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Cyclic changes in verbal person-number indexes are unlikely

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Abstract: This paper discusses the emergence and demise of verbal person-number indexes on the basis of a sample of 310 languages. First, qualitative evidence is provided to show that there are different ways in which indexes may emerge, and that independent anaphoric pronouns are not the only possible source. Second, quantitative evidence is provided against the claim that indexes tend to demise via phonological attrition in the course of time. A considerable degree of demise is not a universally likely process, but rather a major restructuring process that requires additional – areal – triggers in order to come about. Thus, 92% of the languages of my sample do not show any strong tendency toward losing their indexes, and the degree of demise of their indexes is persistently low when compared to the proto-forms. This is despite the fact that indexes constantly change over time, and the phonetic shape found in the proto-languages is never faithfully preserved in the modern languages. Finally, those few languages that exhibit a relatively high degree of demise are not randomly distributed across the world, but are clustered in the following areas: Northwestern Europe, Eastern South East Asia with Oceania and, possibly, Mid Africa as well Northern South America.

Keywords: bound verbal subject indexes; evolutionary typology; inheritance stability; language change; stability; trait stability

1 Introduction

There is a long-standing tradition of assuming that languages develop in spirals or cycles, from synthetic into more analytic and then again to synthetic language – a phenomenon that Hodge (1970: 1) has dubbed the *Linguistic Cycle*. In this vein,

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Givón (1976) discusses grammatical subject-verb agreement, henceforth bound verbal person-number *indexes* (Haspelmath 2013; Lazard 1998).[1] In this seminal paper, he claims that indexes, once they have been grammaticalized, "[…] meet their predictable demise via phonological attrition […]" (Givón 1976: 172). At some point, new indexes would emerge again. Thus the full cycle of emergence and demise can be schematically illustrated as in (1) (Givón 1976: 172; Siewierska 2004: 262). I take the liberty of calling this cycle *Givón's Cycle* after Givón's important paper (1976) in parallel to *Jespersen's Cycle* of negation markers:

(1) Givón's Cycle
(a) *Anaphoric independent pronouns* > (b) *Verbal bound subject indexes* > (c) *Demise of the bound subject indexes* > (a) *Anaphoric independent pronouns* > (b) …

In this paper, I make two claims. First, in Section 2, I argue that there are many more ways in which indexes can emerge than only from independent pronouns (thus amending [1a] > [1b]). Second and more importantly, I claim that indexes are a very stable category cross-linguistically so that the full cycle is found only rarely, primarily in geographically clustered languages, which suggests that an areal impact is a prerequisite for the loss; which in turn means that index loss is not a natural drift that languages generally undergo (Sections 3 and 4).

My argumentation for the second claim consists of two pieces of evidence. I first show that diachronic changes that index forms undergo are very versatile and do not necessarily lead to attrition of the coding string, as is sometimes assumed, but also to its retention and even to its enlargement (Section 3). The second piece of evidence is diachronic quantitative evidence (Section 4). Here, I introduce the notion of *inheritance stability* and I provide diachronic quantitative evidence that the demise of indexes is found only rarely, while indexes remain inheritance-stable in 92% of the 310 modern languages of my sample through several thousand years. Section 5 summarizes the results and conclusions.

Finally, while much of modern diachronic-typological research aims at explaining synchronic patterns via the respective grammaticalization sources (Collins 2019; Cristofaro 2013, 2014, 2017, 2019; Mauri and Sansò 2021; Sansò 2018), this paper examines the cross-linguistic dynamics of indexes in the large time span after their emergence. I believe this focus to be more revealing for

1 I avoid the more traditional terms like *bound pronouns* or *agreement markers* (cf. Corbett 2006) and follow Lazard (1998) and Haspelmath (2013) and refer to these as (*bound person-number*) *indexes* (already introduced in Boelaars 1950 or earlier). Furthermore, I avoid the notions *pro*-drop and agreement which are ill-advised for many reasons (see Haspelmath 2013 with further literature).

understanding language than the purely source-oriented research (see also Seržant and Rafiyenko 2021).

2 Emergence pathways of bound verbal person-number indexes

Givón writes the following about the emergence of indexes from personal pronouns: "One overriding theme – and claim – of this paper is that verb agreement paradigms always arise from anaphoric pronoun paradigms" (Givón 1976: 180, emphasis original). Other authors also tend to only mention independent pronouns as the source of indexes (cf. Ariel 2000: 198, 202; Bybee 1985; Comrie 1981: 217–218; Fuß 2005; Givón 1976: 180; van Gelderen 2011).

In this section, I argue that independent pronouns are not the only source of indexes. I review the most frequent historical sources of indexes: independent pronouns (Section 2.1), auxiliaries (Section 2.2), pronominal possessive clitics (Section 2.3), nominal markers (Section 2.4) and other, rare sources (Section 2.5).

2.1 Index emergence from independent pronouns

Givón (1976) argues that the diachronic source of indexes is sentences with dislocated, topic-shifting NPs, schematized in (2):

(2) Emergence of subject indexes
(a) *The man, he came* > (b) *The man he-came*
(Givón 1976: 155)

The reanalysis process found in the second stage (2b) has been claimed to be an "inevitable natural phenomenon" due to "over-use" of the dislocated structures (Givón 1976: 154–155). More specifically, the marked-topic function of dislocation is lost in favor of the unmarked, continuous-topic interpretation over the course of time, rendering the structure in (2b) a default topic-comment utterance. As a consequence, the intonational contour of the utterance changes, the pause after the dislocated element disappears and the resumptive pronoun, turned semantically redundant, undergoes phonological attrition and cliticization to the verb in (2b). The pathway may be schematically described as follows:

(3) Emergence of indexes from independent pronouns
(a) *Independent pronouns* > (b) *Resumptive pronouns for the dislocated NP* > (c) *Pronouns doubling the subject NP*[2] > (d) *Verbal pronominal clitics, i.e. bound subject indexes*
(Givón 1976)

This process is well attested in non-standard dialects of English, in colloquial French as well as in English or French-based pidgins and creoles. In these languages, the subject indexes are prefixal to the verb:[3]

(4) Non-Standard French
Pierre ***i****-la-voit,* *Marie*
Pierre 3SG.M-3SG.F-see Marie
'Pierre sees Marie.'
(Lambrecht 1981: 77)

Here, French attests the entire cycle. Thus it has almost lost the ancient suffixal indexes inherited from Proto-Romance (and from Proto-Indo-European); contrast the original indexes in Latin with the situation in Modern French in Table 1.

Table 1: The ancient suffixal indexes of French.

	French		Latin	
	Singular	**Plural**	**Singular**	**Plural**
1	*chang-**Ø*** (*-e*)	*chang-**ǫ*** (*-ons*)	*cambi-ō*	*cambī-mus*
2	*chang-**Ø*** (*-es*)	*chang-**e*** (*-ez*)	*cambī-s*	*cambī-tis*
3	*chang-**Ø*** (*-e*)	*chang-**Ø*** (*-ent*)	*cambi-t*	*cambi-unt*

At the same time, Non-Standard French is on its way to developing new, prefixal indexes as illustrated in (4) (Lambrecht 1981).

Note that the initial stage (3a) (=[1]) may either involve no verbal indexing at all, or some referentially dysfunctional remnants from the previous indexing system. Thus Non-Standard French still retains the first and second-person plural suffixal forms as well as the singular-plural distinction with some verb stems. Similarly, in Western Oceanic and Bantu languages, the new indexes have been added on top of the old ones (see Guthrie 1953 for Bantu).

2 Note that the changes in (3) are very complex with different intermediate stages such as the stages I–III in Creissels (2006).

3 Note that constructions like (4) may still have some special informational-structural interpretation. For example, Lambrecht (1981) argues that there are restrictions on (4) such as high activation of *Marie* due to its antitopic role in the information structure of the sentence.

The present tense indexes of modern Turkic languages are another example of indexes that historically stem from pronouns; compare Proto-Turkic clitic pronouns that will become indexes in all modern Turkic languages in Table 2.

Table 2: Clitic personal pronouns to become indexes in Modern Turkic as reconstructed for Proto-Turkic (present tense) (Róna-Tas 1998: 74–75).[4]

1SG	2SG	1PL	2PL
ben > men	*sen*	*biz*	*siz*

Although clitic subject pronouns are almost always adjacent to the verb already in Old Turkic, they may still be separated by small words such as *amtı* 'now' or the question particle as the second person index *siz* in example (5) (M. Erdal, p.c., 2004: 12, 245 fn. 434) – a remnant of the original independence of the pronouns.

(5) Old Turkic

mini	*säv-är*	*mü*	*siz?*
1SG.ACC	love-PRS	Q	2PL.NOM

'Do you love me?'
(M. Erdal, p.c.)

While insertions like this were still possible in Old Turkic, modern Turkic languages no longer allow them and the indexes are entirely suffixal. Thus, the development from Proto-Turkic into modern Turkic languages represent another instance of the development in (3) as predicted by Givón (1976).

As a side note, observe that indexes cliticize postverbally – despite the most common subject-verb word order ("strongly topic-comment" in Erdal 2004: 422) of Old Turkic. This is because bound subject indexes do not have to mirror the basic word order of the language (pace, *inter alia*, Givón 1976: 183; cf. the discussion of Diachronic Syntax Hypothesis in Siewierska 2004: 163–166),[5] since clitics are generally subject to a very distinct set of placement rules than orthotonic subjects, such as Wackernagel positioning, Haspelmath's (2009) externalization of inflection, etc.

Generally, independent pronouns seem to be the most frequent source of indexes. I have evidence from the following languages: indexes of Corachol and

4 The third person is less clear and therefore omitted here.

5 Thus, a small survey of the position of the independent 1SG pronoun *bän* in Old Turkic in Erdal (2004) shows that it does not always occur after the verb, but may also occur before the verb, very much in contrast to its clitic variant *män* (<*bän* due to nasal assimilation, cf. Erdal 2004: 117).

Aztecan (Langacker 1977: 137); East Lezgic (Bogomolova 2018); Buryat (Comrie 1980); Proto-Bantu (Creissels 2006); the present tense indexes in Proto-Turkic (Erdal 2004: 233; Johanson 1998: 45; Róna-Tas 1998: 74–75); first and second person indexes in Proto-Uralic (Laanest 1982 [1975]: 228; Lytkin et al. 1974: 316); etc. (see also the evidence in Siewierska 2004: 251–256).

2.2 Indexes from auxiliaries

The second most frequent source for indexes is somewhat less well-known, namely auxiliaries, which themselves idiosyncratically inflect for person and number (Siewierska 2004: 257–260). Once a language develops new TAM forms from nominalized structures, the inflected auxiliary may cliticize to and fuse with the nominalized verb, thus giving rise to bound verbal indexes. This pathway is found, for example, in the past tense of Polish and some Western Ukrainian varieties (*inter alia*, Andersen 1987: 24; Decaux 1955: 16–18). The past tense forms of Modern Polish (Slavic, Indo-European) stem from a participial form fused with the auxiliary (from 'to be') that originally cliticized to different types of hosts in Old Polish but then was fixed in the postverbal position (with a few exceptions) and became suffixal there. The example of the first person masculine singular in (6) illustrates the development:

(6) Modern Polish < Old Polish
a. *robił-em* < b. *robił=eśm/=em*
work.PST-1SG.M < work.PTCP.M.SG=be.PRS.1SG/=be.PRS.1SG
'I (have) worked.'

The entire paradigm of the past tense of Modern Polish is presented in Table 3.

Table 3: The person inflection in the past tense of Polish (former perfect).

	Singular	**Plural**
1	*robił-em/robił-am*	*robił-yśmy/robił-iśmy*
2	*robił-eś/robił-aś*	*robił-yście/robił-iście*
3	*robił-ø* (M), *robił-a* (F), *robił-o* (N)	*robił-y* (F), *robił-i* (M)

Analogically, the subjunctive paradigm of Lithuanian and Latgalian (Baltic, Indo-European) emerged from the purpose infinitive (traditionally called *supinum*) fusing with the clitic forms of the old subjunctive auxiliary ('to be'):

(7) Lithuanian < Old Lithuanian
ei-tu-m(*ei*) < *ei-tum=bei*
go-SBJV-2SG < go-INF=be.SBJV.1SG
'You would go.'
(Stang 1966: 428)

Other examples of this quite frequent pathway are found, for example, in the following languages: Piaroa (Saliban) (Rosés Labrada 2018), Creek (Muskogean) (Haas 1977: 534–535), Agaw languages (Afroasiatic, Cushitic) (Hetzron 1976: 22), a number of Tibeto-Burman languages (DeLancey 2010, 2014: 9–18), possibly in Proto-Dravidian (Andronov 2009: 233–234), etc.

Obviously this pathway is very different to (3): it does not involve pronouns at all (i.e. no [3b] stage), and accordingly, no subject resumption and doubling (no development [3b]–[3c]).

Having said this, the very inflected auxiliary forms might in some cases be reasonably argued to themselves descend from independent pronouns along (1). In this sense, the entire grammaticalization process would not really contradict Givón's (1976) pathway in (3), as argued in Givón (1976: 180–184). However, under closer inspection, this pathway proves to be entirely different from (3). First, sometimes the inflected auxiliary forms do not stem from a fusion with personal pronouns. For example, the person-number forms of the copulas in Polish (6) or Baltic (7) are not etymologically related to pronouns in these languages, even as far back as Proto-Indo-European (pace Givón 1976: 184; see the authoritative literature from historical-comparative linguistics, e.g. Meier-Brügger 2010: 173–184). Copula inflection forms may often stem from stem alternations and various types of suppletion including zero (typically in the third person, cf. Stassen 1997: 62–100). For example, the third person plural of the past tense of Polish *robił-y* (work.PST-3PL.F) and *robil-i* (work.PST-3PL.M) did not evolve from the auxiliary inflection in Old Polish, in contrast to the first singular in (6). Instead, the indexes *-y/-i* are originally nominal plural markers for the feminine and masculine gender, respectively, that are reanalyzed as dedicated third person (plural) markers (another frequent source of indexes, see Section 2.4 below). Finally, the emergence of indexes in the past tense of Polish (after the Old Polish period, i.e. after 16th c. AD) or of the subjunctive in Baltic (during Proto-East-Baltic, i.e. ca. after 6th c. AD) are much later developments than the very emergence of the copula inflection (before Proto-Indo-European, i.e. at least before 2500 BC). Thus, crucially, the emergence of indexes from auxiliaries is a distinct grammaticalization process that is historically often independent of a development from pronouns.

2.3 Indexes from pronominal possessor clitics

Another frequent source of indexes is *pronominal possessor clitics*, e.g. in Cahuilla-Cupeno (Langacker 1977: 137) or in Cariban languages (Gildea 1998). While I cannot go into the details of this grammaticalization process, it is important to note that it is crucially based on nominalized structures, with the logical agent being coded as the possessor, i.e. the possessive construction such as (8) is extended onto nominalized actions.

(8) Akuriyó (Cariban)
mure *i-pana-ri*
boy 3.POSS-ear-NMLZ
'The boy's ear.'
(Gildea 1998: 105)

Although this source is similar to independent pronouns in (3), there are important differences. First, possessor indexes are nominal, NP-internal markers that are usually clitics to begin with, cf. *i-* in (8) above. Thus, in contrast to the emergence of indexes from independent pronouns in (3), this grammaticalization pathway does not need to involve step (3a). Second, this pathway does not need to involve resumption and dislocation (i.e. steps [3a]–[3b]) since possessive clitics often 'double' the full NP already in the possessive NP – as in (8) – prior to, and independently of, their recruitment for marking the agent in the nominalized action. In this case, bound indexes come, so to say, for free into the nominalized and later verbal construction. This means that steps (3a)–(3c) do not have to occur here at all.[6] Therefore, this pathway is also distinct from the one based on independent pronouns (3).

2.4 Indexes from nominal markers

Indexes sometimes develop from various kinds of nominal markers such as the nominal marker of plural, cf. the Polish indexes *robił-y* (work.PST-3PL.F) and *robil-i* (work.PST-3PL.M) discussed above (Section 2.2). Similarly, the vast majority of Turkic languages have extended the nominal plural marker *-Ir* (and its variants) into the verbal domain (e.g. in Gagauz or Kazakh), where it is primarily used as the dedicated third person plural form. Some other Turkic languages developed the third person in *-DIr* which, in turn, goes back to *turur* 'stands' (Johanson 1998: 41, 45).

6 Note also that this pathway may and often does lead to ergativity in verbal indexing (cf. Gildea 1998) – an outcome that is not predicted by (3).

Note that these markers complete the Turkic paradigm in which the first and second person indexes emerged from independent pronouns along (3).

Other nominal markers may also serve as the source. Thus many North American languages mark the third person plural by a dedicated bound plural marker, which often stems from a distributive morpheme (Mithun 1991: 91–92). Since this marker is often the single marker in the third person plural, e.g. in Chickasaw (Muskogean) (Munro 2005: 128) – while other persons mark plurality differently – it may also be considered to be the dedicated *third person* plural marker.

Another example is Proto-Finnic. Here, bare participles formed by means of the Proto-Finnic suffix **-pi* were reanalyzed as third person forms. Accordingly, **-pi* developed into the dedicated third person index in most of the Costal Finnic languages, cf. Veps *anda-b*, Votic *anna-b*, Estonian *anna-b*, Livonian *ãnda-b* (cf. Kallio 2014: 156; Laanest 1982: 230–231). Analogically, in Permic languages (Uralic), the third person index *-k* historically stems from a nominalization suffix (Lytkin et al. 1974: 325).

These grammaticalization processes are likewise very much distinct from (3).

2.5 Indexes from other sources

Other sources are less frequent (overviews in Helmbrecht 1996; Siewierska 2004: 260–261). For example, in some North American languages, the cislocative marker with the original meaning 'hither' developed into a first (and sometimes second) person marker, e.g. in Mohawk (Iroquoian) the prefix *takw-* indexes second person subject acting upon first person object (Mithun 1996).

Furthermore, in non-standard Finnish and in French, the first person plural stems from the impersonal form: inflectional in Finnish and pronominal (*on*) in French. In some other Finnic languages, the impersonal form has replaced the third person plural, e.g. in Karelian (cf. *lugie-tah* 'read-IMPRS=3PL', 'they read' or 'someone reads'), in some Finnish dialects, in Ingrian and Votic (Laanest 1982: 231).

The morphological reanalysis of other verbal morphemes illustrated below in Section 3 is quite a frequent source of particular person-number indexes, for example, 2SG *-sz* in Hungarian (Lytkin et al. 1974: 325) or 2SG.F in Coptic (Grossman 2016).

3 Is there a universal bias for reduction?

I turn now (Sections 3 and 4) to the second claim in Givón (1976) about the turnover of indexes. Givón (1976) claims that once indexes have been fully grammaticalized,

they will predictably undergo demise at some point (Givón 1976: 172). While there are, of course, uncontroversial instances of Givón's Cycle (1), e.g. in French, as discussed above (Section 2), I claim that Givón's Cycle is not only not a universal but a rare development cross-linguistically. My argument consists of two pieces of evidence: below (Section 3.1), I present qualitative evidence for different types of changes that indexes undergo, and argue that the pure phonetic reduction is far from the only and not necessarily the most frequent diachronic change indexes undergo; there are also processes leading to retention and enlargement of indexes. Thus there is no principled phonetic bias for indexes to become reduced, and subsequently to disappear. Second (Section 4), I present quantitative evidence from different families and macroareas, showing that indexing systems do not normally show a strong trend towards reduction and demise, even over thousands of years.

3.1 Qualitative evidence

The form of bound indexes, once these have emerged, undergoes different types of changes, and reduction is just one type of change among many.

First, there is a whole family of different types of phonetic changes and not all of them automatically lead to reduction of the form length: compression in fast speech, misperception, re-segmentation, phonetic variability in the experience and reassigning the errors in transmission, etc. (Blevins 2004: 8, 32–33). Furthermore, a phonetic change may either be constrained solely phonetically (or phonologically), or it may additionally be subject to restrictions from other domains of grammar. The second type is more complex and involves additional mechanisms of inhibition or analogical restoration. The first type may be illustrated by the development of the past tense third person singular in Ancient Greek. Here, the 3SG *-e* is the result of a purely phonetically driven shortening of Proto-Indo-European **-e-t*. The loss of the final *-t* was pervasive in Ancient Greek and affected all relevant phonetic contexts, with no regard to morphology, parts of speech or the function of the element containing this string (cf. Rix 1992: 243). Analogically, all closed syllables of Proto-Slavic became open, by the process of dropping the syllable-final consonant(s) in all phonologically relevant contexts. One of the consequences here was that all bound person indexes ending in a consonant have lost their coda consonants. These two processes were entirely phonetically driven and did not exclusively affect indexes.

The second type seems to be much more frequent than the first one. Thus the phonetic reduction is very often morphologically restricted, and is exempted from applying in some of the phonetically relevant contexts. For example, the intervocalic *-*s*- of Proto-Greek has been lost in all Ancient Greek dialects and in all word forms (*-*s*- > -*h*- > ø). However, this sound change ceased to operate, or its application has been analogically undone in the case of the *-*s*-, which was the morphological marker of the aorist (i.e. perfective past). In this single case, the intervocalic *-*s*- remained -*s*- unchanged. Thus it seems that the need for transparent information encoding inhibited the expansion of this sound change into this context.

Crucially, this means that processes of phonetic reduction may be and often are inhibited by functional pressures. Therefore it cannot be maintained that phonetic reduction unavoidably leads to reduction and disappearance of morphological markers.

Moreover, while phonetic sound changes sometimes lead to a reduction of the index form, different types of reanalysis may also lead to its enlargement. For example, segments originally belonging to the stem may be reinterpreted as parts of the index string. For example, in Hungarian (Uralic), the second person index *-sz* [s] (e.g. *kér-sz* 'ask-2SG') was originally a tense marker (Lytkin et al. 1974: 325). Likewise, the second person feminine index *-re-* developed via reanalysis of the aorist marker *šare-* in Coptic (Afroasiatic; Grossman 2016). Another example is the realis markers *-d-* and *-k-* in Aghu (Awyu-Dumut subfamily of the Nuclear Trans New Guinea family) that may be said to be the only person markers in the singular, cf. Table 4.

Table 4: Realis (stem I) in Aghu (van den Heuvel 2016: 36).

1SG	*da-d-e*
	hear-real-1SG
2/3SG	*da-k-e*
	hear-real-2/3SG
1PL	*da-d-oã*
	hear-real-1PL
2/3PL	*dà-k-e-nã*
	hear-real-2/3PL

Another example is Lithuanian, which historically has no marker for the third person. In some conjugations, however, the former derivational stem marker can be interpreted as the dedicated third person index, cf. Table 5.

Table 5: The present forms of the Lithuanian verb *dirb-* 'to work'.

	Singular	Plural
1	*dirb-u*	*dirb-a-me*
2	*dirb-i*	*dirb-a-te*
3	*dirb-a*	*dirb-a*

The plural inflection shows that *-a-* is originally part of the verb stem. Likewise, Italian *ama* '(s)he loves' is better analyzed as *am-a* and not as *ama-ø*, cf. Table 6.

Table 6: Present tense conjugation of the verb *amar* in Spanish and *amare* in Italian.

	Spanish		Italian	
	Singular	Plural	Singular	Plural
1	*am-o*	*am-a-mos*	*am-o*	*am-iamo*
2	*am-a-s*	*am-á-is*	*am-i*	*am-ate*
3	*am-a-ø*	*am-a-n*	*am-a*	*am-ano*

Historically, the sound *-a-* (from *-ā-* in Latin *amāre*) was due to the merger (contraction) of the root final vowel and some derivational suffix (either **ā* or the non-agentive **ē*, see the discussion in De Vaan 2008: 39), and was not related to indexing at all.

Other analogical examples may be added: 3PL *-ra* was enlarged by *-a-*, which was originally a stem-final vowel of the so-called *a*-stems, yielding *-ara* in Aisi and Kulsab (Sogeram, Nuclear Trans New Guinea stock) (Daniels 2010: 171); similarly in Sakha (Turkic), cf. Krueger (1962: 132–133). Notably, the development of a stem marker into a bound third person singular index is a process that is exactly reverse to a process later named as Watkins' Law (*inter alia*, Bickel et al. 2015: 42–43), which suggests that the third person index is frequently cross-linguistically reinterpreted as a stem marker, leaving the third person with no overt exponent.[7] There is no typological evidence for this law (Bickel et al. 2015).

In addition to reanalysis, analogy may also be material for enlargement. For example, the Proto-Slavic first person plural index is commonly reconstructed as

7 Watkins (1962: 90–96, 171) himself, however, suggested this path for only some paradigms in Old Irish, Middle Welsh, Persian and the precative of Sanskrit. Other examples were adduced later: past tense in Provençal (Bybee 1985: 39; Bybee and Brewer 1980: 210), past definite of Swiss Vallader Romantsch (Haiman 1977: 322).

*-*mъ* [mŭ]. However, the vowel of this index was lengthened at some point, occasionally in Old Church Slavic and regularly in Polish, yielding *-my* (from **mū*), possibly in analogy to the independent pronoun *my* (1PL.NOM).

There are also other types of change that affect the length of indexes. Distinct person-number indexing paradigms for different TAM categories may be reanalyzed as allomorphic, which then allows for the more frequent allomorphs to replace the less frequent ones, leading to unifying the allomorphic variation across TAM, as for example in Sogeram languages (Daniels 2015: 154–155).

Finally, the form of an index may also remain unchanged over extremely long periods of time. For example, Baltic and Slavic sub-branches of Indo-European are particularly conservative in terms of morphological forms. The Proto-Indo-European third person singular index **-e-ti* was preserved almost unchanged in some Russian dialects as *-et'* with the palatalization of *-t* as a trace of the final **-i*. Note that Proto-Indo-European was spoken at the time around 4000–3000 BC, i.e. five to six thousand years before modern Russian dialects.

3.2 Summarizing the qualitative evidence

Above I provided qualitative evidence, arguing that pure phonetic reduction is far from the only – and not necessarily the most frequent – process that indexes undergo; there are also processes leading to retention and enlargement of indexes. In view of these different changes, the assumption of "predictable demise via phonological attrition" (Givón 1976: 172) is not sufficiently motivated by the cross-linguistic evidence. Conservatively speaking, it remains to be seen whether phonetic reduction is typologically the most frequent change of the coding string of indexes. I turn to this in the next section (Section 4).

4 Diachronic quantitative evidence on stability of indexes

In this section, I argue that there is no universal bias for demise of indexes, and that to the contrary, there is a universal trend for the stability of indexes. Above I argued that the changes indexes undergo cross-linguistically do not unavoidably lead to demise. In this section, I carry out a diachronic-quantitative study to show that indexes do not undergo demise in most languages.

In what follows, I test whether ancient indexing systems do indeed predominantly attest developments leading to the demise in their modern descendants or

not. To anticipate the results, I will conclude in Section 4.3.3 that 92% of the languages in my sample (310 languages) exhibit indexing systems that are highly stable over several thousands of years.

However, before I turn to the quantitative evidence, I introduce my terminological apparatus on *stability* (Section 4.1), describe the underlying methodology, which I dub *evolutionary typology* (Section 4.2), introduce the sample and the database (Section 4.3), explain the measuring conventions of phonetic length (Section 4.4), introduce the distinction between two measures, namely, *shape deviation* and *demise factor* that is crucial for this study (Section 4.5), provide the measures of shape deviation (Section 4.6.1) and of the demise factor (Section 4.6.2), and finally, summarize the results (Section 4.6.3).

4.1 Trait versus inheritance stability

I define *stability* as a high probability for a category to persist in the language for several thousands of years (drawing on Dahl 2004: 261; Parkvall 2008: 235; Wichmann and Holman 2009: 9). Thus, for practical purposes, I take stability here as an absolute rather than relative concept.

Furthermore, I distinguish between *trait stability* and *inheritance stability*. Trait stability is found when there is a high probability for a particular linguistic trait to be present at different stages of evolution of a language, regardless of whether this trait has been lost and then again grammaticalized anew, or whether the same trait is transmitted through all stages. Trait stability is normally explored in typological studies, since historical and/or reconstructed data are hardly available (*inter alia*, Nichols 1995, 2003; Wichmann and Holman 2009). In contrast, inheritance stability is studied less often (e.g. in Dahl 2004).

However, the presence of a category does not necessarily entail the persistence of that category, but may also result from a complete renewal preceded by the total loss. Ideally, a cognitively preferred category (i.e. a universal one) is one that cross-linguistically does not tend to undergo a series of losses and subsequent renewals, instead remaining stable through time by passing on to the next generation of learners. I refer to this kind of situation as *inheritance stability*. Inheritance stability entails a stronger requirement on persistence, that is, it entails not only functional but also etymological, i.e. form continuity, at least to some extent. Form continuity ensures that the category was not renewed at some point in the past.

In contrast, if one and the same feature is often re-acquired, this means that it is also functionally unstable. This aspect is potentially confounding the results when only working with trait stability. For example, word order is often inheritance stable, whereas perfects or words for 'girl' (Dahl 2004: 263) are often re-

acquired and lost again, and thus may exhibit trait stability from a long-term perspective but not inheritance stability. Specifically in relation to Givón's Cycle, it has to be shown that indexes are inheritance stable in order to claim that the entire cycle is generally dispreferred. In order to tackle inheritance stability, I formulate the Principle of Continuity in (9) for my data sampling in the next subsection.

4.2 The approach

Methodologically, in what follows, my approach falls under what one might call *evolutionary typology*, since I am primarily concerned with cross-linguistic dynamics of indexes. Evolutionary typology relies on diachronic methods to respond to the concern that linguistic universals do not play out in language states, but rather in diachronic pressures that lead to these states, as has been repeatedly pointed out in the literature (Bickel et al. 2014; Bybee 1988, 2001, 2006; Creissels 2008; Cristofaro 2012, 2014; Croft 2003: 76–77; Cysouw 2009; Dunn et al. 2011; Gildea and Zúñiga 2016; Givón 1979: 235; Greenberg 1969, 1978; Haspelmath 1999; Maslova 2000, 2004).

Since the dynamics of a particular language may be conditioned by language-specific processes (and therefore be typologically accidental), it is crucial for the method to take a representative number of daughter languages into account. This aspect is also essential for other approaches within evolutionary typology, e.g. for the *family bias method* (Bickel 2013), or for various phylogenetic methods. However, in contrast to these methods, I rely on reconstructions of the respective proto-language forms found in the authoritative literature that are produced by the historical-comparative method, independently of the present study. Although the historical-comparative method is not as powerful, the advantage of the method is that reconstructions produced by this method have a higher probability than those achieved by quantitative, phylogenetic methods.

Relying on the reconstructed proto-forms is crucial for testing inheritance stability along the Principle of Continuity (similar to the *crypto-diachronic method* in Cysouw 2009: 247–248):

(9) Principle of Continuity
Each language in the database should be represented with an inflectional paradigm that – despite different kinds of changes and modifications – continues the selected inflectional paradigm for the respective proto-language, and is not the result of entirely independent grammaticalization.

The Principle of Continuity is slightly less strict than the requirement for etymological continuity that is used in etymological studies. However, it is much stricter

than merely requiring functional continuity. It is unavoidably somewhat vague, because languages are constantly changing their inflectional paradigms by various mechanisms, as will be discussed below. For example, the new third person in Finnic languages (created from the participle suffix *-*pi*, Laanest 1982: 230–231) is an entirely new form, which is still part of the ancient Proto-Uralic paradigm, however. Accordingly, its inclusion in the sample is not a violation of general continuity and thus of (9). In contrast, the emergence of the entirely new paradigm in the past tense of Polish (cf. Table 3 above) produced an entirely new paradigm which does not continue the Proto-Indo-European paradigm in the past tenses. Instances such as this one do not meet the requirement in (9) and paradigms of this type were not included in the sample.

The case of many Bantu languages is somewhat less straightforward. Here, proclitic person-number indexes inherited from Proto-Bantu were sometimes replaced by abbreviated independent pronouns. I count instances such as this one as also adhering to the Principle of Continuity in (9), because there was apparently a gradual and partial replacement, and not a creation of an entirely new paradigm on the basis of a newly grammaticalized structure (as in Polish). Hence the Principle of Continuity holds here. The evidence for this is that many Bantu languages represent transitional stages. For example, in Akwa, the independent pronouns became obligatory, but the ancient prefixes are still used as indexes (Guthrie 1953: 90). Yet, in other languages, the independent pronouns gradually replaced some, but not all, of the old person-number class indexes. In still other languages, like Mpongwe, the ancient prefixes were completely replaced (Guthrie 1953: 57).

The development of subject indexes is highly complex in all Western (Melanesian) Oceanic languages for the following reason. The Proto-Malayo-Polynesian set of subject clitics was continuously subject to renewal both during and after the pre-Proto-Oceanic period, by abbreviation and cliticization the independent pronouns so that many Oceanic indexes go back to independent pronouns of pre-Proto-Oceanic (Ross 1988: 363). Here too, remnants of the Proto-Malayo-Polynesian proclitics are still found scattered here and there across the paradigm (Collins 1983: 25; Ross 1988: 363). Thus, in order for the Principle of Continuity to hold, for Austronesian I have purposely chosen a level lower than the Malayo-Polynesian subfamily, i.e. Oceanic. This allows me to rely on the set reconstructed for Proto-Oceanic (as in Ross 1988: 368), which already accommodates some of the index renewals during Proto-Oceanic. I thus achieve more accuracy in comparing the proto-stage with modern languages in this family with regard to (9).

Similarly, I only took into account the low Sogeram subfamily of the Nuclear Trans New Guinea stock, in order to be sure that I am comparing largely the same paradigm across modern languages and in the proto-language.

Finally, it is important to note that the database is a convenience sample that is crucially based on the availability of reliable reconstructions. Accordingly, there may be a bias in the database toward families that better preserve indexes. If an entire family lost the erstwhile indexing system in all languages, this system obviously cannot be reconstructed, and thus could not become part of this study. I address the issue of how this method compensates for this bias and still achieves robust results in Section 4.6.2.

4.3 The sample and the database

The database – published in Seržant (2021) – consists of person-number (gender) index paradigms for 310 modern languages (Figure 1) and 16 proto-languages. Different families are represented by a different number of modern languages: Indo-European (35 lgs.), Turkic (41), Mayan (25), Uralic (21), Dravidian (30), Semitic (Afroasiatic) (20), Oceanic (Austronesian) (52), Bantu (Atlantic-Congo) (21), Sogeram (10) and Awyu-Dumut (6) (Nuclear Trans New Guinea), Athabaskan (11), Muskogean (8), Worrorran (5), Salishan (21), Rgyalrongic (7) and Kiranti (7) (Tibeto-Burman).

Figure 1: Modern languages of the database.

Languages were selected so as to include and balance all larger lower-level subfamilies. Furthermore, the database contains the paradigms of the proto-languages reconstructed in the authoritative literature: Proto-Indo-European (Meier-Brügger 2010: 173–184), Proto-Turkic (Róna-Tas 1998: 75; Old Turkic in Abduraxmanov 1997: 68; Erdal 2004: 232; Tuguševa 1997: 59), Proto-Mayan (Bricker 1977: 2; Schele 1982: 9), Proto-Uralic (Honti 2010: 21; Janhunen 1982: 35; Kulonen 2001; Laanest 1982 [1975]: 229–230), Proto-Dravidian (Andronov 2009: 224–231), Proto-Semitic (Hasselbach 2004: 32; Huehnergard 2000; Lipiński 2001: 378), Proto-Oceanic (Blust 1972; François 2016: 32; Ross 1988: 366, 2002 [2011]: 60; Starosta et al. 1981), Proto-Bantu (Meeussen 1967: 97–99; Schadeberg 2003 [2014]: 151), Proto-Sogeram (Daniels 2015: 155), Proto-Awyu-Dumut (Wester 2014: 78–85), Proto-Athabaskan (Hoijer 1971: 127–132; Leer 2006: 429), Proto-Muskogean (Booker 1980: 33), Proto-Worroran (McGregor and Rumsey 2009: 68), and Proto-Salishan (Newman 1979: 213, 1980: 156), Proto-Kiranti and Proto-rGyalrongic (DeLancey 2010: 15, 2011: 2, 2014; Jacques 2016; LaPolla 2003: 30).[8]

Only indexing paradigms featuring the S argument of an intransitive verb were taken into account, in order to treat both ergative and accusative languages alike. If there were distinct allomorphs, I tried to enter the more frequent allomorph in the database. If the frequency was not immediately indicated in the grammar (which was most often the case), then only the form mentioned first was taken into account.

The precise morphophonological realization of indexes is subject to cross-linguistic variation, which however has no bearing on the claims to be made here (cf. Haspelmath 2013). For example, I gloss over a number of the morphological differences across languages, such as cumulatively or agglutinatively coded person and number features or between affixes versus clitics (cf. Haspelmath and Sims 2010: 198). Moreover, in many instances, one may argue that this categorization changes in languages over time, e.g. from clitics in Proto-Turkic into affixes in modern Turkic languages. Given the diachronic perspective of the paper, it makes sense to treat these as variants of the same phenomenon.

Each language is represented by only one paradigm which complies with the Principle of Continuity in (9) and which is used in the present tense, except for

8 The reconstructed paradigm adopted here as the proto-paradigm certainly predates Proto-Kiranti and Proto-rGyalrongic, as its reflexes have been found far outside these two subfamilies as well (DeLancey 2011: 2, 2014: 8–9, 25; Jacques 2012, 2016: 69; cf. the "Rung group" in LaPolla 2003: 30) and can probably be reconstructed for Proto-Tibeto-Burman (*inter alia*, DeLancey 2010; see criticism in LaPolla 2001, 2003, 2005: 395). Since there is disagreement on how ancient the indexes are, I take the most conservative approach and treat Kiranti and rGyalrongic as two (sub)families which have the same proto-paradigm.

Semitic, for which the so-called *imperfect* paradigm was chosen since it is this paradigm that is found across all modern Semitic languages.

4.4 Measuring the length of an index

An important methodological convention of this study is that it simply relies on the spelling found in the relevant literature when determining the length of an index and when comparing the phonetic shapes. The only exceptions are French and English, where the spelling does not really mirror the pronunciation (cf. Table 1).

The length of an index is computed in the following way. Every letter is counted as one segment. Furthermore, long vowels or long consonants were assigned 1.5 points instead of 2, in order to distinguish them from diphthongs and consonant clusters (both 2 points). Here, I deviated from the strict mora counting for the following reason: long vowels often develop via contraction or compensatory lengthening, which is – diachronically viewed – a reductive process. It is important to take the fact of reduction into account here. Another deviation was that sounds such as the reduced schwa-vowels [ə],[9] the glottal stop [ʔ], aspirated sound *h* or a nasal co-articulation (e.g. Polish *pisz-ę* 'write-1SG') were only given 0.5 points.[10]

In order to measure the dynamics of indexes for each modern language, I compare its forms with those of the proto-language as reconstructed in the literature, as exemplified in Table 7 for Dutch. Each modern language is represented with just one paradigm (usually the present tense) in the database.[11] Since I want to measure the dynamics of particular paradigms through time, the proto-paradigm and the modern paradigm have to be historically related (Principle of Continuity [9]) in order for the method to give meaningful results.

In contrast, newly grammaticalized paradigms such as the past tense of Polish (Table 3) do not materially continue the proto-forms, but represent an entirely new start, as has been explained above.

9 Note, however, that Bulax and Kogan (2013)'s description of Ethio-Semitic languages uses the letter *ə* for the high-mid vowel [ɨ] that resulted in the merger of the Proto-Semitic **i* and **u* (Bulax and Kogan 2013: 72). Here, *ə* counts as one full segment and not as a half one. This vowel may sometimes also be stressed (Lyosov, p.c.; Rubin 2010: 22). The vowel *i*^{w} in Gafat (Semitic) was counted as one segment.

10 Note that the latter two conventions do not really affect the results if one counted, for example, a long vowel as two segments, because there are not many long vowels in the database.

11 Non-present-tense paradigms often cumulatively include tense or aspect-related functions.

Table 7: Proto-IE indexes (thematic conjugation: cf. Meier-Brügger 2010: 173–184) and Modern Dutch indexes.

	1SG	2SG	3SG	1PL[12]	2PL	3PL
Proto-IE	*-oh_2	*e-s-i*	*e-t-i*	*o-m-es*	*e-th_2-e*	*o-nt-i*
	2	3	3	4	4	4
Dutch	*Ø*	*-t*	*-t*	*-en*	*-en*	*-en*
	0	1	1	2	2	2

4.5 Two types of deviation from the proto-form: *degree of shape deviation* versus *demise factor*

When comparing the proto-forms with the modern forms, a principled distinction between the following two kinds of deviations should be made. Clearly, not any kind of deviation from the proto-form is an indication of the demise of the indexing system. Accordingly, I distinguish between two types of deviation: *deviations that may potentially lead to demise* and *shape deviations* (that are not indicative of demise).

4.5.1 Shape deviations

Shape deviations are found when the modern index is only phonetically different from its proto-form, but does not show any signs of functional demise. For example, the Proto-Indo-European 2SG form **-e-si* changed into *-e-ši* in Early Slavic. Evidently, the new articulatory coloring of the sibilant cannot be interpreted as a sign of demise of the indexing system of Early Slavic, because the exact phonetic realization of grammatical markers is generally arbitrary, and does not correlate with their functions. Other examples of phonetic deviation include the change from Proto-Indo-European 1SG **-oh_2* to East Baltic *-uo*. Again, whether the index is coded by a vowel with a laryngeal or a similar diphthong does not affect the functionality of the indexing system in any way. These instances represent phonetic *shape deviations* of the index.

Shape deviation was measured by comparing the sounds of the proto-form with those of the modern form, and giving a point to every modern sound that also occurs in the proto-form. This total is subsequently divided by the length of the proto-form, in order to compute the proportion of the retained sounds. For

12 The alternative reconstructed form **-o-me-s(i)* was not taken into account here.

example, shape deviation of the Russian 3PL (present) *-ut* (the thematic conjugation, e.g. *nes-ut* 'carry.PRS-3PL') is computed as 1/4 = 0.25, i.e. there is one segment (namely *-t-*) that is also found in the proto-form of Proto-Indo-European, which is **-o-nti*, i.e. four segments. The value 0.25 is the degree of *phonetic retention* of the 3PL of Russian (normalized Levinshtein distance). Accordingly, 1 – 0.25 = 0.75 is the degree of shape deviation of the 3PL of Russian. Note that the method is very coarse and misinterprets those instances in which sounds re-occur accidentally, cf. Dutch 2PL *-en*, which yields the same degree of phonetic retention of 0.25 because *-e-* is found in the Proto-Indo-European index (*-*e-th*$_2$-e), even though *-e-* in Dutch has a different origin. Furthermore, those indexes that were zeros in the proto-form were not counted at all.

Importantly, the degree of shape deviation is not completely independent of the loss of segments. A segment of the proto-form that is lost in the modern form is automatically counted here as not represented in the modern form, thus increasing the degree of shape deviation. For example, Russian 3PL *-ut* only retains one segment of the 4-segment proto-form **-o-nti*. This approach makes sense because a loss is obviously also a subtype of shape deviation.

4.5.2 Deviations leading to demise

Deviations leading to demise, in contrast to shape deviations, are deviations from the proto-form that lead or may potentially lead to the demise of the entire indexing paradigm. In an extreme case, an indexing paradigm may be considered to have entirely lost its functions if all person-number slots (i) are entirely reduced when compared to the proto-language, (ii) are zeros by form (phonetically unmarked) and (iii) are mutually syncretic. In the extreme case, these three factors are tautological, but otherwise not. For example, Mainland Scandinavian languages almost lost the original, present tense paradigm. While all slots are syncretic, i.e. marked with *-r*, these are not zeros, cf. Norwegian *komme-r* 'come-1SG/2SG/3SG/1PL/2PL/3PL'. In contrast, Kursav (Sogeram) has first person singular zero, but is otherwise morphologically quite conservative, in that it retains all the distinctions and has no syncretism. Thus, Kursav exhibits only a minor degree of demise. In contrast, a paradigm that did not undergo any length reduction of its indexes, has no syncretism and no zeros, should count as maximally preserving, regardless of whether the forms have remained the same or have undergone shape deviation.[13]

13 For example, the degree of shape deviation of 2SG of Early Slavic *-e-ši* compared to Proto-Indo-European 2SG *-*e-si* is 1 – 2/3 = 0.33, while the demise factor for this index is zero, because it was neither reduced nor became syncretic with some other index of its paradigm.

Accordingly, I define three demise factors that can be measured: (i) length *reduction*, (ii) the number of *zeros* in the paradigm, and (iii) emergence of *syncretism* in the paradigm (e.g. an indexing paradigm is entirely dysfunctional if all its indexes are syncretic, as is the case in the Mainland Scandinavian languages). The higher these factors are, the less functional the paradigm, and the closer it is to a total demise.

In what follows, I explain these factors and exemplify the measurement conventions.

Reduction (i) is found when the modern index form is shorter than its proto-form. For example, Spanish 3SG *-e* is two segments shorter than the Proto-Indo-European 3SG **-e-ti*. The degree of reduction is measured as the difference in the number of segments between the modern form and its proto-form divided by the length of the proto-form (in order to level out long proto-indexes that can be reduced with more segments than short proto-indexes), cf. 3PL Russian *-ut* versus Proto-Indo-European **-o-nti*. This yields 2 – 4 = –2, –2/4 = –0.5, i.e. the degree of reduction of the 3PL of Russian is –0.5.

Factor (ii) *zeros* is computed as the total number of zeros in the paradigm. For example, the English present tense paradigm of *to walk* has five zeros.

Finally, *syncretism* (iii) may emerge in different ways, including phonetic changes or analogical extension. For example, the person syncretism in the plural of Dutch (1PL/2PL/3PL *-en*) did not emerge from sound change, but rather via analogical extension of *-en* from 1PL or 3PL to 2PL. In contrast, the syncretism 3SG/2PL (*-t*) in German is the result of sound change. I compute the degree of syncretism of a paradigm by counting the number of syncretic-slot pairs. For example, German has two syncretic pairs: (i) 1PL and 3PL *geh-en* 'go-1PL/3PL' 'we/they go' and (ii) 3SG and 2PL *geh-t* 'go-3SG/2PL' 'he/you go(-es)'. The maximum value here has been set as five, which is the case in Mainland Scandinavian. Mainland Scandinavian languages have entirely lost the person-number distinction, and the verb indistinguishably bears the affix *-r* in all person-number slots in the present tense.

Subsequently, the values of shape deviation and the three demise factors have been normalized, in order to make them comparable with each other, arranging all values between 0 and 1 along the formula in (10):

(10) Adapted minimum-maximum feature scaling[14]
$X_{norm} = X/X_{max}$

14 This formula is as follows: $X_{norm} = (X - X_{min})/(X_{max} - X_{min})$. However, since X_{min} is always zero with all factors, I have simplified the formula above.

Finally, I computed the degree of demise for each modern language by averaging across the normalized values of the three factors (i)–(iii) for each index, and subsequently, by averaging across indexes of the entire paradigm of each language. Similarly, I computed the degree of shape deviation for each language by averaging the degrees of shape deviation of each index of the paradigm. The results are presented in the following subsection.

4.6 Discussion and results

In what follows, I present the results. I first present the tendencies in the degrees of shape deviation (Section 4.6.1) and then the degrees of demise (Section 4.6.2) in the languages of the sample.

4.6.1 Measuring shape deviations

Table 8 presents shape deviations of each (sub)family computed as the means for all its languages, and Figure 2 visualizes the density distribution of the languages of the sample according to their shape-deviation degrees.

Table 8: Degrees of shape deviation per (sub)family (max = 1, highest in Indo-European).

Semitic	0.310
Kiranti	0.321
Sogeram	0.381
Turkic	0.398
Rgyalrongic	0.417
Athabaskan	0.476
Worrorran	0.482
Mayan	0.528
Muskogean	0.530
Awyu-Dumut	0.542
Oceanic	0.611
Dravidian	0.622
Uralic	0.622
Bantu	0.625
Salishan	0.706
Indo-European	0.767

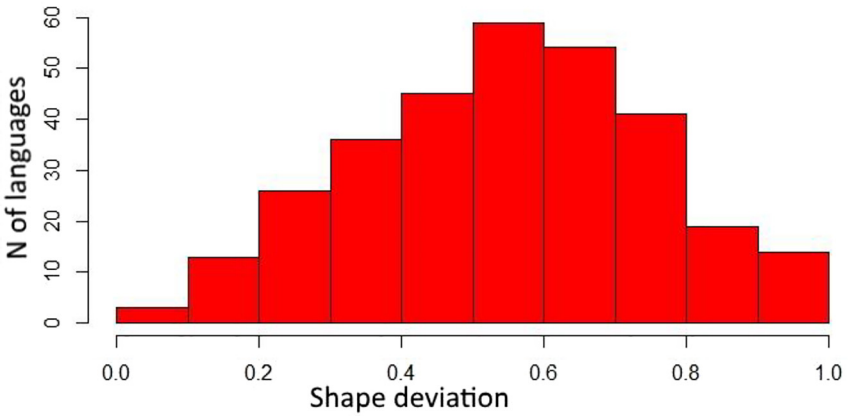

Figure 2: Distribution of shape deviation across languages of the sample.

The following observations can be made from the counts in Table 8. First, there is no family that does not show any shape deviations from the proto-language. Moreover, there is not a single language in my database (0/310) that shows the shape deviation of zero, i.e. no shape deviation at all (cf. Figure 2). Second, the degree of shape deviation in various families (Table 8) is quite high (the maximum value is 1). The high averages are not due to some outlier languages in the respective families, but indeed represent the distribution of all shape-deviation degrees of the sample very well. Thus Figure 2 illustrates that most of the languages in the database display quite a high degree of shape deviation. Note also that the probability of a language retaining at least one or two segments in the entire indexing paradigm is also high, since shape deviations of more than 0.8 become rare (cf. Figure 2).

Generally, this means that indexes are subject to a high change rate, permanently undergoing different sorts of change processes such as described in Section 2. Accordingly, any possible effects of putative macrofamilies (such as Nostratic), or even more, of the proto-world, are highly unlikely in this domain. Likewise, the high change rate makes the application of the source-oriented typology less meaningful.

4.6.2 Measuring demise

The situation is entirely different with regard to the degree of demise, which is primarily functional. Table 9 presents the degrees of demise in each (sub)family computed as the means of all its languages which, in turn, are computed as the

average of all three demise factors (i)–(iii) explained above in Section 4.5.1 (the maximum value here is 1.0). I also add the proportion of languages with a more significant degree of demise (somewhat arbitrarily set as more than 0.3) for each family in the second column. Finally, the third column contains the relative age of each (sub)family measured by a method related to lexicostatistics in Holman et al. (2011), E. Holman (p.c.) and S. Wichmann (p.c.), see also Parkvall (2008: 241).

Table 9: Degree of demise per (sub)family (with the highest in IE) and family age (according to Holman et al. 2011).

	Degree of demise	% of languages with the degree of demise >0.3	Age
Kiranti	0.000	0	
Rgyalrongic	0.013		
Uralic	0.021		3,178
Worrorran	0.025		2,183
Semitic	0.048		3,301
Sogeram	0.052		3,884
Athabaskan	0.056		2,062
Muskogean	0.056		1,720
Turkic	0.069		2,500
Mayan	0.075	4%	2,220
Bantu	0.097	10%	3,267
Salishan	0.133	0	3,827
Dravidian	0.144	7%	2,055
Oceanic	0.163	21%	3,803
Awyu-Dumut	0.182	0	2,916
Indo-European	0.279	29%	4,348

All 16 (sub)families are quite conservative with regard to the demise of indexes. Contrary to what has been suggested in Givón (1976), these (sub)families do not show any strong trend toward demise. Moreover, 11 out of 16 (sub)families are extremely conservative, in that their demise factor is below 0.1. This means that most of the languages of these (sub)families show no trend towards potential demise of their indexing systems whatsoever. Figure 3 shows the distribution of demise degrees across the languages of the sample. In total, 92% of the languages in the database show a degree of demise below 0.3, while all languages that are above are clearly outliers.

Furthermore, even those families which do show a higher degree of demise indirectly also support the conservative picture. The higher demise factor here is due to a small subset of languages that indeed undergo a high degree of demise of their indexing system. Thus, although the Indo-European stock has 29% of such

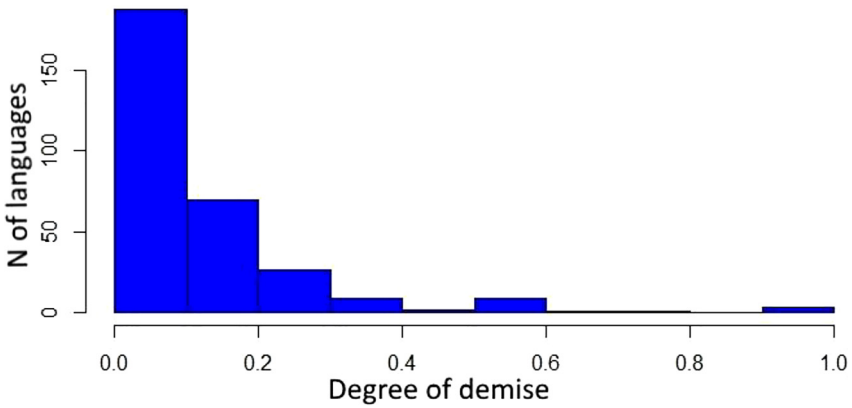

Figure 3: Distribution of the demise degrees across the languages of the database.

languages, these languages are areally clustered (Figure 4), while other Indo-European languages, i.e. all Slavic and Baltic languages, many Romance languages (e.g. Spanish), Iranian, Greek and Albanian show very little demise of the ancient Proto-Indo-European indexing system. The fact, that the languages with a high degree of demise are not evenly distributed across the globe but cluster areally, suggests that there is more than just a natural attrition leading to loss in these languages, and language contact must be the crucial factor here.

Yet, a potentially confounding factor for the conservative picture illustrated so far might be the age of the indexing systems: young indexing systems are more

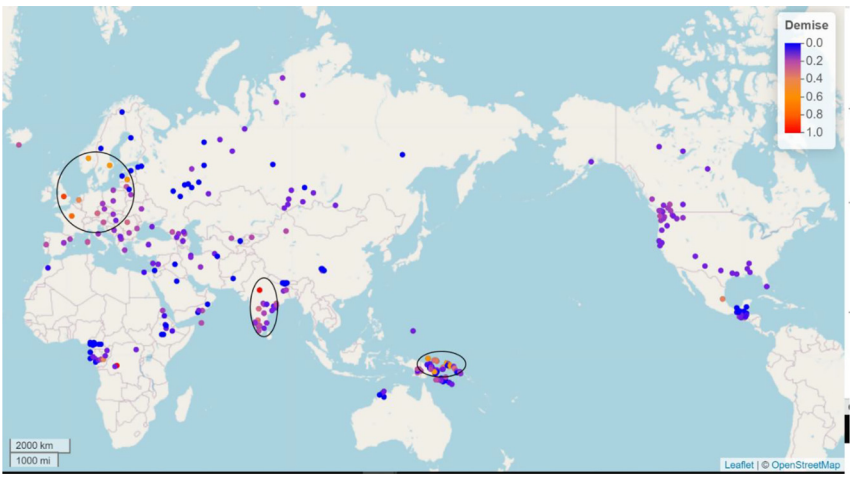

Figure 4: Demise degrees across the languages of the database.

likely to be more preserving than the ancient ones. While the ages of the indexing systems cannot be measured straightforwardly, I take the time depth of the proto-language computed by the method in Holman et al. (2011) as *terminus ante quem*.[15] This is a reasonable approximation here, since all proto-forms are safely reconstructed for the respective proto-languages, and therefore cannot be younger than the proto-languages themselves. Of course, their function might have been somewhat different (e.g. referentially stronger, morphologically more clitic-like), but the very phonetic cues must have already existed in the proto-languages, fulfilling a similar function. When the demise factors for all 16 (sub)families are compared with the relative age, a *chi*-square test shows no interaction between the degree of demise and the relative age ($p = 1$). Thus the age factor can be safely excluded.

Another potentially confounding factor is the sampling method. The data has not been gathered randomly. The sample is a convenience sample. The data collection was crucially dependent on the availability of uncontroversial reconstructions in the literature. Thus, potentially, the sample underrepresents 'innovating families' that have completely lost their indexing systems, which is why no proto-forms are available for them. In other words, I might only have sampled conservative families. This may represent an important objection to the validity of the overall conservative picture observed so far. However, precisely in order to control for the effects of this sampling confound, I used a more fine-grained method of assessing the evidence from the sample. Thus I did not simply count the number of languages that have lost an erstwhile indexing system – a method that would have been valid for an entirely randomly selected sample. In contrast, the method of testing the inheritance stability aims at finding out whether there is at least some detectable trend toward such a loss in the languages of the sample, even if these languages are predominantly conservative. In other words, if the loss of indexes were a universal process as alluded to in Givón (1976), then, first, its repercussions should be detectable even in the sample of conservative families, yielding high degrees of demise across families. And, second, these repercussions should be distributed normally around the globe and should not be areally biased. Since none of the two situations is found in the data, I claim that indexes are generally diachronically stable and an entire loss of indexes is highly unlikely.

15 Note that the absolute figures in Holman et al. (2011) are not important here. What matters here are the ages of the (sub)families relative to each other.

4.6.3 Demise areas

Above, I mentioned that the innovating languages (8% of the database) are grouped together in particular areas. I have mapped the languages according to their degrees of demise in Figure 4 (blue – conservative and preserving, orange and red – innovating, undergoing demise).

As can be observed from the heat map in Figure 4, there are at least three clear areas in which languages with a high degree of demise group together: Northwestern Europe, Northern Hindustan and Eastern Papua New Guinea.

Unfortunately, my database is too small for identifying all demise areas and for establishing their exact boundaries. Therefore, in order to incorporate more data into the original database, I have rearranged and somewhat simplified the database in the following way. First, I have tagged all languages with the degree of demise below 0.3 as *preserving* their indexing system. All other languages have been tagged as *losing* their indexing system (e.g. English, French, Hindi, etc.). This binary, coarse-grained distinction allowed me to add more languages from other families and areas on which there is much less reconstruction data. Here, I have added more modern languages. I have tagged each new language, depending on whether (i) it has indexing or not and (ii) whether the respective proto-language had an indexing system. This yielded in total five values: *loss* (the proto-language has an indexing system but the modern language does not), *new* (the modern language recently grammaticalized an indexing system), *non-development* (neither the proto-language nor the modern language has indexing), *losing* (the modern language undergoes a considerable decay of the indexing paradigm) and *preserving* (the modern language preserves the same paradigm as the proto-language). For example, I have tagged Central Khmer (Austroasiatic) as *non-development* since neither this language nor its Proto-Austroasiatic ancestor has an indexing system (cf. Bisang 2014, 2015).

By this method, I have arrived at 428 languages in total, i.e. 310 languages from the original database and 118 new languages for which this kind of coarse-grained diachronic information I could find (published in Seržant 2021). Figure 5 illustrates the distribution of the 428 languages and the areal clusters in which the languages diachronically dispreferring indexes (tagged as *loosing*, *loss*, *new* and *non-development*) are located.

At least four such areas can be roughly identified: Northwestern Europe, Eastern South East Asia with Oceania and, possibly, Mid Africa and Northern South America.

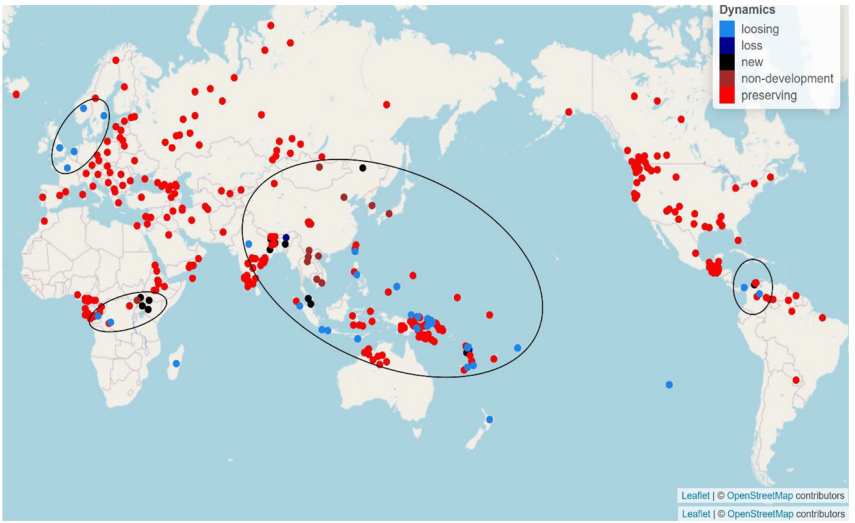

Figure 5: Preserving languages versus innovating languages and languages with no development of indexes.

4.6.4 Summarizing the results

In Section 4.6.1, I show that indexes constantly change their phonetic shapes. This is due to various change processes, including different sorts of phonetic changes, analogies, reanalyses, etc. (Section 2). Crucially, hardly any form faithfully retains the phonetic cue of its proto-form, which is why any proto-world effects or even just source effects (in the sense of the source-oriented typology) are unlikely in this domain.

In contrast, there are almost no morphologically relevant changes to the indexes that might potentially lead to the demise of the entire indexing system (Section 4.6.2). Not only the entire turnover of Givón's Cycle (1), but even the "predictable demise via phonological attrition" (Givón 1976: 172), i.e. the change from (1b) to (1c), is not supported by the cross-linguistic diachronic evidence presented. Note that the time span in focus is at least several thousands of years (see Table 9 with time depth approximations on the basis of Holman et al. 2011).

Thus I claim that a considerable degree of demise is not a universal drift, but a major restructuring process that needs additional triggers in order to come about. I have shown that the outlier languages with a high degree of demise cluster areally. It follows that a strong areal effect is necessary in order for an indexing system to undergo loss. At least, the following areas impose such an effect on their

languages: Northwestern Europe, Eastern South East Asia with Oceania and, possibly, Mid Africa and Northern South America.

5 Conclusions

In this paper, I have made two claims constraining the turnover pathway of bound verbal indexes in (1) that I dubbed Givón's Cycle (crediting Givón 1976) repeated here as (11) for convenience.

(11) Givón's Cycle
(a) *Anaphoric pronouns* > (b) *Verbal bound subject indexes* > (c) *Demise of the bound subject indexes* > (a) *Anaphoric pronouns* > (b) …

First (Section 2), I have shown that there are many more pathways for the emergence of indexes than just from anaphoric pronouns, cf. (1a) > (1b).[16] For example, idiosyncratically inflecting auxiliaries represent the second most frequent source. Crucially, these different sources involve quite different pragmatic and semantic mechanisms of change than those of (3a) > (3c) discussed in Givón (1976).

Second, I have argued that the change (1b) > (1c) from "predictable demise via phonological attrition" (Givón 1976: 172) is not supported by the diachronic evidence presented. I have presented qualitative diachronic evidence that phonetic reduction is not the only process that indexes undergo; they also undergo change processes that lead to enlargement of the phonetic string of the index, and sometimes indexes are simply retained unchanged over several thousands of years (Section 3).

Crucially, I have provided quantitative diachronic evidence for the claim that indexing systems are inheritance stable. Thus, a considerable degree of demise is not a universally likely process, but rather a major restructuring process that require areal triggers in order to come about (Section 4). Thus, 92% of the languages in my database (310 in total) do not show any strong tendency toward losing their indexes (their demise factor is lower than 0.3 vs. the maximum of 1). Note that the time span in focus is at least several thousand years (see Table 9 with time depth approximations on the basis of lexicostatistics, Holman et al. 2011). This is despite the fact that indexes constantly change over time, and the phonetic shape is never faithfully preserved in any of the modern languages from their ancestors.

16 Moreover, sometimes independent pronouns themselves stem from indexes (cf. Siewierska 2004: 254–255).

Reduction, retention or enlargement of indexes are not teleological processes. For example, the triggers of sound change – often leading to reduction – are "essentially random and non-optimizing" (Blevins 2004: 78; cf. Ohala 1993). Each of these processes has its internal motivation and triggers. However, as I have argued above, there is qualitative evidence that particular change processes may be inhibited or strongly constrained by functional considerations. I suggest that the overall inheritance-stability effect observed through thousands of years, despite various changes, is the result of adaptive constraints in functional selection, in which new patterns expand via functional selection from originally marginal patterns that themselves emerged by historical accidents (parallel to Darwin's *natural selection*) (cf. Haspelmath 1999, 2019).

Finally, those languages that do exhibit a quite high degree of demise are not randomly distributed, but clustered in the following areas: Northwestern Europe, Eastern South East Asia with Oceania and, possibly, Mid Africa and Northern South America (Figures 4 and 5; Seržant 2021). These areas are those where indexing is dispreferred in genealogically unrelated languages (cf. the map in Donohue and Denham 2020: 455[17] based on 2,378 languages).

My results are in line with the more general claim in McWhorter (2016) that languages universally prefer synthetic, morphological coding as well as with the claim that familiar subjects tend to be coded only once in the clause (Berdičevskis et al. 2020). Exceptions to this trend may be found in those areas which have undergone a strong and abrupt admixture of L2 speakers. South East Asia and partly Island South East Asia is one such area (McWhorter 2016), and it is this area that is responsible for the heavy index losses our method shows in Hindustan, Eastern Papua New Guinea and Oceania. As Siewierska (2004: 281) concludes "(t)he assumption seems to be that […] the factors underlying loss are essentially of an external, political/social nature rather than language internal".

List of abbreviations

All glosses follow the conventions adopted in Leipzig Glossing Rules.

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17 Unfortunately the database Donohue and Denham (2020) itself does not seem to be publicly available.

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