# Reconstructing a Protolanguage

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This paper documents an experimental reconstruction of a protolanguage. Combining research from diverse fields such as phonology, syntax and archaeology, we construct a plausible and expressive protolanguage vocabulary of 170 words, and provide examples of the protolanguage in use. We thus obtain a direct, reverse-engineered insight into the evolution from protolanguage to modern language.

## 1. Introduction

Protolanguage (PL) is the conjectured non-grammatical hominin language which was the precursor of modern fully syntactic languages (MLs), spoken roughly in the timeframe of 2 – 0.2 mya. The alternative, a Chomskyan theory of an abrupt emergence of ML from scratch ca. 70 – 100 kya (e.g. Bolhuis et al., 2014) does not pan out well. While a capacity for language can emerge abruptly (e.g. as a result of a mutation), the emergence of a ML implies a long and piecemeal process of inventing and tinkering with a large number of signs. Thus, the complexity of MLs implies a prehistoric existence of a PL. However, a PL is not directly attested and cannot be reconstructed by methods of historical linguistics, in contrast to, e.g. the Proto-World, the last common ancestor of all MLs (for the latter, see e.g. Starostin, 2019; http://ehl.santafe.edu/intro1.htm). Likewise, it is difficult to estimate the number of PLs that have existed[1] or the possible genealogical relationships between them — although one of them had to be the first chronologically.

Since the investigations of Swadesh (1972), research in various fields including phonetics, ideophones, historical linguistics, grammar, archeology, and medicine has shed much light on the evolution from PL to ML. The present paper combines such diverse insights, attempting a complete reconstruction of a plausible PL vocabulary (with poetic examples, see Supplementary Materials: bit.ly/46Kjf6z).

[1] See Johansson (2021) for some results in this direction.

Despite being a thought experiment, the reconstruction enables one to study rich examples of PL *in vivo*. We thus arrive at experimental, hands-on results on the evolution of language and the relations between diverse investigations of PL.

## 2. Phonology

The Frame/Content Theory of MacNeilage and Davis is one of the first to provide a basis for understanding the origin of the syllable and the evolution of phonemic inventories from PL to ML (see e.g. MacNeilage, 1994, 1998; Davis & Zajdó, 2008). This approach considers the CV syllable cycle to constitute the basis of all speech, drawing on similarities with the mandibular cycle. It considers the evolution from baby "babbling" to adult speech as parallel to the evolution of phonemic inventories from PL to ML, with the phonemes that are spoken earlier occurring more frequently in the world's languages (also noting the correlation between certain vowels and consonants, e.g. velars and back vowels).

The reconstruction of PL phonemes of MacNeilage (1994) is one of the main inspirations of the present paper. The authors improve upon this by extrapolating to a simpler phonemic inventory to reach a more distant past. Considering its gradual evolution from nonlinguistic calls (cf. MacNeilage, 1994), one can assume a limited phoneme inventory for PL. Taking into account the phonological universals as well as the phonemics of "babbling" (Stefanuto & Vallée, 1999; Hyman, 2007), there emerges a minimal inventory of six consonants and three vowels as the limit of what one can extrapolate from phonological typology. The most plausible such inventory would be akin to /p, t, k, b, d, g, i, a, u/ (see Stefanuto & Vallée, 1999; Hyman, 2007: 345-359). Amongst 3-vowel systems, /i, a, u/ is the most common, and the Rotokas language constitutes a foremost example of 6-consonant systems (Firchow & Firchow, 1969; Hyman, 2007: 349-351). The phonemic inventory used in this paper is a variation on the Rotokas theme, /p, t, k, m, l, ɣ, i, a, u/ (/m/, /l/, /ɣ/ are allophones of /b/, /d/, /g/, respectively). The letter symbols could, in principle, stand for any 6-consonant and 3-vowel system, and in any case, one expects much allophonic variation in languages with a limited inventory. To reiterate, the PL constructed in this paper is a *possible* PL. We make no claim as to the occurrence/attestation of these particular phonemic and lexical inventories beyond their possibility and partial plausibility, largely due to the enormous number of PLs (Johansson, 2021).

At the other end of the spectrum, one considers non-human primate calls, and the speech capacities of early hominin physiology during the evolution from PL to ML. Neanderthals likely had speech capacities similar to modern *H. sapiens* (see the discussion in Lieberman & Crelin, 1971; Albanese, 1994; Lieberman, 2002; Boë et al., 2007; Barney et al., 2012; Conde-Valverde et al., 2021). Given the blurry distinction and lineage between *Australopithecus* and *Homo* (Bruner & Baudet, 2023; Herries et al., 2020; Kimbel & Villmoare, 2026), the linguistic capacities of early members of *Homo* remain uncertain,

though see MacLarnon & Hewitt (1999), Meyer et al. (2006) and Tobias (1998). On gauging the phonetics and origin of protospeech by studying other primates and the evolution of "speech organs" in general, the reader is referred to Boë et al. (2017).

The correlation between the evolution of phonemic inventories and genetic evolution is certainly an interesting open problem. It is clear that, given specific constraints on the syllable/word structure, the phonemic inventory is directly related to the size of the lexicon. Martinet (1957, 1960a, 1960b) and Hockett & Hockett (1960) independently introduced the concept of *duality of patterning* or *double articulation*, the property of meaningful words being comprised of combinations of meaningless phonemes. Hockett & Hockett (1960) considered duality to be the final step in the evolution of language from primate calls, satisfying the need for clarity in a large vocabulary. For a detailed study of duality and its other possible motivations such as predictability/learnability and conventionalization, see e.g. Del Giudice et al. (2010), Jackendoff (1999), Nowak & Krakauer (1999), Pinker & Jackendoff (2005), Sandler et al. (2011), Verhoef et al. (2014) and the references therein.

An interesting question is whether duality was a characteristic of all PLs. The study of Sandler et al. (2011) indicates that duality, even if not *a priori* necessary, becomes inevitable over the course of time (especially in vocal as opposed to gestural modality). In the absence of a grammar governing morphological transformations, the definition of duality for PL may not be straightforward, as it presupposes a functional distinction between *phonemes* and *words*. It is plausible, however, that most PLs had a far greater number of words than phonemes, and this statistical distinction would be equivalent to duality. It would be interesting to investigate the close relationship between duality and the size of the lexicon with e.g. a certain syllable structure (cf. Jackendoff, 1999, and the references therein). Concerning the PL reconstructed here, the 6 consonant, 3 vowel inventory is a plausible extrapolation at the limit of attested inventories, while still allowing for sufficient lexical freedom. We finally remark that significant evolution of human sound systems has occurred even during the last few ky — for example, post-neolithic changes in diet favored the occurrence of labiodentals such as /f/, /v/ (Blasi et al., 2019).

## 3. Sound-Symbolism

The Saussurean arbitrariness of the sign has been called into question by recent research on sound-symbolism as a universal tendency of language (see Voeltz & Kilian-Hatz, 2001; Lockwood & Dingemanse, 2015; Westbury et al., 2018). Moreover, the seminal results of Swadesh (1972) agree with the current state of the art. Remarkably, Swadesh (1972), Lockwood & Dingemanse (2015) and Blasi et al. (2016) are mutually compatible theories of sound-symbolism.

In constructing the bulk of the vocabulary of our PL, we have attempted to use the most popular combinations of sound and meaning found in the ASJP database (Wichmann et al., 2020). The research on sound-symbolism and

ideophones confirms that such popular (statistically relevant) combinations are not random statistical outliers, but often correlate with sound-symbolism. It is also possible that universal principles other than sound-symbolism contribute to such tendencies. It is an open question what those principles would be, and whether their identification as "sound-symbolism" is a matter or definition or not.

Studies on sound-symbolism (such as Swadesh, 1972; Lockwood & Dingemanse, 2015; Westbury et al., 2018) were particularly useful in creating a plausible PL vocabulary, both as starting points and as guiding principles. For example, *muki*, *miki*, *lila*, "man", "boy", "woman", are partly inspired by *impicic*, *alyel* of Westbury et al. (2018, Table 9). In order to create a PL as simple and archaic as possible, the etyma were constructed to be short and regular: all syllables are CV, in accordance with the Frame/Content Theory, and words contain at most two syllables.

As a historical note, we remark that while the "Global Etymologies" of Bengtson & Ruhlen (1994) are rightfully criticized by many for inconsistencies such as allowing for the construction of fallacious etyma (e.g. Campbell, 2008), several such etyma do describe sound-symbolism. The intuitions of Bengtson and Ruhlen pinpointed not correct etymologies but certain sound-symbolic tendencies of language. Cabrera (2012) shows that two of the "global etyma" can be derived from the sound-symbolic theories of Swadesh (1972) and well-known archeological evidence of symbolism. Other false "global etyma" can be constructed almost directly from the sound-symbolic tendencies documented in Blasi et al. (2016: 10820). E.g. the etyma *buka*, *čunga*, resemble very closely the /o, u, p, k, q/ and /u, n/ phonemes predicted by Blasi et al. (2016: 10820), for the meanings "knee" and "nose", respectively. While Bengtson & Ruhlen (1994) set out to find global etyma, they didn't, but found sound-symbolism instead.

## 4. The Origins of Syntax and Morphology

PL is, by definition, a hominin language without syntax and morphology, which was the precursor of modern (fully) syntactic languages. An alternative, weaker definition would be a language without grammatical morphemes (cases, adpositions, articles, etc.). A word order rule would automatically result in different grammatical categories for the words, inducing a syntax and grammar even in the absence of such morphemes (Luuk, 2012). Given the number of extinct hominin species and the possibility that *H. habilis* was a speaker (see Tobias, 1998, and the tentative timeframe in Luuk, 2018), one is inclined to assume a staggering diversity of PLs over a very long period (perhaps even one million years). The diversity would be due to the great time span, the number of distinct hominin species, and the difficulty of discerning a stable stage in the evolution of PL (from the vantage point of ML).

The essential continuity between embedding and non-embedding, modal markers and non-modal words, etc. (cf. Evans & Levinson, 2009, 2.2.5; Luuk, 2013) would make the evolution from PL to ML gradual. Discussions about e.g.

the status of embedding in Pirahã (e.g. Everett, 2009; Nevins et al., 2009) underline such ambiguities.

The evolution from non-human primate calls to PL was even more gradual and remains harder to track. While primates are capable of producing, communicating and combining a variety of signs (Engesser et al., 2016; Leroux & Townsend, 2020) and possess a rudimentary understanding of message structure, there remains a stark gap between human and non-human primate capacities (Wang et al., 2015; Jiang et al., 2018) — a difference in quality of signal processing, or a difference in quantity and speed large enough to be *de facto* qualitative.

Either a fractionation or concatenation of the existing signs could explain the evolution of language. A closely related question is whether the advent of morphology preceded that of syntax or vice versa. Fractionation (see e.g. Wray, 1998) might explain the origin of nonconcatenative morphology, as well as its seeming "persistence" and universality (Dubé, 2011), even in pidgins and creoles (Plag, 2006). However, fractionation is dubious and statistically unfeasible (Bickerton, 2003; Johansson, 2008). Further, (nonconcatenative) morphology seems to owe its "persistence" to the ease with which it is learned by children (Ratcliffe, 2007) and its origin to concatenative grammar (Svenonius & Bye, 2012). Thus, it is assumed that grammar traces its origins to the concatenation of signs and syntax (e.g. Jackendoff, 1999; Luuk, 2013; Nowak et al., 2001).

## 5. Vocabulary

The "Semantic Universals" project of Goddard and Wierzbicka is a philosophically ambitious one, including the analysis of — presumably universal — semantic units from which all other meanings can be constructed (see Goddard & Wierzbicka, 1994; Goddard, 2001, and the references therein). It has been successful in revealing several semantic units that are reliably lexicalized across the world's languages, improving on previous work such as Swadesh's lexicostatistical list (Swadesh 1972: 283-284). The semantic universals list (Goddard & Wierzbicka, 1994, 2.2; Wierzbicka, 1996; Goddard, 2001, Table 3) and the discussion in Goddard & Wierzbicka (1994, 2.2) and Goddard (2001, 2) were a useful basis in forming a PL vocabulary. Several modal etyma were modified or replaced with non-grammatical equivalents, implementing ideas from Goddard (2001, 2) and Evans & Levinson (2009, 2.2.5). For example, instead of "or" and "if", "may(be)" was used, in accordance with the Guugu Yimidhirr language (see Haviland, 1979).

The semantic universals formed the scaffolding around which the senses of each word were organized. As the PL has a limited lexicon, it makes extensive use of *colexification*, association of different senses with the same lexical form. Since the seminal paper of François (2008), several studies have shed light on its motivation and function (Di Natale et al., 2011; Karjus et al., 2021; Brochhagen

& Boleda, 2022). Colexification boosts efficiency of communication by expressing related concepts with the same word when there is no risk of ambiguity. It also has interesting relations to the evolution of metaphor and highlights the simultaneous pressures for simplicity and clarity/information that influence the lexicon. There exist several cross-linguistic databases of colexification, the most extensive of which is the CLICS colexification database (Rzymski et al., 2019, https://clics.clld.org). The reader is referred to the discussion in Brochhagen & Boleda (2022: 2) for more information on such databases. CLICS was consulted throughout the formation of the PL vocabulary, guiding the association of senses/meanings to the etyma.

Another valuable insight into languages with limited vocabulary was Toki Pona, the philosophical language created by Sonja Lang (Lang, 2014; https://tokipona.org). Similarly to PL, Toki Pona operates with minimal grammar, vocabulary, and phoneme inventory, achieving in philosophy what the present paper does in linguistics.

Since PL had (by definition) no grammatically distinct word classes, a universal flexible word class (e.g. Luuk, 2010; Rijkhoff & van Lier, 2013) has been used extensively. For example, *kuka* means both "crawl" and "reptile", *ɣuɣi* "slither" and "snake", *kipa* "cleave" and (the tool) "cleaver", etc. In the absence of distinct word classes, predicates and arguments were identified by their semantics and pragmatic context. E.g. *muma kapa*, literally "many/much oar/paddle", either "many oars" or "paddle much", can be resolved to the second meaning in the context of two (*pali*) persons going (i.e. sailing, *ma*) at sea (*ɣuma*).

Special attention was paid to accommodating words for the cultural artifacts of the Lower Paleolithic (spears, cupules, pigment, etc.), as well as for the relevant social (gang, friend, wife, foreign, etc.), kinship (father, mother, son, daughter, etc.), natural (tree, stone, hunt, etc.) and body part (leg, hand, belly, head, etc.) categories. The result of the work was a compact yet rich vocabulary of 170 words, which allows to convey information on diverse topics from subsistence to mythology, from natural to technological and conceptual to bodily domains, and even compose poems (see Supplementary Materials: bit.ly/46Kjf6z).

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