

Borrowing Strategies and Neological Creation Processes in Mathematical Terminology in Wolof

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Abstract

The planning of the Wolof language, particularly aimed at providing it with the missing terms in the field of mathematics, is now a current concern. To enrich its lexical stock, Wolof has frequently resorted to borrowing. In this study, we aim, on one hand, to explain how borrowing occurs, focusing mainly on the processes of phonological, morphosyntactic, and lexico-semantic adaptation of borrowed terms. On the other hand, we analyze the reasons behind borrowing. Borrowing is just one method of revitalizing, readapting, or enriching contemporary common Wolof. Another method involves the neological creation of terminology using native linguistic elements. This study also aims to describe how Wolof names mathematical realities through neological processes such as calques and metaphorical imagery.

Keywords: borrowing, mathematics, neology, terminology, Wolof

Stratégies d'emprunt et processus de néologisme dans la terminologie mathématique en wolof

Résumé

La planification de la langue wolof en vue, notamment de lui donner les termes qui lui font défaut dans le domaine des mathématiques est aujourd'hui d'actualité. Le wolof, pour enrichir son stock de termes a souvent eu recours à l'emprunt. Dans cette étude, nous avons montré les mécanismes avec lesquels s'opèrent les emprunts, en se fondant essentiellement sur l'observation des processus d'adaptation phonologique, morphosyntaxique et lexico-sémantique. D'autre part, nous avons analysé les raisons qui motivent ces emprunts. L'emprunt n'est que l'un des moyens permettant de redynamiser, de réadapter ou d'enrichir la langue wolof commun actuel. L'autre moyen est la création terminologique néologique à partir d'éléments significatifs propre à la langue. La présente étude a également pour but de décrire comment le wolof va dénommer des réalités mathématiques à partir des procédés de création néologique comme les calques, ainsi que le recours à l'image.

Mots clés : emprunt, mathématique, néologie, terme, wolof

Introduction

Neology is a field of research that attracts the interest of linguists. This is evident in the conferences and bibliographies devoted to it. Looking at the literature on this field in languages with an oral tradition, we have seen a surge in research on terminology creation and its general dynamics in recent years. The proliferation of neology and terminology is one indication of the dynamism of this field of research. In Wolof, atlantic language and the majority language of Senegal, the neology of mathematical terms is undergoing changes and developments. We have chosen to work on terminological neologies in Wolof in order to put into perspective reflections on a synchronic description of the processes of creation and integration. The aim of this work is to study the systematic functioning of borrowing in the Wolof linguistic system, but also to reveal, to describe and to analyze the mechanisms of terminology création. This reflection raises key questions such as linguistics motivations and influence in the Wolof system, but also strategies specific to the languages for naming new realities. We will inevitably focus on issues relating to the identification of neologisms and the interpretation of neological creations. We all know that borrowings from Wolof, particularly from French, will adapt to the language system. We will therefore describe the various adaptation processes in this paper. Neology, as an established field of research, is at the very heart of theoretical reframing. However, to carry out this work, we have chosen the cultural theory of Diki-kidiri (2008: 3). Our data consists of 150 terminology entries drawn from a corpus obtained after two field missions in June 2023 and March 2024, which were supplemented by the Sentermino terminology database creation project.

1. Borrowing Strategies

The borrowing strategy refers to the methods by which a language incorporates foreign words into its lexicon. Wolof is a language in which most borrowed words come from French. Throughout the borrowing process, it is necessary to adhere to the main borrowing strategies, which revolve around several aspects:

- Direct borrowing (the foreign word is integrated almost as it is)
- Semantic borrowing (translating the idea literally without considering its original form)
- Truncation or modification borrowing (a foreign word may be borrowed in a reduced or altered form)
- Hybrid borrowing (combining a borrowed word with a word from Wolof)

The borrowings mentioned above have occurred quite naturally and inevitably; their integration happened, so to speak, automatically, due to the internal dynamics of the borrowing language. This description of the collected data could lead to the development of foundational guidelines aimed at planning the phenomenon of borrowing by incorporating it into a forward-looking linguistic perspective of neological creation (or lexico-semantic "engineering"). In a broader project of planning the Wolof language, particularly with the goal of providing it with the terminology it currently lacks in technical and scientific fields, the following elements should be taken into consideration regarding borrowing: Describing the "how" of borrowing, primarily by observing the phonological, morphosyntactic, and lexico-semantic adaptation processes. It is possible to extract integration rules from these various levels of analysis. Regarding phonological elements in particular, phonostatistics would certainly be useful. As shown previously, it helps justify (or even predict) the potential formal evolution of a word.

Examples:

- *miniteer* from "militaire"
- *pombiteer* from "pomme de terre"
- *siifar* from "chiffre"
- *kaare* from "carré"

These can be explained by a higher occurrence probability in contemporary Wolof of consonantal sequences like *m-n-t-r* and *p-m-b-t-r* over *m-l-t-r* and *p-m-d-t-r*, respectively.

Then, Analyzing the "why" of borrowing, by identifying the fields, subjects, and topics where linguistic borrowing is necessary and appropriate. Additional questions may concern the frequency and origin of the borrowings in question.

- In terms of frequency within the lexicon and discourse, it seems advisable that borrowings do not exceed a certain threshold (to be defined). This means they should not play a predominant role.

For instance, if a hypothetical scientific Wolof language were composed of half French borrowings, it would no longer be Wolof but rather a "Franlof jargon" or "Frafro-European dialect."

- As for the origin of borrowings, it would be logical to first consider neighboring national languages before turning to foreign ones. However, this principle is practically limited

in the current context by the specificity of the fields involved. It is unlikely, for example, that languages like Pulaar or Serer are better equipped than Wolof in technical or scientific domains where Wolof currently lacks vocabulary.

The domains concerned and the fundamental motivations for linguistic borrowing in Wolof are already well known. Borrowing can help equip Wolof with meaningful terms currently missing in its modern context. These terms express material, conceptual, or sociocultural novelties, often relating to urban modern life (though rural Wolof can also be concerned, e.g., with technical terms related to agriculture).

This phenomenon is closely linked to globalization, the development of a mega-civilization, or a global technoscientific policy. The main themes observed in Wolof borrowings such as fashion, family life, science, mechanics, administration, politics, health, etc. guide further possibilities for enriching the language, especially through endogenous neological creation.

However, while borrowing meets specific needs, it can also serve to enrich the language in a more superficial or redundant way what we might call "luxury borrowings" type of redundancy that arguably exists everywhere and always in language.

Now we are going to focus on the integration of linguistic forms of borrowed terms. This borrowed terms relate to urban wolof or languagemixing, and French.

During our field research we noted the following statement:

Da nga koy diviser

The verbal borrowing *diviser* used within the framework of the rules governing the conjugation of Wolof verb forms. Indeed, we note an imperfective aspect marked by the existential marker *y* in *kay*. As for the two-parts segment following the borrowing *diviser*, we note that it introduces a deviation from the canonical norm of Wolof and does not obey the rules governing Wolof syntax.

2. Neological Creation

Borrowing is only one of the methods available to revitalize, readapt, or enrich a language like contemporary common Wolof. The other method is neological terminological creation based on meaningful elements intrinsic to the language itself — and this second method should, in fact, take precedence over the first.

As noted by P. Dumont and C. Mbodj (1983:53) in the previously cited article of which we reproduce an essential excerpt here

Some Senegalese Wolophones, mathematicians, physicists, and educators have demonstrated that their language can serve as a vehicle for the most modern knowledge. They have endeavored to use grammatical processes and translation to express scientific notions, concepts, and realities. They rely solely on the national linguistic resources.

Example: Some Borrowed Words

- **Square** = *kaare*
- **Set square** = *eker*
- **Rectangle** = *rektàngal*
- **Machine** = *masin*
- **Cube** = *kib*
- **Label** = *tiket*
- **Ruler** = *reegal*
- **Mathematics** = *matematig*

Take for example, the term growth un a function, which is translated a *màggaay*. This term is constructed by analogy with the model *baaxaay* «goodness» and *bonnaay* «wickness». The creation of terminology does not pose any immediate problems, as the term is created with complete morphological transparency. All wolof speakers are fully aware that it is meaning is related to the meaning of each of its formants. This neologism cannot satisfy either the criterion of monoreferentiality of that of monosemy. This calls into questions the criterion of terminological bi-univocity in terms of both meaning and referent.

2.1. Morphological Processes

Wolof nouns and verbs are either simple or complex in form. Those with a simple form (or whole words) are uninflectable, they are generally roots that can potentially serve as bases for complex words. The latter are formed or affected in modern Wolof by the four morphological formation processes, which are, on the one hand composition, and on the other hand derivation with reduplication, consonant alternance and affixation.

2.1.1. Affixation

Affixation is undoubtedly the most productive lexical derivation process in Wolof. Affixes are elements with a more or less clear meaning but which exist almost exclusively in combination

with roots. It's is one of the most widely used morphological processes for creating new words in Wolof. It involves adding an affix such as a prefix, suffix, or infix to a root base to form or derive a new word.

In Wolof, **suffixation** is more common than prefixation or infixation. Prefixation is virtually no existent in wolof

- **Nominal suffixes**

When combined with nominal, they produce derivates that have uses, functions, and/or values either solely as nouns. A nominal suffix is a morpheme placed after the root of a word to form a new noun.

Examples:

- **Suffix -al** (causative):

- *Feeñal* (to reveal)

from *feeñ* (revealed) + *-al* (causative)

- *Jëmmal* = to represent,

jëmm ("represent") is the nominal base, *-al* marks the causative.

- *Giiral* = classification,

giir ("to classify") is a verb, *-al* marks the causative.

- *Rafetal* = decoration,

rafet ("beautiful") is the root, the suffix *-al* marks the causative.

- **Suffix -aay** (quality or state):

- *Guddaay* (length of a rectangle) from *gudd* (to be long)

- *Kowewaay* (height of a triangle) from *kowe* (to be high)

- *Xaajalekaay* (division) from *xaajale* (to divide)

- **Suffix -in** (manner):

- *Biralin* (demonstration) from *biral* (to show, to explain)

- *Dogatin* (elementary particle) from *dogat* (to cut into small pieces)

- **Suffix -eef** (affective suffix):

- *Xaajaleef* (dividend); *-eef* is used here as an affective marker

- *Fuleef* = multiplication. The root *ful* means "to multiply." The derived form *fuleef* designates the nominal process (multiplication).

- *Firndeel* = to define. The verb is derived from the base *firn* ("define, determine"), and the suffix *-eel* functions here as a causative/derivational morpheme. In some cases, the suffix *-eef* may also carry a semantic nuance related to a feeling or perception.
- *Ñaareel* = second. The numeral base *ñaar* ("two") combined with the suffix *-eel* expresses ordinality, thus yielding the ordinal second.

- Verbal suffixes

A verbal suffix is a morpheme added to a verbal root to form a new verb or alter its meaning. It is widely used to express causation, reflexivity, intensity, reciprocity, or passive voice.

Example:

- **Suffix *-adiku*** (*adi* = privative, *ku* = passive-reflexive):

- *Gàppoodiku* (infinite):

from *gàpp* (limit), *gàppu* (to be limited)

- *Xeloodiku* (irrational [number]):

from *xel* (reason, mind)

- Bivalent suffixes

A bivalent suffix is a morpheme that can serve to create either a noun or a verb, depending on the context in which it is used.

Example:

- **Suffix *-ale*** (factitive-objective):

- *Yemale* (equation = to make equal): from *yem* (equal, just)

Throughout our corpus, we did not find any terms formed by sequences of suffixes, terms with several different derivation suffixes.

2.1.2. Reduplication

The simplest formal process, the reduplication is a morphological process in which a word is repeated either partially or totally to create a new word.

Examples:

- *Cér-céral* (fraction): from *cér* (part, portion)
- *Xew-xew* (phenomenon = event): from *xew* (to happen)

It's interesting to note that in our corpus, productivity with nominal roots is limited. However, with verbal roots, productivity is much less limited.

2.1.3. Consonant Alternation

In Wolof, consonant alternation also called **consonant mutation** is a morphological process where the consonant of a root changes during the formation of a new word and allowing differentiation between nominal and/or verbal radicals from the same families, bases, or roots. This change follows specific morphological and phonological rules.

Examples:

- **Nasal / Non-nasal alternation:**

- *Ndëng* (curve): from *dëng* (to be bent, not straight)

- **Plosive / Non-plosive alternation:**

- *Céddale* (division): from *séddale* (to divide, to share)

Concerning nominal classifier alternation, this process involves changing the nominal class or determiner of a noun to form a new lexical item.

Examples:

- *Ab taxaaru* (a coil) vs. *Ag taxaaru* (a spiral)
- *Galan w.* (drumstick) vs. *Galan b.* (diagonal)

2.1.4. Composition

Composition is a process by which a new word is formed by combining two or more lexical units. It consists of combining several different roots, usually nominal, verbal or adverbial (expressive, ideophonic), to form compound noun in particular. These have minimal form possibilities (using only roots). It may also involve repeating a lexical base partially or completely to derive a new term.

As for what concerns simple Complementary Compounds, we have noted that these are combinations of two words (e.g., a noun followed by another noun or adjective), where the second element functions as a complement or specifier of the first.

Examples:

- ***Njub-koñ* (rectangle):**

from *jub* (to be straight) + *koñ* (angle)

- ***Mbëj-feppal* (electron):**

from *mbëj* (electricity) + *fepp* (grain)

- ***Mbëj-lasiyaal* (electromagnetic):**

from *mbëj* (electricity) + *lasiye* (steel = magnet)

Throughout our corpus, we found only these two forms

N	+	N
N	+	N+SUF

2.1.5. Syntagmatic Compounds

In our corpus we note more or less complex syntagmatic compounds containing fixed non radical elements (indicators of nominal or verbal functions). This process creates compound words from initially independent lexical units, organized in a syntactic structure but functioning as a single word. These sequences can be noun+noun, noun+verb, verb+complement, etc.

Example:

- ***Gëstu-bëtal kajuteefal* (relativistic physics):**

- *Gëstu* (to research)
- *Bët* (eye)
- *Aju* (to be based on)
- *Al* (causative: to make)
- *Kajuteef* (the state of being relative)
- *Kajuteefal* (to relativize, make relative)

2.2. Syntactic Processes

These are morphological processes used to create new lexical items without modifying the internal structure of individual words, unlike affixation or consonant alternation. Instead, they rely on combining multiple words in a syntactic structure.

2.2.1. Complement Phrases

The complement phrase is a lexical unit used to complete or specify another element. In Wolof, this phrase serves to clarify, complete, or determine the meaning of a word or clause.

Examples:

- ***Doxub tàngaay* (heat propagation):**

dox (to move/walk) + *tàngaay* (heat) + *ub* (connective + classifier)

- *Jublug dawaan gi la* (current direction):

jublu (direction, to turn toward) + *dawaan* (current, from *daw* = to run) + *ug* (connective + classifier)

- *Xaajaleef* (dividend):

xaaj (to divide) + *a* (connective) + *leef* (complement)

2.2.2. Qualifying Phrases

The qualifying phrase is a lexical unit that attributes a quality or property to a noun. It either describes or qualifies the noun.

Examples:

- *Mboole yu gàppu* (finite sets):

boole (to group) + *yu* (which are) + *gàpp* (limit, from *gàppu* = to be limited)

- *Jëmu yu taqoo* (linked vectors):

jëmu (to head toward) + *taq* (to be attached) + *oo* (reciprocal suffix)

- *Rëdd wu taxaw* (vertical line):

rëdd (line) + *wu* (nominal class marker) + *taxaw* (standing, vertical)

- *Rëdd wu weng* (oblique line):

rëdd (line) + *wu* + *weng* (oblique), which qualifies the line

2.3. Lexico-Semantic Processes

In Wolof, the issue of lexical-semantic creation of terms is particularly acute. Lexico-semantic processes are used to create new words or meanings without altering the form of existing words. They rely on manipulating the meanings rather than the structure of words.

Literal translation and metaphorical imagery are two major techniques used here.

Then, Literal Translation or Calque, we note that this neological process involves translating foreign terms word-for-word into Wolof. It is particularly common in scientific domains like mathematics.

Examples:

- *Tool yi ag dogatit yi* (fields and particles):

tool (field, garden) + *dogatit* (small pieces, from *dogat* = to cut)

- *Reenub ñaar* (square root of two):

reen (plant root) + *ub* (of) + *ñaar* (two)

- *Lim yi ëpp tus* (positive numbers):

lim (to count) + *ëpp* (to exceed) + *tus* (nothing, zero)

- *Def ab xayma* (to perform an operation):

def (to do) + *ab* (article) + *xayma* (operation)

Some terms are coined using metaphorical or figurative images.

Example:

- *Lim yu jëggib gàpp* (transfinite cardinal numbers): literally “numbers that have overstepped the limit”; *jëgg* (to cross over), *gàpp* (limit)

For additional notes, we note in these examples of Wolof scientific terminology, among roughly 40 roots, Cheikh Anta Diop (1975: 162) uses only two borrowings from French: *koñ* (corner, angle) and *lasiye* (steel, magnet), both of which have been fully integrated into Wolof, with changes in form and/or meaning.

Some terms may raise issues due to forced or overly complex formations, such as *gëstu-bëtal kajuteefal*, where extreme compositional complexity is coupled with somewhat “unorthodox” use of suffixes (e.g., *-teef* not being easily verbalizable, and *-al* used to verbalize it).

Another more systematic approach which also falls under calque and literal translation is to find Wolof equivalents for French derivational elements. Regarding derivational markers, particularly suffixes, Wolof offers a wide range of options:

- *kat* (agentive suffix) = French *-eur* → *balekat* (sweeper)
- *aay* (quality/state) = French *-té, -ité* → *baaxaay* (kindness), *tooyaay* (humidity)

As for scientific morphemes, typically of Greek origin in French, the options are more limited but some equivalents do exist:

- *Natt* (to measure) = *-meter, -metry*
- *Tàngaay* (heat) = *thermo-, -thermy*
- *Yem* (equal) = *iso-*

Examples:

- *Natt-mbëj* (electrometry)
- *Natt-sedd* (cryometry)
- *Natt-leer* (photometry)
- *Natt-tàngaay* (thermometry)
- *Yem-guddaay* (isometry)

- *Yem-tàngaay* (isothermy)

Conclusion

The reflection carried out in this study shows that the future of Wolof, particularly in the scientific and technical fields, still depends on its ability to acquire linguistic tools adapted to modern realities. Moreover, borrowing is a morphological process that remains unavoidable in this context, as it allows for the rapid integration of terms borrowed from other languages. However, borrowing alone cannot guarantee the autonomy and vitality of the Wolof language. This is why neological creation represents an important path, drawing from Wolof's own linguistic resources. Such an approach highlights the internal ingenuity of the language and demonstrates its ability to express complex concepts, particularly in mathematics. This reflection has shown that many wolof mathematical terms are notable for their polysemy or the vagueness surrounding them. For this reason, this clarification is of particular interest. Wolof speakers often use strategies that involve stabilizing the meaning of terms by using a set of consistent and collectively accepted semantic features.

Ultimately, the challenge is not only to translate knowledge from elsewhere, but also to provide Wolof with the means to become a true tool for knowledge and for the transmission of learning. This endeavor contributes both to the preservation of linguistic heritage and to the construction of a modernity rooted in our national languages. The challenge is great, but it carries hope: that of seeing Wolof continue to evolve, to grow richer, and to occupy a legitimate place in the scientific and educational fields.

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