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Numeral Formation in Ígálâ: Morphological Structure, Arithmetic Logic, and Typological Insights

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Abstract

This paper offers the first detailed typological account of the numeral system of Ígálâ, a West Benue-Congo language of Nigeria, addressing a longstanding gap in descriptive and comparative research. Drawing

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on native-speaker data, elicitation, and textual sources, the study shows how Ígálâ encodes arithmetic through systematically organized morphological and syntactic processes. Numerals up to ten have distinct lexical forms, while eleven to nineteen follow a quasi-decimal additive pattern. From twenty upward, the system is fundamentally vigesimal, with higher numerals constructed through multiplication anchored on twenty and fifty, and extended by additive combinations and recursive stacking. The vigesimal optimum, which caps multiplication at nineteen, yields forms that are both cognitively transparent and typologically coherent. Borrowed items from Hausa and English occur mainly in monetary contexts and remain structurally peripheral. Overall, the Ígálâ evidence not only affirms the vigesimal base as the organizing principle of the system but also sharpens our understanding of Greenbergian universals, showing how high-before-low ordering can be maintained with unusual consistency across operations. The system is thus both theoretically significant for crosslinguistic models of numeral typology and practically relevant for orthographic standardization and language pedagogy.

Keywords: Ígálâ language, numeral system, vigesimal base, numeral morphology, West Benue-Congo

1. The Concept of a Numeral System

A numeral system comprises a language's counting words and the rules governing their formation (Trask 1997). Hammarström (2010) describes numerals as conventional spoken forms that denote exact quantities across object types and social contexts, shared by the entire speech community. Numerals function as cardinals, ordinals, nominals, and sequence markers (Corver et al. 2007), and their recursive morphology can in principle generate infinite values (Booij 2010).

Cross-linguistically, numeral systems are self-contained yet systematic components of grammar (Hurford 1999), structured around base

values and operations such as addition and multiplication (Welmers 1974). While many emerge from embodied practices like finger-counting, others extend into abstract domains of measure and time (Payne 1997, Omachonu 2011). This study describes the morphological structure of the Ígálâ numeral system and situates it within broader typologies. As a West Benue-Congo language closely related to Yoruba and Itsekiri (Akinkugbe 1976, Capo 1989), Ígálâ exemplifies both a coherent internal logic and the cultural reasoning encoded in number words.

2. A Cross-Linguistic Exploration of Numeral Systems

Cross-linguistic research shows both diversity and convergence in numeral systems, which encode arithmetic operations, morphosyntax, and cultural conventions. In West Africa, Welmers (1974) highlights multiplicative constructions in Akan, where *íná* “and” marks addition, and the highly vigesimal Yoruba system, which combines additive, subtractive, and multiplicative strategies (e.g., seventy-five = four twenties minus five), with higher bases such as 200 and 400. Comparable strategies occur elsewhere: French retains vigesimal remnants (*quatre-vingt-dix* ‘90’), Latin employs subtraction (*undecim* ‘11’), Yukatek Maya builds on powers of twenty, and Nuuchahnulth mixes decimal and vigesimal forms while allowing numeral incorporation into verbs. Typological surveys (Hurford 1975, Gvozdanović 1999, Haspelmath et al. 2005, Stonham 2007) show base numerals (10, 20, 60) as universal anchors shaped by cognition and culture. Against this backdrop, Ígálâ stands out for its coherent

vigesimal-multiplicative logic, where base units, operations, and morphosyntax form an integrated system, enriching both West African typology and the comparative study of numerical cognition.

Yakub et al. (2021) argue that linguistic description must attend to the internal organization of categories if their communicative force is to be understood. Comrie (2020), in reassessing Greenberg's claims about numeral systems, reinforces this point by showing that while descending order is widespread, other languages display ascending (Khmer), mixed (German), and vigesimal (Welsh, Breton, French) patterns, each reflecting its own structural logic. Alphonce (2023) adds that such logics are vulnerable to language contact, as seen in the replacement of Alagwa and Burunge numerals by Swahili, which undermines intergenerational transmission. Across these studies, the principle is clear: crosslinguistic comparison must rest on the structural and functional specificities of linguistic categories, even when they are pressured by dominant lingua francas.

2.1. Literature on Ígálâ Numerals

Ígálâ is a West Benue Congo language spoken majorly in Kogi State, Nigeria by the Igala ethnic group (Ejeba 2020). Earlier works on numerals in the language (Etu 1999, Ocheja 2001) emphasize lexical reform over structural analysis, differing mainly on the form for '100' (*ólíú* vs. *íchányí*). Both overlook the vigesimal logic of the system, treating numerals as static items rather than constructions of addition, multiplication, and subtraction, a concern noted by Ekundayo (1971) and Welmers (1974). Omachonu (2011) advocates decimal reform, claiming the system "did not go beyond one thousand" (2011: 84), a ceiling inconsistent with evidence that vigesimal systems extend much higher (Hurford 1975, Haspelmath et al. 2005). While reflecting modernization concerns, such approaches risk obscuring the

coherence of the indigenous system. The present study therefore offers a descriptive account of Ígálâ numerals, analyzing their structural strategies and situating them within cross-linguistic typologies (cf. Gvozdanović 1999, Stonham 2007).

2.2. Methods in the Description of Ígálâ Numerals

Data for this study were obtained from naturally occurring speech events, supplemented by native-speaker intuition. The researcher, a native speaker of the Dekina dialect of Ígálâ, provided direct linguistic access and internal validation. Examples are presented in tabular format and analyzed through morpheme-by-morpheme glossing, in keeping with the Leipzig Convention for interlinear glossing (Max Planck Institute for Evolutionary Anthropology 2015). Glossing prioritizes morphosyntactic structure over phonological realization. Orthographic conventions follow Miachi and Armstrong (1986), with subsequent modifications proposed in Ejeba (2016). Tone is represented as high (ˊ), low (ˋ), and mid (unmarked). The study adopts a descriptive methodology, providing an overview of the Ígálâ numeral system and examining its morphological and grammatical strategies for encoding numerical relations.

3. The Ígálâ Numeral System

As noted in Section 2, numeral systems vary cross-linguistically in base structures and grammatical strategies. In traditional Ígálâ society, where counting needs were modest, devices such as finger-counting, twigs, kola nuts, or cowries sufficed. Larger quantities were often expressed metaphorically, as in *ilè fíá tẹ* “a mammoth crowd,” literally

“the world scattered in place,” *ùjẹnwu lẹ ómi lẹ ẹkẹtẹ* “more than enough food,” literally “food rained water rained and sand,” or *ókó gwúṣọ gwúṣọ* “an exceedingly large sum of money,” literally “nonsense nonsense money.”

Such strategies met the needs of a subsistence economy, but modern contexts demand greater numerical precision. This raises a typological question: is the Ígálâ system merely a rudimentary tool for basic arithmetic, or a structurally complex system that integrates decimal and vigesimal logics? This study answers by presenting a paradigm of Ígálâ numerals from zero to indefinitely large values, tracing additive, multiplicative, and subtractive strategies, examining borrowing, and situating the system within broader cognitive and typological frameworks. The analysis shows the system to be not only arithmetically robust but also structurally coherent and culturally significant.

Ígálâ numerals are organized through the interplay of additive, multiplicative, and subtractive principles, with base-10 and base-20 interacting in systematic ways. Table 1 presents the paradigm from 0 to 1,000 (and beyond), illustrating both morphological composition and semantic logic.

Table 1. Paradigm of Ígálâ Numerals (0–10,000)

Numeral	Expression	Literal Breakdown	Notes
0	<i>òfo</i>	Zero	Also means “nullity, emptiness”
1	<i>ényẹ, òkâ, òké</i>	1	Variant forms
2	<i>ẹ̀jì</i>	2	With prefix: <i>òkémọ̀ẹ̀jì</i>

3	<i>èta</i>	3	With prefix: <i>òkémóèta</i>
4	<i>èlè</i>	4	With prefix: <i>òkémóèlè</i>
5	<i>èlú</i>	5	With prefix: <i>òkémóèlú</i>
6	<i>èfà</i>	6	With prefix: <i>òkémóèfà</i>
7	<i>èbie</i>	7	With prefix: <i>òkémóèbie</i>
8	<i>èjọ</i>	8	With prefix: <i>òkémóèjọ</i>
9	<i>èlá</i>	9	With prefix: <i>òkémóèlá</i>
10	<i>ègwá</i>	10	With prefix: <i>òkémóègwá</i>
11	<i>ègwáòkà</i>	10 + 1	With prefix: <i>òkémóègwáòkà</i> or <i>ègwányúòké</i> is a possible alternative
12	<i>ègwáèjì</i>	10 + 2	With prefix: <i>òkémóègwáèjì</i> or <i>ègwányúòkémóèjì</i> is a possible alternative
19	<i>ègwáèlà</i>	10 + 9	With prefix: <i>òkémóègwáèlà</i> or

			<i>ègwányúòkémòèlà</i> is a possible alternative
20	<i>ógwú</i>	20	Lexicalized base-20 form (cf. <i>ògbò</i>)
21	<i>ógwúnyúòké</i>	$20 + 1$	—
22	<i>ógwúnyúòkémòèjì</i>	$20 + 2$	—
29	<i>ógwúnyúòkémòèlà</i>	$20 + 9$	—
30	<i>ógwùègwá</i>	$20 + 10$	<i>ógwúnyúòkémòègwá</i> is a possible alternative
40	<i>ògbòmòèjì</i>	20×2	—
50	<i>óje</i>	50	Lexicalized base-50 form (cf. <i>ólí</i>)
60	<i>ògbòmòèta</i>	20×3	—
70	<i>ògbòmòètaègwá</i>	$(20 \times 3) + 10$	—
80	<i>ògbòmòèlè</i>	20×4	—
90	<i>ògbòmòèlèègwá</i>	$(20 \times 4) + 10$	—
100	<i>ògbòmòèlù/</i> <i>ólimòèjì</i>	$(20 \times 5) /$ (50×2)	Dual base strategy
200	<i>ògwáókò/</i> <i>ògbòmòègwá/</i> <i>ólimòèlè</i>	$(20 \times 10) /$ (50×4)	Multiple forms
300	<i>ólimòèfà</i>	50×6	—

400	<i>úluókó/ ólimòèjọ</i>	400 / (50 × 8)	Lexicalized and multiplicative
500	<i>ólimòègwá</i>	50 × 10	—
600	<i>úlúógwǎ / ólimòègwáèjì</i>	400 + 200 / 50 × 12	Mixed strategy
700	<i>ólimòègwáèlẹ</i>	50 × 14	—
800	<i>íchámû / ólimòègwáèfà</i>	800 / 50 × 16	Lexicalized and multiplicative
900	<i>ólimòègwáèjọ</i>	50 × 18	—
1,000	<i>íchámûnyúògwáókó</i>	800 + 200	Additive
1,001	<i>íchámûnyúògwáókó nyúòké</i>	1,000 + 1	—
1,010	<i>íchámûnyúògwáókó nyú(òkémó)ègwá</i>	1,000 + 10	—
1,020	<i>íchámûnyúògwáókó nyúógwú</i>	1,000 + 20	—
1,100	<i>íchámûnyúògwáókó nyúògbòmòèlú</i>	1,000 + 100	—
1,200	<i>íchámûnyúògwáókó nyúògwáókó</i>	1,000 + 200	—
2,000	<i>íchámûnyúògwáókó mòèjì</i>	1,000 × 2	Multiplicative
10,000	<i>íchámûnyúògwáókó mòègwá</i>	1,000 × 10	Multiplicative

The Ígálâ numeral system follows a quasi-decimal pattern from 1–19, with values above 10 formed additively (e.g., *ègwáǎkâ* ‘10 + 1’). From 20, it shifts to a vigesimal base (*ògbòmóèjì* ‘20 × 2 = 40’), while a quinquagenary element (*óli* ‘50’) introduces a hybrid vigesimal–quinary structure. Lexicalized forms for single units (*ógwú* ‘20,’ *óje* ‘50’) differ from the multiplicative bases (*ògbò* ‘20,’ *óli* ‘50’), showing functional specialization; thus, 100 is expressed as *ólímóèjì* ‘50 × 2.’ Numerals beyond 1,000 extend recursively through addition and multiplication (e.g., *íchámúnyúògwáókó* ‘800 + 200’), reflecting structural economy and cultural arithmetic ingenuity.

3.1. Morphological Structure of Ígálâ Numeral

The Ígálâ numeral system comprises distinct lexical items for the numbers zero through ten, which serve as the foundational counting units as in (1).

(1) Unit Expressions in Numerals 0–10

Numeral	Ígálâ Expression
0	<i>òfo</i>
1	<i>ényé, ókâ</i>
2	<i>èjì</i>
3	<i>èta</i>
4	<i>èlè</i>
5	<i>èlú</i>
6	<i>èfà</i>
7	<i>èbie</i>
8	<i>èjọ</i>
9	<i>èlá</i>
10	<i>ègwá</i>

Beyond these basic units, Ígálâ employs specialized lexical forms that serve as higher counting anchors as illustrated in (2).

(2) Specialized Lexical Numerals

Numeral	Ígálâ Expression
20	<i>ógwú</i>
50	<i>óje</i>
200	<i>ògwá(ókó)</i>
400	<i>úlú(ókó)</i>
800	<i>íchámû</i>

These lexical bases form the backbone of the Ígálâ numeral system. The morpheme *ókó* “money, unit of value” grammaticalized from trade and commercial contexts into general counting, while *úlú* “four hundred” originates from agrarian usage, literally meaning “seed” and subsequently extended to countable large quantities. Higher numerals are then systematically constructed through functional morphemes that encode arithmetic operations, producing a fully productive number grammar as shown in (3).

(3) Functional Morphemes

Morpheme	Role	Meaning
<i>òké/ówó</i>	unit-score	“one, unit”
<i>nyú</i>	additive	“plus”
<i>mó</i>	multiplicative	“times”
<i>chí</i>	subtractive	“minus”

The discussion in Sections 3.2–3.4 will therefore demonstrate how lexical anchors and grammatical operators interact to yield additive, multiplicative, and subtractive constructions, while further situating

these processes within the broader dynamics of borrowing and contact that characterize the modern Ígálâ numeral system.

3.2. Addition in the Ígálâ Numeral System

Additive constructions in Ígálâ operate across three structural zones: (i) simple juxtaposition up to nineteen, (ii) templatic addition with *ny(ú)òkè(mó)/ny(ú)ówó(mó)* for units following higher bases, and (iii) free addition with *nyú* beyond nineteen.

3.2.1. Simple Juxtaposition (1–19)

Numerals from eleven to nineteen are formed by directly combining *ègwá* ‘10’ with a unit. Alternatively, these values may also be expressed through templatic addition, reflecting the treatment of 1–9 as units within the quasi-decimal structure (4).

(4) Simple Juxtaposition in Numerals 11–20

Numeral	Ígálâ Expression	Structure	Alternative Expression
11	<i>ègwá(ò)kâ</i>	10 + 1	<i>ègwány(ú)òkè</i>
12	<i>ègw(á)èjì</i>	10 + 2	<i>ègwány(ú)òkém(ó)èjì</i>
19	<i>ègw(á)èlâ</i>	10 + 9	<i>ègwány(ú)òkém(ó)èlâ</i>
20	<i>ógwú</i>	lexical numeral	–

This direct juxtaposition is confined to the first cycle of addition but reappears in forms such as *ógw(ú)ègwá* ‘30,’ where it functions as an idiomatic, lexicalized choice. By contrast, the templatic form *ógwíny(ú)òkém(ó)ègwá* (‘20 + 10 units’) represents a more transparent, compositional strategy.

3.2.2. Templatic Addition for Units after Higher Bases

From twenty upward, additive constructions require the *ny(ú)òké(mó)* or *ny(ú)ówó(mó)* template, the latter metaphorically invoking fingers as counting units. With *ówó* “one,” the morpheme *mó* is omitted, giving *ny(ú)òké* or *ny(ú)ówó(ò)ká*, as shown in (5).

(5) Adding ‘one’ to Higher Bases

Numeral	Expression	Structure
21	<i>ógwúny(ú)òké/ógwúny(ú)ówó(ò)ká</i>	20 + 1
31	<i>ógwúègwány(ú)òké</i>	(20 + 10) + 1
1,001	<i>ichámũny(ú)ògwáókony(ú)òké</i>	(800 + 200) + 1

For numerals above one, the full template with *mó* is obligatory, as illustrated in (6).

(6) Adding more than ‘one’ to Higher Bases

Numeral	Expression	Structure
22	<i>ógwúny(ú)òkémóèjì</i>	20 + 2
29	<i>ógwúny(ú)òkémóèlá</i>	20 + 9
32	<i>ógwúègwány(ú)òkémóèjì</i>	(20 + 10) + 2
111	<i>ògbòmóèlíny(ú)òkémóègwá(ò)ká</i>	(20 × 5) + (10 + 1)

Thus, *òké/ówó* anchor lower numerals as atomic units, giving way to the bare additive *nyú* as the principal mechanism for constructing higher numbers.

3.2.3. Adding Beyond 19: Free *nyú*

For numerals above nineteen, only the bare additive *nyú* is grammatical, as extensions of the *òké/ówó* template produce ill-formed expressions as shown in (7).

(7) Grammatical vs. ungrammatical addition beyond 19

Numeral	Expression	Notes
1,050	<i>íchámûny(ú)ògwáókony(ú)óje</i>	$800 + 200 + 50$
*	<i>*íchámûny(ú) ... ny(ú)òkémóóje</i>	ungrammatical

Here, *nyú* alone sustains productive addition with higher bases.

3.3. Multiplication in the Ígálâ Numeral System

Multiplication in Ígálâ is expressed through the morpheme *mó* “times” and by templatic strategies at various base thresholds. These strategies extend the system from single units up to billions and beyond. Multiplicative productivity is bounded at each base, reflecting both cognitive economy and cultural arithmetic conventions.

3.3.1. Multiplication in Base-1: *òkémó*

At the lowest tier, multiplication is expressed by the template *òkémó X* (‘ $1 \times X$ ’), where *òké* “unit” functions as the immutable base and numerals 1–19 serve as multipliers. Within this range, *mó* merely marks the pattern and signals the multiplicative structure without producing additional semantic content. Multiplication in Base-1 extends from 1 up to 19 and terminates; attempts to extend it to higher numerals (e.g., *ègwá mó èjì* = 10×2) are ungrammatical, illustrating the first structural ceiling in the system (Table 2).

Table 2. Base-1 Multiplication and Blocked Extensio

Expression	Structure	Status	Notes
<i>òkémó èjì</i>	1×2	Grammatical	Base-1 multiplication allowed
<i>òkémó ègwá</i>	1×10	Grammatical	Base-1 multiplication allowed
<i>*òkémó ógwú</i>	1×20	Ungrammatical	Base-1 multiplication blocked
<i>*ègwá mó ètá</i>	10×3	Ungrammatical	Base-10 multiplication blocked

This blocking principle motivates the shift to Base-20 (*ògbò*) for higher numerals.

3.3.2. Higher Multiplication: Base-20 and Base-50 Templates

Beyond 19, larger numerals are constructed using Base-20 (*ògbò*) and Base-50 (*ólí*) templates, supplemented by additive blends and lexical anchors. Base-20 multiplication (*ògbòmó X*) is productive up to 380 (20×19), the vigesimal optimum, which marks the structural ceiling of regular vigesimal computation. Additive constructions fill intermediate gaps, e.g., $30 = \text{ógwú ègwá}$, $70 = \text{ògbòmó èta ègwá}$.

Certain numerals are lexicalized: $50 = \text{óje}$, $200 = \text{ògwáókò}$, and $400 = \text{úluókò}$, with 200 also appearing transparently as *ògbòmóègwá* (20×10). From 400 onward, Base-50 multiplication (*ólimó X*) extends up to 950 (50×19), mirroring the vigesimal optimum, but it competes with vigesimal templates, additive blends, and lexical forms. Lexical forms dominate conventional usage, while templates provide

arithmetically transparent alternatives (Table 3).

Table 3. Higher Numerals in Ígálâ: Base-20 and Base-50 Multiplication

Numeral	Expression	Structure	Notes/Strategy/ Foreshadowing
50	<i>óje</i>	Lexical form	Quinquagenary innovation
100	<i>ògbòmó èlú / ólímó èjì</i>	$20 \times 5 /$ 50×2	Alternative templatic forms; early Base-50 usage foreshadows vigesimal limits
200	<i>ògwáókò / ólímó èlẹ̀</i>	Lexical / 50×4	Free variation; Base-50 mirrors vigesimal optimum
380	<i>ògbòmó ègwáèlá</i>	20×19	Vigesimal optimum
400	<i>úlúókò / ólímó èjọ̀</i>	Lexical / 50×8	Coexisting strategies; continues vigesimal ceiling analogy
600	<i>úlúógwǎ / ólímó ègwá èjì</i>	Blended lexical / 50×12	Lexical blend preferred; Base-50 templates transparent
800	<i>íchámû / ólímó ègwá èfà</i>	Lexical / 50×16	Lexical anchor dominates
950	<i>ólímó ègwá èlá</i>	50×19	Base-50 maximum; mirrors vigesimal ceiling
1,000	<i>íchámû nyú ògwáókò</i>	$800 + 200$	Additive composition; multiplication blocked

3.3.3. Multiplication at Higher Thresholds: Recursive and Juxtaposed Strategies

At the threshold of the thousands, Ígálâ reactivates explicit *mó*-based multiplication, which had receded in the mid-range cycles. For example, 2,000 is expressed as *íchámû nyú ògwáókómó èjì* ($1,000 \times 2$), and 19,000 as *íchámû nyú ògwáókómó ègwàèlâ* ($1,000 \times 19$). Here, the multiplicative marker *mó* resumes its full arithmetic function, contrasting with lexical anchors and blends in mid-range numerals.

The vigesimal optimum continues to function as a structural ceiling in the Ígálâ numeral system, with *mó*-based multiplication productive only up to 19,000. Beyond this point, the system shifts from overt *mó* marking to a strategy of juxtaposing free numerals and employing recursive compounding. For instance, 20,000 is expressed as *íchámû nyú ògwáókò ógwú* ($1,000 \times 20$), while 1,000,000 is formed as *íchámû nyú ògwáókò íchámû nyú ògwáókò* ($1,000 \times 1,000$), illustrating how higher numbers are systematically generated without extending the explicit multiplicative marker beyond the vigesimal threshold.

This recursive architecture allows indefinite extension: higher numerals are built by stacking lower anchors in strict descending order, with lexicalization, blending, and template strategies providing systematic, complementary mechanisms (Table 4).

Table 4. Higher Threshold Multiplication and Recursion in Ígálâ

Numeral	Expression	Structure	Strategy/Notes
2,000	<i>íchámû nyú ògwáókómó èjì</i>	$1,000 \times 2$	<i>mó</i> -based multiplication (productive ≤ 19)
5,000	<i>íchámû nyú ògwáókómó èlú</i>	$1,000 \times 5$	<i>mó</i> -based multiplication
10,000	<i>íchámû nyú ògwáókómó ègwá</i>	$1,000 \times 10$	<i>mó</i> -based multiplication
19,000	<i>íchámû nyú ògwáókómó ègwáèlá</i>	$1,000 \times 19$	Vigesimal ceiling reached; <i>mó</i> -based multiplication terminates
20,000	<i>íchámû nyú ògwáókó ógwú</i>	$1,000 \times 20$	Shift to juxtaposition; multiplication marker blocked
50,000	<i>íchámû nyú ògwáókó óje</i>	$1,000 \times 50$	Juxtaposition with lexical Base-50 anchor
100,000	<i>íchámû nyú ògwáókó ólimó èjì</i>	$1,000 \times 100$ (via 50×2)	Juxtaposition of anchors; arithmetic transparent
1,000,000	<i>íchámû nyú ògwáókó íchámû nyú ògwáókó</i>	$1,000 \times$ $1,000$	Recursive stacking of lower anchors

10,000,000	<i>íchámû nyú ògwáókọ íchámû nyú ògwáókọ mòègwá</i>	$(1,000 \times 1,000) \times 10$	Recursion + localized <i>mó</i> marking
1,000,000,000	<i>íchámû nyú ògwáókọ íchámû nyú ògwáókọ íchámû nyú ògwáókọ</i>	$1,000 \times 1,000 \times 1,000$	Recursive compounding; no new lexical anchors

3.4. Subtraction in Ígálâ Numeral System

Building on the additive and multiplicative architecture, subtraction in Ígálâ is structurally simpler but functionally narrower, largely restricted to monetary and transactional contexts. The key marker is the morpheme *chí* “pluck,” which conceptualizes subtraction as the removal of a part from a whole. Its fixed syntactic template is:

(8) [Higher Numeral] + *chí* + [Lower Numeral]

Subtraction ensures clarity and structural transparency, as illustrated in (9).

(9) Subtraction in Numerals

Ígálâ Expression	Literal Meaning	Value
<i>ògbòm(ó)èlè chí èta</i>	eighty minus three	77
<i>ògbòm(ó)èlú chí èlú</i>	one hundred minus five	95
<i>ólim(ó)èta chí èlè</i>	one hundred and fifty minus four	146
<i>ichámù nyú ògwáókọ chí èlá</i>	one thousand minus nine	991
<i>ògbòm(ó)ègwá chí óje</i>	two hundred minus fifty	150

Subtractive constructions are morphologically uniform and allow flexible combinations of minuends and subtrahends. However, they are cognitively more demanding than addition or multiplication, since the base must first be computed (e.g., 100 as 20×5) before subtraction is applied. Communicatively, the unpredictability of subtrahends further limits routine use.

Notably, subtraction does not conform to the vigesimal optimum (19) that governs productive multiplication. There is no ceiling on the size of either minuend or subtrahend; any higher numeral can be reduced by any smaller numeral. This contrasts with addition and multiplication, where the vigesimal optimum constrains productive combinations. Despite this, subtraction fully respects the hierarchical top-down ordering: the minuend (higher numeral) always precedes the subtrahend (lower numeral), consistent with the structural transparency of the Ígálâ numeral system.

Conceptually, the minuend precedes the subtrahend, in contrast to Latin-style ‘one from ten’ constructions, reflecting a distinct, transparent mapping of subtractive reasoning that aligns with the hierarchical and metrical architecture of the numeral system.

3.5. The Vigesimal Optimum as a Unifying Principle of the Ígálâ Numeral System

A defining feature of the Ígálâ numeral system is the vigesimal

optimum (19), which sets a ceiling for productive multiplication across all arithmetic cycles. At the unit level, nineteen marks the upper limit of simple lexical items (*ègwàèlâ* = 19). In the vigesimal cycle, multiplication extends up to $20 \times 19 = 380$ (*ògbòmó ègwàèlâ*), while in the quinquagenary cycle, it reaches $50 \times 19 = 950$ (*ólimó ègwàèlâ*). In the thousands, *mó*-based multiplication operates from $1,000 \times 2$ up to $1,000 \times 19 = 19,000$ (*íchámû nyú ògwáókómó ègwàèlâ*). Beyond this ceiling, multiplication via *mó* is blocked, and higher numerals are expressed through *nyú*-mediated addition, lexical blends, or juxtaposition, as in $20,000 = íchámûnyúògwáókò ógwú$ or $1,000,000 = íchámûnyúògwáókò íchámûnyúògwáókò$, illustrating recursive stacking of anchors.

While the vigesimal optimum governs multiplication, subtraction operates independently. Any higher numeral can serve as minuend or subtrahend without restriction by 19, highlighting that subtraction is a specialized operator rather than a fully integrated arithmetic cycle.

3.6. Hierarchical Ordering and Operator Architecture

This study confirms Comrie's (2020) claim that Greenberg's ordering universals should be treated as tendencies rather than absolutes. Crosslinguistically, languages such as Sakalava Malagasy and Insular Celtic show ordered shifts at structural cut-off points (e.g., 20, 60, 100), demonstrating that high-before-low ordering, though globally dominant, is not inviolable. Ígálâ, however, provides a counterweight within this spectrum: it exemplifies a strict descending system in which higher numerals consistently precede lower ones, without cut-off reversals or mixed strategies.

Grounded in the vigesimal optimum (19), Ígálâ organizes its numerals through a hierarchical template with dual operators: *nyú* marking additive or juxtaposed combinations and *mó* marking multiplicative

scaling. Additive forms like *ègwá(ò)ká* ‘11’ ($10 + 1$) contrast with the ungrammatical reversed *òkáègwá*. Multiplicative constructions (*ògwùègwá* ‘30’ = $20 + 10$; *ùlùòègwá* ‘600’ = $400 + 200$) maintain the descending order that Celtic systems, by contrast, relax after 20. Even subtraction (*ògbòm(ò)èlú chí èlú* ‘95’ = $(20 \times 5) - 5$) adheres to the same hierarchy, where Malagasy often permits alternative structuring.

Large numerals extend the same logic. Multiplication is capped by the vigesimal ceiling, after which juxtaposition applies, as in *íchámû nyú ògwáókómó ègwàèlâ* ‘19,000’ ($1,000 + 20 \times 19$) and *íchámû nyú ògwáókò ógwú* ‘21,000’ ($1,000 + 20,000$). The generalized Ígálâ template can be schematized as follows:

- (10) [HIGHER NUMERAL] (+ nyú [HIGHER NUMERAL])
 (+ mó [LOWER NUMERAL]) (+ chí [LOWER NUMERAL]).

By maintaining recursive, transparent, and typologically coherent structures across all operations, Ígálâ buttresses Comrie’s crosslinguistic claim foreshadowed in Rutkowski (2003): even where universals admit exceptions, the high-before-low principle exerts strong gravitational force on numeral systems. Ígálâ thus provides a ‘purist’ case that sharpens our understanding of how robust tendencies manifest alongside controlled variability in the world’s numeral architectures.

3.7. Borrowing in the Ígálâ Numeral System

Borrowed numerals in Ígálâ reflect layered sociohistorical contact, including British colonial administration, Hausa trade, and contemporary English influence. These forms are functionally restricted, appearing almost exclusively in monetary contexts and rarely extending to general counting. From British currency, the term *ípámû* ‘pound’ persisted well beyond Nigeria’s 1973 reform, with constructions like

ipámú mọ̀ èlú (“pound times five” = ₦10) showing how colonial-era forms were arithmetically adapted to the naira. Hausa influence contributed *èjika* (from *jẹka*, “bag”) for ₦200, especially in bulk trade (e.g., *èjika mọ̀ ègwá* = ₦2,000). As Oyinloye (2020) notes, loanwords, a universal outcome of language contact, are not simple transfers but are reshaped by the structural preferences of the borrowing language. Beyond phonological accommodation, an Ígálâ calque *àkpúlù* “sack” appears alongside the Hausa form for “two hundred,” further illustrating this internal logic. More recently, English exerts pressure through code-switching, as urban youth increasingly use “two hundred naira” instead of indigenous *èjika (ò)kâ*.

Such items exemplify Hammarström’s (2010) notion of a restricted numeral system: domain-specific, communicatively efficient, but structurally peripheral. While borrowed forms enhance clarity in monetary discourse, their spread threatens the integrity of Ígálâ’s indigenous numeral architecture. In this respect, Ígálâ resonates with broader typological concerns raised by Alphonse (2023) on the Cushitic languages Alagwa and Burunge, where Swahili contact has progressively displaced native numeral systems and curtailed intergenerational transmission. The difference lies in scale: whereas Alagwa and Burunge face wholesale replacement, Ígálâ demonstrates a reasonable containment strategy in which borrowed forms are integrated and functionally narrowed, though not without long-term risks.

4. Conclusion

This study has shown that the Ígálâ numeral system, though displaying a limited decimal arrangement in the lower range (‘one’ to

‘nineteen’), is best characterised as vigesimal. Counting in twenties is the generative base, with fifties reducible to twenties but not the reverse, confirming Omachonu’s (2011) analysis. Within this framework, Ígálâ exemplifies a strict high-before-low ordering: higher numerals consistently precede lower ones across addition, multiplication, subtraction, and large-number constructions. Through the dual operators *nyú* (additive juxtaposition) and *mó* (multiplicative scaling), the system maintains recursive and transparent structures. In contrast to systems like Sakalava Malagasy and Insular Celtic, which show ordering reversals at cut-off points, Ígálâ stands as a ‘purist’ case of crosslinguistic tendencies, reinforcing Comrie’s (2020) view of Greenberg’s universals as strong but non-absolute principles.

Borrowed forms from trade and colonial contact exist, but they are peripheral and largely confined to monetary discourse, leaving the core architecture intact. This resilience underscores the adaptability of Ígálâ numerals in accommodating contact-induced items without compromising structural integrity. More broadly, Ígálâ contributes to typological debates by showing how robust ordering principles and vigesimal logic persist even in contact-rich settings. It thus offers a valuable test case for future comparative and diachronic research on numeral systems under conditions of variability and exchange.

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