

A Comparative Analysis of Counting Systems in Goidelic and Brythonic Celtic Languages

Vishrut Mehrotra (student)^{1*}

1. Indus International School, Billapura Cross, Sarjapur, Bangalore, Karnataka, 562125, India

* Corresponding author email: vishrut.mehrotra@icloud.com

Abstract

This study is a comparative analysis of the counting systems within the Goidelic and Brythonic branches of the Celtic languages, an Indo-European family comprising six extant languages. While Irish, Manx, and Scottish Gaelic constitute the Goidelic branch, Welsh, Cornish, and Breton form the Brythonic branch. Despite their common Proto-Celtic origins, these languages have evolved distinct features over time, influenced by historical migrations nearby cultures. This analysis aims to highlight the similarities and differences in the numeral systems of these 6 languages as well as their salient features.

Keywords

Keyword 1 Linguistics; Keyword 2 Number Systems; Keyword 3 Celtic Languages; Keyword 4 Comparative Analysis; Keyword 5 Goidelic Languages; Keyword 6 Brythonic Languages.

Introduction

The Celtic languages, members of the Indo-European family, comprise by six extant languages—Irish, Manx, and Scottish Gaelic which form the Goidelic branch, and Welsh, Cornish, and Breton which comprise the Brythonic branch (**Ball**) (**MacAulay**). Historically, these languages enjoyed widespread usage across the British Isles and the northwestern coast of France. Today however, of all the Celtic tongues, only Irish holds the distinction of being an official language of an independent nation, Ireland, and was also the 21st officially working language by the European Union in 2007 (**Hoyte-West**).

The Brythonic languages as well as the Goidelic languages trace their origins to early Celtic migrations, leading to the spread of the Brythonic languages across southern Scotland, Wales, Cornwall, and Brittany (**Jackson**). The migration of Brittonic people to the Armorican peninsula (Brittany) and the subsequent development of the Breton language are attributed to the influx of Anglo-Saxons to the British Isles. Meanwhile, Goidelic languages took root primarily in Ireland before being diffused to the Isle of Man and Scotland (**McEvoy et al.**).

The Goidelic and Brythonic Celtic languages exhibit a significant linguistic divergence stemming from their Proto-Celtic origins. Goidelic languages like Irish, Scottish Gaelic, and Manx are classified as Q-Celtic due to their retention of the Proto-Celtic *k^w phoneme, represented by a 'k' sound. In contrast, Brythonic languages such as Welsh, Breton, and Cornish are categorized as P-Celtic, characterized by the transformation of the *k^w sound into 'p'.

Both Brythonic and Goidelic language groups exhibit unique features, such as initial consonant mutations. These initial mutations involve word-initial or morpheme-initial consonant changes under the influence of a preceding word or morpheme. (**Willis**). Additionally, both language families demonstrate similar tendencies in their use of the verbal noun or infinitive constructions, wherein the verbal noun can perform the function of a finite verb. (**Fowkes**). Both groups also share a common lexical heritage with words of non-Indo-European origin found only in Brythonic and Goidelic (**Mikhailova**).

In addition, Goidelic and Brythonic branches exhibit nuanced similarities and differences in their counting systems, encompassing not just cardinal numbers but also ordinals. Despite

both branches sharing a base-20 counting system (vigesimal), their syntax and morphology exhibit differences. While there has been some exploration of the differences and similarities between these two branches in other fields, research into how numbers are expressed in these languages is limited. This comparative analysis of counting systems in Goidelic and Brythonic languages aims to unravel this and highlight each system's distinguishing features.

Cardinal Numbers in Goidelic Languages

Number	Irish (Gaeilge)	Scottish Gaelic (Gàidhlig)	Manx (Gaelg)
1	a haon	aon	nane
2	a dó	dhà	jees
3	a trí	trì	tree
4	a ceathair	ceithir	kiare
5	a cúig	còig	queig
6	a sé	sia	shey
7	a seacht	seachd	shiaght
8	a hocht	ochd	hoght
9	a naoi	naoi	nuy
10	a deich	deich	jeih
11	a haon déag	aon deug	nane-jeig
12	a dó dhéag	dhà dheug	daa-yeig
13	a trí déag	trì deug	tree-jeig
20	fiche	fichead	feed
21	fiche a haon	fichead 's a h-aon	feed nane
22	fiche a dó	fichead 's a dhà	feed jees
23	fiche a trí	fichead 's a trì	feed tree
30	tríocha, fiche a deich	trithead, deich air fhichead	treead, jeig as feed
40	daichead, dhá fhichead)	ceathrad, dà fhichead	daeed
50	caoga, dhá fhichead a deich	caogad, leth-cheud	queigad, jeig as daeed

60	seasca, trí fichid	seasgad, trí fichead	sheyad, tree feed
70	seachtó, trí fichid a deich	seachdad, trí fichead 's a deich	shiaghtad, tree feed as jeih
80	ochtó, ceithre fichid	ochdad, ceithir fichead	hoghtad, kiare feed
90	nócha, ceithre fichid a deich	naochad, ceithir fichead 's a deich	nuyad, kiare feed as jeig
100	céad	ceud	keead
200	dhá chéad	dà cheud	daa cheead
400	ceithre chéad	ceithir ceud	kiare keead
800	ocht gcéad	ochd ceud	hoght keead
1000	míle	míle	thousane

Adapted from Omniglot

Cardinal Numbers in Byrthonic Languages

Number	Irish (Gaeilge)	Scottish Gaelic (Gàidhlig)	Manx (Gaelg)
Number	Welsh (Cymraeg)	Cornish (Kernewek)	Breton (Brezhoneg)
1	un (M) / un (F)	onan (M) / unn (F)	unan (M) / unan (F)
2	dau (M) / dwy (F)	dew (M) / diw (F)	daou (M) / div (F)
3	tri (M) / tair (F)	tri (M/F)	tri (M) / teir (F)
4	pedwar (M) / pedair (F)	peswar (M) / peswar (F)	pevar (M) / peder (F)
5	pump	pymp	pemp
6	chwech	hwegh	c'hwec'h
7	saith	seyth	seizh
8	wyth	eth	eizh
9	naw	naw	nav
10	deg	deg	dek
11	un ar ddeg	unnek	unnek
12	deuddeg	dewdhek	daouzek

13	tri ar ddeg	tredhek	trizek
20	ugain	ugens	ugent
21	un ar hugain	onan warn ugens	unan warn ugent
22	dau ar hugain	dew warn ugens	daou warn ugent
23	tri ar hugain	tri warn ugens	tri warn ugent
30	tri deg, deg ar hugain	tregens	tregont
40	pedwar deg, deugain	dew ugens	daou-ugent
50	hanner cant, deg a deugain	hanter kans	hanter-kant
60	chwe deg, trigain	tri ugens	tri-ugent
70	saith deg, deg a thrigain	dek ha tri ugens	dek ha tri-ugent
80	wyth deg, pedwar ugain	peswar ugens	pevar-ugent
90	naw deg, deg a phedwar ugain	dek ha peswar ugens	dek ha pevar-ugent
100	cant	kans	kant
200	dau gant	dew kans	daou c'hant
400	pedwar cant	peswar kans	pevar c'hant
800	wyth cant	eth kans	eizh kant
1000	mil	mil	mil

Adapted from Omniglot

Comparison Between Goidelic and Brythonic Cardinal Systems

Base Systems

Goidelic Languages incorporate both base-10 and base-20 systems in their numerals. In Irish, for example, *fiche* (20) and *dhá fhichead* (40, literally 'two twenties') showcase the base-20 system. However 40 can also be called *daichead* in the base-10 system. In Scottish Gaelic, 50 can be called *caogad* as well as *leth-cheud* (literally 'half hundred').

On the other hand, Brythonic languages such as Cornish and Breton predominantly use a vigesimal (base-20) system for counting. For example, 60 in Cornish and Breton is *tri ugens*

and tri-urgent (literally 'three twenties') respectively. Welsh, while historically vigesimal, now frequently uses a decimal system, especially in formal and educational contexts, making it an exception within the Brythonic branch. In Welsh, 50 is both *hanner cant* (literally, 'half hundred') and *deg a deugain* (literally, 'ten and forty'), showcasing both a decimal and vigesimal system.

Morphological Similarities

Within each branch, numbers share morphological similarities:

- The number 1 in Irish (*a haon*), Scottish Gaelic (*aon*), and Manx (*nane*) shows clear linguistic kinship.
- The number 3 is *a trí* in Irish, *trì* in Scottish Gaelic, and *tree* in Manx.
- The number 4 across the Brythonic languages: Welsh (*pedwar* (M) / *pedair* (F)), Cornish (*peswar*), and Breton (*pevar* (M) / *peder* (F)) exhibit remarkable similarity, derived from a common Proto-Brythonic root.
- For 20, Welsh uses *ugain*, Cornish *ugens*, and Breton *ugent*.

Use of Compound Forms

Both the Goidelic and Brythonic branches of the Celtic languages exhibit the use of compound forms to construct larger numbers, especially within the vigesimal (base-20) system. For instance, in Irish, the number 65 is expressed as "*trí fichid a cúig*," which translates to "three twenties and five." This expression demonstrates how three groups of twenty are combined with an additional five. Similarly, 75 in Irish can be articulated as "*trí fichid a cúig déag*," meaning "three twenties and fifteen." Here again, the base-20 system is used to reach sixty (three twenties), and then fifteen is added on top.

The Brythonic languages, including Welsh, Cornish, and Breton, also exhibit this intricate use of compound forms for cardinal numbering. Welsh, for example, expresses 50 as "*deg wyth ar hugain*," which directly translates to "eighteen on twenty." Cornish and Breton follow a similar pattern.

Gender Variations in Numerals

A unique feature within some of these languages is the variation of numerals with gender, particularly noticeable in the Brythonic branch. For example, in Welsh, the numbers two, three, and four change form based on the gender of the noun they modify (e.g., *dau* (M) / *dwy* (F) for "two").

In Cornish, the numbers also exhibit gender variations:

- "*onan*" (masculine) / "*unn*" (feminine) for "one"
- "*dew*" (masculine) / "*diw*" (feminine) for "two"

Breton, too, shows gender distinction in its numbers:

- "*unan*" (masculine) / "*un*" (feminine) for "one"
- "*daou*" (masculine) / "*div*" (feminine) for "two"

Similar to Welsh, these variations help to match the numeral to the gender of the noun it is quantifying. This gender variation in numerals, applicable from numbers one to four, is a

distinctive feature of the Brythonic languages, that is different from the Goidelic languages, where such gender distinctions in numbers are generally not made.

Ordinal Numbers in Goidelic Languages

Number	Irish (Gaeilge)	Scottish Gaelic (Gàidhlig)	Manx (Gaelg)
1st	céad	ciad	kiad
2nd	dara	dara	nah
3rd	tríú	treas	treeoo
4th	ceathrú	ceathramh	kerroo
5th	cúigiú	còigeamh	queiggoo
6th	séú	sia(gh)amh	sheyoo
7th	seachtú	seachdamh	shiaghtoo
8th	ochtú	ochdamh	hoghtoo
9th	naoú	naoidheamh	nuyoo
10th	deichiú	deicheamh	jeihoo
11th	aonú déag	aonamh deug / h-aonamh deug	nane-jeigoo
12th	dóú déag	dàrna deug / dàrna deug	daa-yeigoo
13th	tríú déag	treasamh deug / an treasamh deug	tree-jeigoo
20th	fichiú	ficheadamh	feedoo
21st	fiche haonú	fichead 's a h-aonamh	feed as naneoo
22nd	fiche dóú	fichead 's a dhàrna	feed as daaoo
23rd	fiche tríú	fichead 's an treasamh	feed as treeoo
30th	tríochadú	tritheadamh	tree-feedoo
40th	daicheadú	dà fhicheadamh	daeedoo
50th	caogadú	caogadamh	queigadoo
60th	seascaú	seasgamh	shey-feedoo

70th	seachtóú	seachdad(ach)amh	shiaght-feedoo
80th	ochtódú	ochdad(ach)amh	hoght-feedoo
90th	nóchadú	naochadamh	nuy-feedoo
100th	céadú	ceudamh	keeadoo
200th	dhá chéadú	dà cheudamh	daa cheeadoo
400th	ceathrú céadú	ceithir ceudamh	kiare cheeadoo
800th	ochtú céadú	ochd ceudamh	hoght cheeadoo
1000th	mílítheach	mileamh	thousaneoo

Adapted from Omniglot

Ordinal Numbers in Byrthonic Languages

Number	Welsh (Cymraeg)	Cornish (Kernewek)	Breton (Brezhoneg)
1st	cyntaf	kynsa	kentañ
2nd	ail	eil	eil
3rd	trydydd	tressa	trede
4th	pedwerydd	peswora	pevare
5th	pumed	pymthek	pempvet
6th	chweched	hwetek	c'hwec'hvet
7th	seithfed	seytek	seizhvet
8th	wythfed	ethek	eizhvet
9th	nawfed	nawnsek	naved
10th	degfed	degthek	dekvvet
11th	unfed ar ddeg	unnekves	unnekvet
12th	deuddegfed	dewdhekves	daouzekvet
13th	trydydd ar ddeg	tredhekves	trizekvet
20th	ugeinfed	ugensves	ugentvet
21st	unfed ar hugain	onan warn ugensves	unan warn ugentvet
22nd	ail ar hugain	dew warn ugensves	daou warn ugentvet
23rd	trydydd ar hugain	tri warn ugensves	tri warn ugentvet

30th	degfed ar hugain	degves warn ugens	tregontvet
40th	pedwar deg deugainfed	dew ugensves	daougentvet
50th	pum deg hanner canfed	hanter kansves	hanter-kantvet
60th	chwe deg trigainfed	tri-ugensves	tri-ugentvet
70th	saith deg degfed a thrigain	degves ha tri ugens	dek ha tri-ugentvet
80th	wyth deg pedwar ugainfed	peswar-ugensves	pevar-ugentvet
90th	degfed a phedwar ugain	degves ha peswar ugens	dek ha pevar- ugentvet
100th	cantfed	kansves	kantvet
200th	dau gantfed	dew kansves	daou c'hantvet
400th	pedwar cantfed	peswar kansves	pevar c'hantvet
800th	wyth cantfed	eth kansves	eizh kantvet
1000th	milfed	milves	milvet

Adapted from Omniglot

Comparison Between Goidelic and Brythonic Ordinal Systems

Base Systems

Goidelic Languages incorporate only base-10 systems for their ordinal numbers. In Irish, for example, 30th is tríochadú in Irish, tritheadamh in Scottish, and tree-feedoo in Manx. On the other hand, Brythonic languages use both a vigesimal (base-20) system and a decimal (base-10 system) for ordinal number counting. For example, 60th in Cornish and Breton is tri-ugensves and tri-ugentvet respectively. Welsh, unlike cardinal numbers, uses a vigesimal system too. In Welsh, 70th is saith deg degfed a thrigain. However, the traditional ordinal numbers above 31 are not commonly used in colloquial Welsh.

Language-Specific Constructions

In the Goidelic languages a straightforward method is typically used, where the base number is directly combined with an ordinal indicator to form ordinals. For example, the Irish ordinal number for 11th is "aonú déag," which directly combines "aon" (one) with "déag" (ten) and an ordinal suffix "-ú." Similarly, for 12th, "dóú déag" follows the same pattern, blending "dó" (two) with "déag." In Manx, a unique suffix "-oo" is added to denote ordinality, as seen in "nane-jeigoo" for 11th, where "nane" stands for one, and "jeig" for ten.

Conversely, the Brythonic languages often employ a combination of prepositional phrases and vigesimal counting, particularly for ordinals beyond 20. This approach reflects a nuanced relationship between numerals and their linguistic context. For instance, the Welsh for 21st is "unfed ar hugain," literally translating to "first on twenty." The Cornish for 22nd, "dew warn ugensves," translates to "two on twenty," employing a similar structure. In Breton, "unan warn ugentvet" for 21st showcases the same vigesimal basis combined with prepositional phrasing.

Conclusion

The numeral systems in Goidelic and Brythonic languages, while sharing a common Celtic origin, diverge significantly in their structure and complexity. Research into numeral systems across languages supports the idea that these systems reflect a functional need for efficient communication. In doing so, they balance the need to communicate precisely with minimal cognitive resources (**Xu, Liu, & Regier**).

The morphological similarities within each branch, such as the resemblance among the numerals for 'one' and 'three' in Goidelic languages (a haon, aon, nane; and a trí, trí, tree, respectively), and among 'four' and 'twenty' in Brythonic languages (pedwar/pedair, peswar, pevar/peder; and ugain, ugens, ugent, respectively), showcase a shared linguistic heritage between both branches of languages.

The use of compound forms for constructing larger numbers, a common feature in both branches helps expanding numeral systems beyond basic numerals to express larger quantities among Celtic languages. Languages from both branches utilize a consistent scheme of compound forms to form numerals above 10. In addition, Brythonic languages have numbers with grammatical gender between numbers 1 to 4 to distinguish objects of differing genders.

Conflict of Interest

The author is not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

References

1. Ball, M. J. *The Celtic Languages*. Routledge.
2. Fowkes, R. *The Syntax and Semantics of the Verb in Classical Greek*. University of Chicago Press.
3. Hoyte-West, M. Irish as the 21st Official Language of the European Union. *Journal of European Integration History*.
4. Jackson, K. H. *Language and History in Early Britain: A Chronological Survey of the Brittonic Languages*. Edinburgh University Press.
5. MacAulay, D. *The Celtic Languages: Contemporary Overview*. Cambridge University Press.

6. McEvoy, B., et al. The Origins and Historical Development of the Goidelic Languages. Oxford Journal of Linguistics.
7. Mikhailova, T. Non-Indo-European Lexical Elements in the Celtic Languages. Journal of Celtic Linguistics.
8. Willis, D. Syntactic Change in Welsh: A Study of the Loss of Verb-Second. Oxford University Press.
9. Xu, Y., Liu, E., & Regier, T. Numeral Systems Across Languages Support Efficient Communication: From Approximate Numerosity to Recursion. Open Mind: Discoveries in Cognitive Science, 4, 57-70.