	la-sìgi
4. eat; feed	bálú	bálú
5. learn; teach	kàran	la-kàran
6. see; show	yén	hóllí
7. be angry; anger	ðirè	—
8. fear; frighten	kílán	la-kílán
9. hide; hide	lamára	lamára
10. boil; boil	bàràbára fáte	bàràbára la-fáte
11. burn; burn	bìntan	bìntan
12. break; break	tíjá	tíjá
13. open; open	láka	láka
14. dry; make dry	gbálá	la-gbálá
15. be straight; straighten	—	—
16. hang; hang	yòngì	yòngì
17. turn over; turn over	mayèlèmàn	mayèlèmàn
18. fall; drop	bòyi	la-bòyi

2.6. Soso

Position into the family: Mande West, Central-Southwestern, Central, Susu-Yalunk Sources Touré 2004; New Tribes Mission 2004; Shluinsky 2014

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	yélé	rá-yèlè
2. die; kill	fàxá	sùtò
3. sit; seat	dòxó	dòxó
4. eat; feed	dón	mà-dòn
5. learn; teach	tìkà	má-tìkà
6. see; show	tóó	mà-tóò rà-tó
7. be angry; anger	xònó	rá-xònò
8. fear; frighten	gàaxú	má-gàaxù rá-gàaxù
9. hide; hide	nòxù ma-nòxù	nòxù
10. boil; boil	bàràbàrá	bàràbàrá
11. burn; burn	gà	rá-gà
12. break; break	í-girà	girá
13. open; open	bii	ra-bii
14. dry; make dry	—	—
15. be straight; straighten	tìxì	má-tìxì
16. hang; hang	singan	singan
17. turn over; turn over	—	—
18. fall; drop	bìrá	ra-bìrá

2.7. Soninke of Bakel

Position into the family: Mande West, Northwest ... Soninke-Bozo Source Creissels & Diagne 2013

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	soyi	soyi-ndi
2. die; kill	kara	kari
3. sit; seat	taaxu	taaxu-ndi
4. eat; feed	yiga	yiga-ndi
5. learn; teach	xara	xara-ηηundi
6. see; show	wari	koyi
7. be angry; anger	butu	butu-ndi
8. fear; frighten	kanu	kanu-ndi
9. hide; hide	muxu lùutí	muxu-ndi lùutí
10. boil; boil	wari	wari-ndi
11. burn; burn	buyi	buyi
12. break; break	kar-e	kara
13. open; open	wuñi ηùní	wuñi ηùní
14. dry; make dry	kaawa	kaawa

15. be straight; straighten	teleño	teleño-ndi
16. hang; hang	loggi jòngí	loggi jòngí
17. turn over; turn over	kippe	kippa
18. fall; drop	xenu	xenu-ndi

2.8. Soninke of Kingi

Position into the family: Mande West, Northwest ... Soninke-Bozo
Source Creissels 1996

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	sòyí	—
2. die; kill	kàrá	kàrí
3. sit; seat	táaxú	—
4. eat; feed	yígá	—
5. learn; teach	séer-é	séerá
6. see; show	ɲàrí	kòyí
7. be angry; anger	bútú	—
8. fear; frighten	kànú	—
9. hide; hide	lùuti	lùuti
10. boil; boil	wàrí	bàràbàrà
11. burn; burn	bíyí	bíyí
12. break; break	kar-e	kara
13. open; open	ɲùñí	ɲùñí
14. dry; make dry	káawá	káawá
15. be straight; straighten	télénjò	—
16. hang; hang	jòngí	jòngí
17. turn over; turn over	kúpp-è	kúppà
18. fall; drop	yèré / qénú	—

3. Mel

3.1. Sherbro

Position into the family Kisi-sherbro
Sources Pichl 1967, Childs 2017

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	mam	mam-i
2. die; kill	wu	di
3. sit; seat	chál	chel-í
4. eat; feed	səp jo	ɲiti
5. learn; teach	ka-raŋ	ka-raŋ
6. see; show	ke	thoŋki
7. be angry; anger	—	—
8. fear; frighten	pakil	pakal-i
9. hide; hide	mat-ni	mat
10. boil; boil	cheth-ni hel	cheth

11. burn; burn	man hei-ni	man hei
12. break; break	kent	kent-i
13. open; open	—	—
14. dry; make dry	sək-il	sək-əl-i
15. be straight; straighten	viki-ni	viki
16. hang; hang	gbaloni ²⁸	gbani
17. turn over; turn over	pinki-ni thim-ni	piŋki thim
18. fall; drop	dúk	duk-i

3.2. Kisi

Position into the family Kisi-sherbro

Sources Childs 2000 and pc

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	màmòó	mèmìó
2. die; kill	wu wi	di
3. sit; seat	càllé	—
4. eat; feed	dió	mìòùwó
5. learn; teach	pèèkòó	pèèkòó
6. see; show	còó	còmndó
7. be angry; anger	pààsìàlló	—
8. fear; frighten	wòó	yààláá
9. hide; hide	wìòń-ńndó	wìòńóó
10. boil; boil	ŋəl	ŋəl
11. burn; burn	lùm	lùm
12. break; break	piəl piəl-nuŋ	piəl
13. open; open	kààńiá-ńndó	kàńàá
14. dry; make dry	ńàùwó	ńèwìó
15. be straight; straighten	sàndòó	sièndiò
16. hang; hang	bàá bàà-ńńńndó	bàá
17. turn over; turn over	pìmbùlń-ńndó	pìmbùlló
18. fall; drop	dugegan dèlòó	mèlió

3.3. Kim

Position into the family Kisi-sherbro

Sources Childs 2012 and pc

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	—	—
2. die; kill	—	—

²⁸ Childs (2000) gives this form inside the entry of *gbani* (causal) and signals here a verbal extension. Therefore, although the morphology remains unclear to us, it was counted as a decausative strategy.

3. sit; seat	—	—
4. eat; feed	sóm	ké
5. learn; teach	kàà	kàà
6. see; show	ke	gbòṅ
7. be angry; anger	—	—
8. fear; frighten	wì	sòpì
9. hide; hide	mát-ìn	mát
10. boil; boil	—	—
11. burn; burn	tèi	tè-n
12. break; break	kent	kent-i pəl
13. open; open	—	—
14. dry; make dry	—	—
15. be straight; straighten	—	—
16. hang; hang	—	—
17. turn over; turn over	—	—
18. fall; drop	—	—

3.4. Mani

Position into the family Kisi-sherbro
Source Childs 2012

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	—	—
2. die; kill	—	—
3. sit; seat	cál	cél-í
4. eat; feed	—	—
5. learn; teach	pèrí	pèrì
6. see; show	ké	cònkí
7. be angry; anger	—	—
8. fear; frighten	wò(li)y-én wè	wòlì
9. hide; hide	màt-én	màt
10. boil; boil	—	—
11. burn; burn	té	té-í
12. break; break	—	—
13. open; open	—	—
14. dry; make dry	—	—
15. be straight; straighten	—	—
16. hang; hang	—	—
17. turn over; turn over	—	—
18. fall; drop	—	—

3.5. Temne

Position into the family Temne-Baga-Landuma
Sources Thomas 1916; Kanu 2004

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	shel	shel-əs

2. die; kill	fi	dif
3. sit; seat	—	—
4. eat; feed	di	di-s
5. learn; teach	təkəs	təkəs-a
6. see; show	nənk	tāk
7. be angry; anger	—	—
8. fear; frighten	nès	nès
9. hide; hide	mānk-əne	mānk
10. boil; boil	—	—
11. burn; burn	—	—
12. break; break	gbây	gbây-əs
13. open; open	—	—
14. dry; make dry	—	—
15. be straight; straighten	bəl (long)	bəl-əs
16. hang; hang	—	rāth
17. turn over; turn over	—	—
18. fall; drop	pət-ər fumpə	pat

3.6. Baga Sitem

Position into the family Temne-Baga-Landuma

Sources Ganong 1998, Lamp 2016

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	sel	—
2. die; kill	—	—
3. sit; seat	nde	dəs
4. eat; feed	—	—
5. learn; teach	θəkəs	θəkəs
6. see; show	niŋk	meŋtr
7. be angry; anger	—	—
8. fear; frighten	—	—
9. hide; hide	menkir	gop-ne
10. boil; boil	won	pɛc
11. burn; burn	teye	tsəf
12. break; break	—	—
13. open; open	—	—
14. dry; make dry	—	—
15. be straight; straighten	—	—
16. hang; hang	—	—
17. turn over; turn over	—	—
18. fall; drop	sumprə tempene	gbalər

3.7. Landuma

Position into the family Temne-Baga-Landuma

Sources Rogers & Bryant 2012, Rogers in prep. and pc

NB. Some data were difficult to interpret because the analysis of the verb system of Landuma has not been fully completed to date. The segmentations below are our interpretation after

considering Rogers' work in preparation and the remaining problems mentioned by the author. In particular we have analyzed some final - Λ as a voice suffix (probably undergoing freezing) that was not clearly identified as such by Rogers.

<i>verb pair</i>	<i>non causative</i>	<i>causative</i>
1. laugh; make laugh	kul- Λ	kul-is
2. die; kill	fi	dif
3. sit; seat	yir- Λ	yir-əs
4. eat; feed	di	di-s
5. learn; teach	təkəs	tək-s-əs
6. see; show	nənk	mənək
7. be angry; anger	baŋs Λ	t Λ Λ
8. fear; frighten	nes- Λ	nes-əs
9. hide; hide	mənək-əs- Λ	mənək-əs
10. boil; boil	cəks- Λ	cəks-əs
11. burn; burn	təy- Λ	təy
12. break; break	wək(ə)c- Λ	wəkəc
13. open; open	ŋ Λ r-ε	ŋ Λ ri
14. dry; make dry	wos	wos-əs
15. be straight; straighten	lonp	lonp-əs
16. hang; hang	d Λ t-s- Λ	d Λ t
17. turn over; turn over	kalf-ε	kalfi
18. fall; drop	funp- Λ	funp-əs

Appendix 4. The data sources

Most of the data (i.e. pairs of causal-noncausal verbs in 51 languages) have been retrieved from the *RefLex* lexical database:

Segerer, Guillaume & Sébastien Flavier. 2011-2019. *RefLex: Reference Lexicon of Africa*. <http://reflex.cnrs.fr/>

RefLex is an online lexical database devoted to the languages of Africa, covering presently 789 languages with over one million words, retrieved from **referenced and accessible sources**.

The sources of the data used in our article are listed below (by language families), including the ones additionally consulted for completing or substantiating the data extracted from RefLex.

Lastly, when no published data were available, the following experts have generously complemented our data or analyses on various languages, through personal communications (*as indicated in the article acknowledgments*):

Sokhna Bao Diop (Baynunk Guñaamolo), Alain-Christian Bassène (Jóola Banjal), Tucker Childs (Kisi and Sherbro), El Hadji Dièye (Laalaa), Gérard Dumestre (Bambara), Dame Ndao (Pepel), Pierre Sambou (Jóola Karon), Kirk Rogers (Landuma), Amadou Sow (Pulaar).

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