Beyond Popular Science

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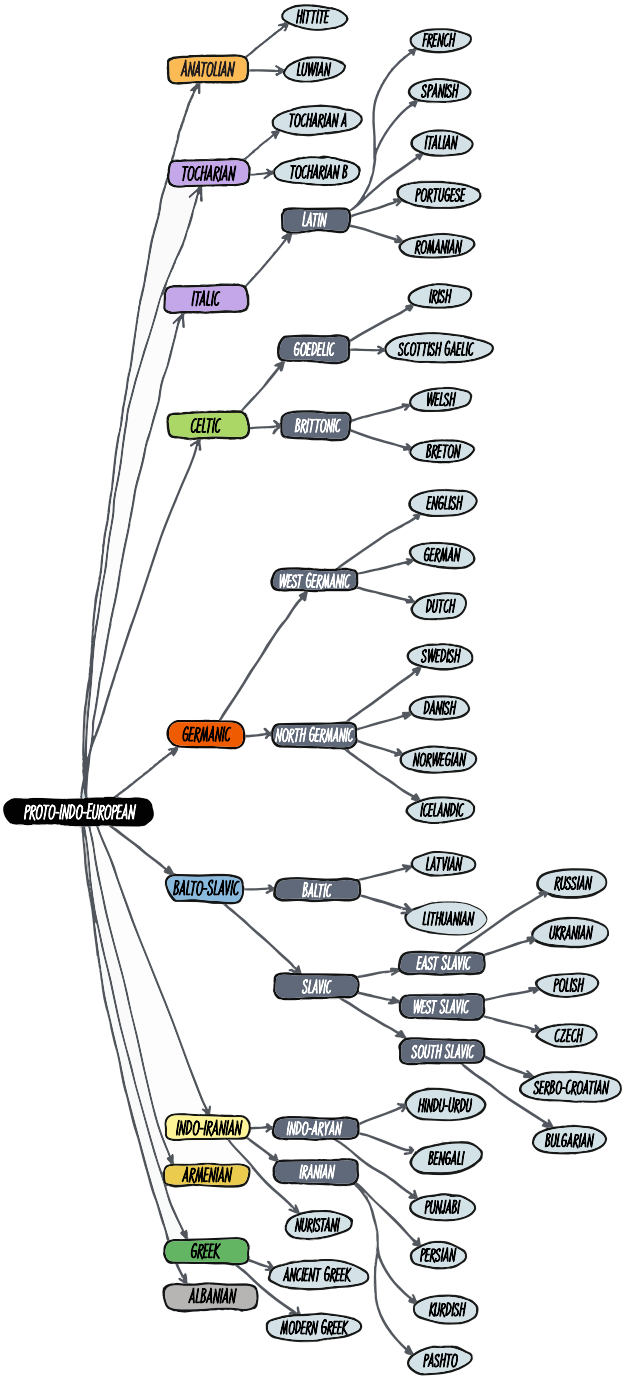
A Circle of PIE

Indo-European Language Family Tree: This phylogenetic reconstruction illustrates the hierarchical relationships among Indo-European languages, flowing from Proto-Indo-European (PIE) on the left to modern languages on the right. The tree demonstrates the systematic branching described by the comparative method, where shared innovations define intermediate nodes and regular sound correspondences link ancestral forms to their descendants.

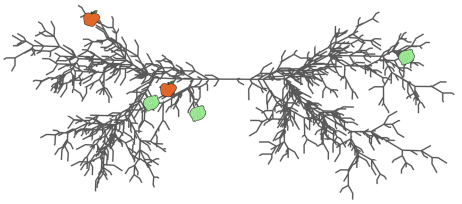
The diagram directly supports the etymological analysis presented in this chapter. The PIE root *k^{w}ék^{w}los ('wheel, circle') appears across multiple branches with predictable phonological transformations: Greek κύκλος (*kyklos*) via labiovelar to velar shift, Sanskrit चक्र (*chakra*) through labiovelar palatalisation, and English 'wheel' via Grimm's Law (*k^{w} > hw). Each pathway reflects the systematic sound changes that characterise individual language families.

Major branches are colour-coded: Germanic (red) encompasses English, German, and Scandinavian languages; Celtic (green) includes Irish and Welsh; Italic (purple) covers Latin and its descendants; Balto-Slavic (blue) spans Russian, Polish, and Baltic languages; Indo-Iranian (yellow) includes Hindi, Persian, and related languages. The tree reveals morphological and phonological spread through subgroups.



A Circle of PIE

The terms ‘wheel’ and ‘cycle’ (but not circle!) derive from Proto-Indo-European *k^{w}ék^{w}los despite their phonetic dissimilarity in modern languages. Regular sound shifts transformed this root differently in Germanic and Hellenic branches through documented phonological processes. These linguistic patterns preserve evidence of Bronze Age terminology and illustrate consistent patterns of language change. Comparative methods identify these transformations through sound correspondences across Indo-European languages.



Proto-Indo-European ◦ *K^{W}ÉK^{W}LOS
Wheel ◦ *D^{H}UGH$_{2}$TÉR Daughter ◦ Comparative
Method ◦ Sound Correspondences ◦ False
Cognates ◦ Reduplication & Circularity ◦ Hebrew *g-l-l*
Root ◦ חלילה וחוזר Mystery ◦ High-Retention
Vocabulary ◦ Linguistic Reconstruction

“English isn’t a language, it’s three languages
stacked on top of each other wearing a trenchcoat.”
— Various Attributions

A Circle of PIE

The systematic study of language families emerged in the eighteenth and nineteenth centuries, when philologists began identifying regular correspondences between phonemes, grammatical structures, and syntactic patterns across geographically distant languages. Sir William Jones's 1786 observation that Sanskrit, Greek, and Latin exhibited similarities unlikely to arise by chance laid the foundation for reconstructing their common ancestor: *Proto-Indo-European (PIE)*, a prehistoric language hypothesised to have been spoken around 3000–4000 BCE in the Pontic–Caspian steppe.

Franz Bopp advanced the field by developing the *comparative method*, a procedure for recovering unattested forms through systematic analysis of sound correspondences and inflectional morphology. August Schleicher introduced genealogical tree diagrams to represent linguistic divergence (Schleicher, 1861)—a model that remains standard today. These methods enabled reconstruction of PIE roots with high consistency, revealing shared grammatical principles across its descendants.

The PIE daughter branches—Indo-Iranian, Hellenic, Italic, Celtic, Germanic, Balto-Slavic, and Anatolian, among others—developed distinct phonologies while preserving identifiable ancestral features. For example, the PIE voiced aspirated stop *b^h appears as *bh* in Sanskrit, *f* in Latin, and *b* in English. Such rules apply across lexicon and morphology, enabling broad reconstruction. Grimm's Law (Grimm, 1822) captured the phonetic shifts distinguishing Proto-Germanic from other Indo-European languages, accounting for correspondences such as Latin *pater*, Greek *patēr*, Sanskrit *pitṛ́*, and English 'father.'

Though no written PIE record survives, its form emerges from consistent patterns in attested ancient languages including Hittite, Old Church Slavonic, and Old Persian. Core vocabulary—kinship terms, natural elements, agriculture, and tools—resists borrowing and anchors the comparative framework. PIE reconstruction also illuminates semantic evolution. Many roots generate both concrete and abstract derivatives across daughter languages. Motion, time, and cyclical processes often yield terms spanning physical action, ritual practice, and philosophical speculation.

The reconstruction of ancestral languages depends on regularities that persist across phonological evolution. Sound change occurs according to consistent patterns that affect entire grammatical systems (Osthoff & Brugmann, 1878). These patterns allow historical inference to proceed by rule-governed comparison. When daughter languages show aligned differences in equivalent words, the shape of the ancestral form can often be inferred with precision.

Historical linguistics considers shared morphological and syntactic structures as indicators of genealogical descent. Correspondences in case endings, agreement systems, and word order provide signals of common ancestry. These features must appear across lexical items to count as evidence for descent. Chance resemblance or cultural borrowing cannot produce such system-wide alignment.

Proto-Indo-European (PIE) is the name assigned to the unattested language reconstructed from parallels among Indo-European languages. Its existence is inferred from regularities

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in grammar and phonology shared by Sanskrit, Ancient Greek, Latin, Hittite, Old Church Slavonic, and others. These languages exhibit consistent transformations that converge on reconstructed PIE forms, reflecting their shared ancestry.

The comparative method identifies sound correspondences (Bopp, 1816) that link descendant languages to a shared root. For example, Latin *f*, Sanskrit *bh*, and English *b* align in inherited words, implying a common source consonant in PIE. Such correspondences must be supported by examples across word families. Once established, they allow reconstruction of ancestral forms that conform to a phonological system.

Phonological transformations affect all levels of morphology, including declensions, conjugations, and derivational patterns. These shifts are governed by well-defined constraints such as syllable structure, stress placement, and adjacent sounds. A given transformation applies across the lexicon once its domain is defined. This internal consistency permits reconstructions that are testable.

Kinship terms, natural elements, and tools form high-retention vocabulary with cross-linguistic stability (Swadesh, 1955). These words resist borrowing, undergo regular phonological change, and remain semantically intact across time scales. They serve as indicators of shared ancestry in historical reconstruction.

The PIE root *$\text{d}^\text{h}\text{ugh}_2\text{tḗr}$, meaning "daughter," provides one of the clearest examples of stability across Indo-European languages. Despite phonological divergence, the kinship meaning is retained with consistency from Vedic Sanskrit to modern English.

In Sanskrit, the form is दुहितृ (*duhitṛ*), preserving both the root and the feminine suffix. Ancient Greek gives θυγάτηρ (*thygatēr*)—where the initial aspirated dental is retained. Latin replaced the expected cognate of PIE *$\text{d}^\text{h}\text{ugh}_2\text{tḗr}$ with *filia*, from an entirely different root meaning 'suckling' (related to *filius* for 'son'). In Gothic, the reflex is *dauhtar*, leading to Old English *dohtor* and eventually modern English 'daughter.'

These forms are an example of predictable sound changes. The PIE voiced aspirated dental *d^h becomes *th* in Greek and *d* in Germanic. The laryngeal *h_2 affects surrounding vowels and often disappears. Preservation of suffixes and semantic continuity reinforce the reconstruction's accuracy.

A second example, drawn from material instead of kinship vocabulary, illustrates the principles of retention and transformation. The PIE root *$\text{k}^\text{w}\text{ék}^\text{w}\text{los}$, meaning 'wheel' or 'circle,' illustrates how this root produced enduring derivatives across Indo-European languages. Across language families, this root led to distinct yet semantically linked terms for circularity and motion.

In Greek, κύκλος (*kyklos*) retained the meanings of 'circle' and 'wheel,' later influencing Latin *cyclus* and English 'cycle.' Sanskrit preserved the root as चक्र (*chakra*), initially referring to a physical wheel, and later extended to cycles in philosophical and spiritual contexts. In Proto-Germanic, the root evolved into *hweulą, producing Old English *hweol*, Middle English *whele*, and modern English 'wheel.'

Phonological shifts altered the surface form, but the meaning remained around rotation and recurrence. Latin *colere*, meaning 'to cultivate' or 'to tend,' may derive from *k^wel-

('to turn')—though this etymology remains speculative—generating *cultus* ('ritual care') and eventually 'cult.' A related case is Latin *circulus*, a diminutive of *circus* ('ring'), which became English 'circle' via Old French *cercle*. Although derived from a separate PIE root (*sker-, 'to bend, turn'), its semantic parallel to κύκλος reflects linguistic convergence.

In Semitic languages, comparable formations are found. Hebrew גלגל (*galgal*), meaning 'wheel' or 'rolling object,' derives from the root *g-l-l*, which denotes circular motion. Related terms include גל (*gal*, 'wave'), גללים (*galalim*, 'dung pellets'), and גולגולת (*gulgoleth*, 'skull'). The reduplication in *galgal* superficially resembles the PIE form *k^{w}ék^{w}los (k^{w}e-k^{w}l-os), but the similarity is incidental, as these forms derive from distinct morphological systems.

Reduplication as a strategy for emphasising repetition or motion appears independently across language families. Its presence in both Indo-European and Semitic systems points to a broader cross-linguistic pattern. The recurrence of phonemes, as in גלגל and *k^{w}ék^{w}los, reinforces the idea of circularity through sound. Just as the wheel itself arose independently in different cultures, linguistic forms encoding rotation also emerged separately.

The comparative method excludes false cognates. Consider English 'day' and Latin *dies*—both refer to a twenty-four-hour period and share similar sounds, yet they derive from entirely unrelated PIE roots.

English 'day' traces back through Old English *dæg* to PIE *d^{h}eg^{wh}-, meaning 'to burn' or 'to be hot.' The semantic connection runs from the heat of daylight to the daylight period itself. In contrast, Latin *dies* descends from PIE *dyéws, meaning 'sky' or 'to shine,' related to *deus* ('god') and Sanskrit *dyáus* ('sky, heaven'). Both roots metaphorically extended to 'day,' but through independent pathways.

The comparative method distinguishes such cases by requiring regular sound correspondences across word families. English 'day' follows Germanic sound laws: PIE *d^{h} regularly becomes *d* in English, and *g^{wh} becomes *g* (later weakened to zero). Latin *dies*, however, shows the expected Latin treatment of PIE *dy: the sequence becomes *di-* in Latin, as seen in *Iovis* (Jupiter) from *dyēws.

Had these words been genuine cognates, we would expect to find the same root appearing across Romance and Germanic languages with parallel semantic development. Instead, we find that other Germanic languages show the *d^{h}eg^{wh}- root (German *Tag*, Dutch *dag*), while Romance languages consistently reflect *dyéws (French *jour* from Latin *diurnus*, Spanish *día*). The pattern confirms separate origins despite surface similarity.

Another case involves English 'much' and Spanish 'mucho'—words that are nearly identical in sound and meaning yet stem from unrelated PIE roots. English 'much' derives from Old English *micel* and ultimately PIE *mégh$_2$s ('great'), whose Latin cognate is *magnus*. Spanish 'mucho,' however, comes from Latin *multus* ('many'), which traces to PIE *mel- ('strong'). The superficial resemblance results from convergent phonological development: Germanic *k > English *ch*, and Latin consonant clusters *-lt-* > Spanish *ch*. The true English cognate of 'mucho' would be a derivative of *magnus*, while the Spanish cognate of 'much' appears in *más* (from Latin *magis*).

This systematic approach prevents the method from accepting coincidental resemblances, borrowings, or parallel semantic developments. True cognates must satisfy constraints

simultaneously: sound correspondences, morphological patterns, and semantic plausibility across the language family.

A Personal Encounter

At thirteen, I spent lunch breaks calling the Academy of the Hebrew Language from a pay phone, taking advantage of their public consultation hours. One question preoccupied me: the meaning of the Hebrew phrase וחוזר חלילה (*vechozer chalilah*). The expression denotes endless repetition, 'again and again' or 'in a cycle,' yet the word חלילה (*chalilah*) also means 'God forbid.' Why would a phrase about recurrence contain a word implying prohibition?

The Academy asked for two weeks to investigate. When I called again, they proposed three hypotheses. One traced it to חלל (*chalal*, 'void'), implying unboundedness. Another derived it from חול (*chol*, 'sand'), whose accumulation metaphorically signals continuity. A final suggestion pointed to חליל (*chalil*, 'flute'), possibly named for its cylindrical form.

None of these answers resolved my curiosity. Years later, I encountered *kʷékʷlos and its descendants: κύκλος (*kyklos*), चक्र (*chakra*), 'cycle,' and 'wheel.' I remembered that call. Across language families, words for turning often imply repetition.

Sound plays a role. Words like חלילה (*chalilah*) and גלגל (*galgal*) echo themselves, as do Greek ροίζος (*rhoizos*, 'whirring noise') and other motion-related terms. Reduplication strengthens the perception of rotation. Whether וחוזר חלילה originated independently or reflects a linguistic universal, it illustrates a principle: what turns, returns.

Years later, at the Technion, I worked in an EEG lab run by Professor Hillel Pratt, a scientist of towering breadth and compassion. Our conversations drifted across neuroscience, etymology, and Aramaic grammar. For over a couple of years, we debated word origins.

Then one day I learned he was a sitting member of the Academy of the Hebrew Language. He had never mentioned it. He let the ideas speak for themselves. Technically, he was *always* right.

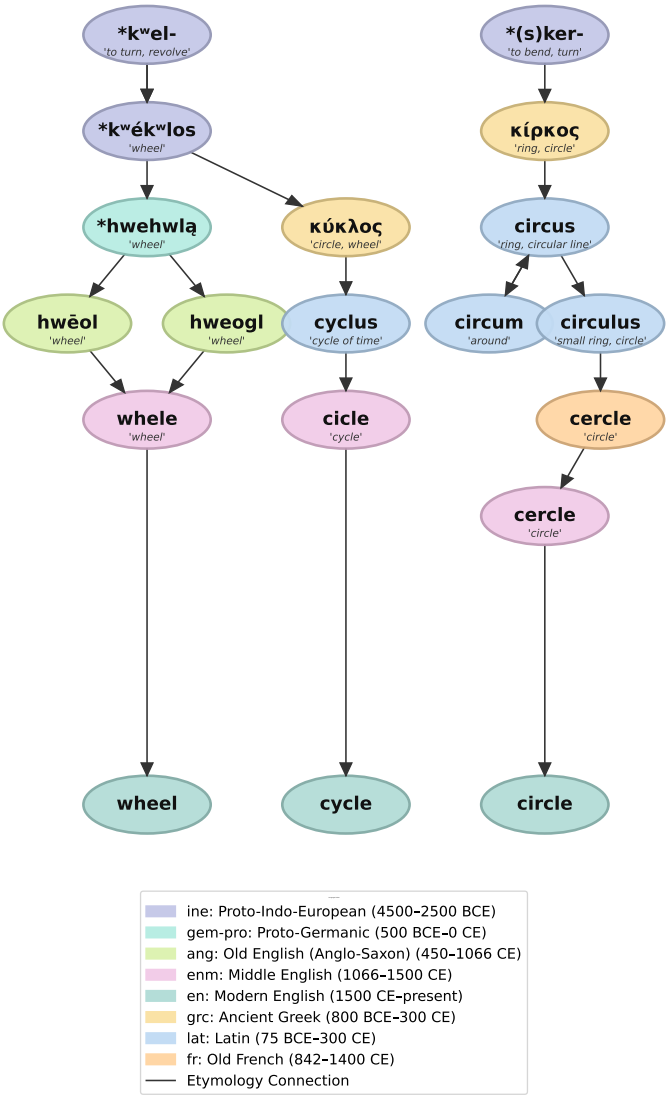

Figure by author. Etymological relationships in the Indo-European family showing the evolution of the PIE root *kʷékʷlos (‘wheel, circle’) across major language branches. The diagram illustrates systematic phonological transformations: de-labialization in Latin (*colere*) versus preservation as *qu* (e.g., *equus*, *quattuor*), palatalization in Sanskrit (*chakra*), contextual neutralisation in Greek (*kyklos*), and fricativization through Grimm’s Law in Germanic (*wheel*). Colour coding distinguishes language families while maintaining visual clarity of the genealogical relationships that underlie comparative reconstruction.

The Phonological Evolution of Labiovelars in the Indo-European Descendants of *kʷékʷlos

Proto-Indo-European (PIE) contained labiovelar stops (*kʷ, *gʷ, *gʷʰ) with simultaneous velar closure and labialization, contrasting with plain velars (*k, *g, *gʰ) and palatalized velars (*ḱ, *ǵ, *ǵʰ). The PIE root *kʷékʷlos, a reduplicated form of *kʷel- (‘to turn’), underwent systematic shifts across branches.

In Greek, By Mycenaean Greek (c. 1400 BCE, attested in Linear B, the earliest known form of the Greek writing system), labiovelars were still distinguished. Later Greek neutralised them context-dependently: *kʷ became t before front vowels (πέντε ‘five’ < PIE *pénkʷe), p in many environments (λείπω ‘I leave’ < PIE *leikʷ-), and k in certain contexts:

$$\kappa\kappa\lambda o\varsigma \text{ (}kyklos\text{)} < \text{PIE } *k^wk^wlos.$$

The labiovelars were thus fully neutralised, with reflexes depending on phonological environment.

In Sanskrit, labiovelars merged with palatals before front vowels, so *kʷ became च (*c*, [t͡ʃ]):

$$\text{(}chakra\text{)} < \text{PIE } *k^wk^wlos.$$

This is part of a broader Indo-Iranian shift where labiovelars fronted or merged with palatals.

In Latin, *kʷ was generally preserved as *qu* in most environments (*quis*, *quo*, *equus*, *aqua*, *quattuor*). However, certain roots show regular de-labialization to *c-*, notably the *kʷel- family: PIE *kʷel- → Latin *colere* (‘to cultivate’), *incola* (‘inhabitant’). This reflects dissimilation: the labial element of *kʷ is lost before a rounded vowel in the following syllable. In contrast, *circulus* (‘circle’), from Greek *kirkos* (‘ring’), derives from PIE *(s)ker- ‘to turn, bend’—a distinct root without labiovelars.

In Proto-Germanic, Grimm's Law altered the stop system: *kʷ → *hw. Thus, *kʷékʷlos became *hweulą (Proto-Germanic), which evolved into Old English *hwēol*, Middle English *whele*, and Modern English *wheel*.

Summary: Greek neutralised labiovelars context-dependently (*kʷ > t/p/k), Sanskrit palatalized (*kʷ > c → चक्र), Latin generally preserved *qu* but de-labialized in certain roots like *colere*, and Germanic fricativized via Grimm's Law (*kʷ > hw → *wheel*).

These transformations illustrate how a single PIE labiovelar stop produced diverse reflexes across Indo-European languages, shaping words that remain etymologically linked despite significant phonetic divergence.

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