

# HISTORICAL SYNTAX

## Dative sickness: A phylogenetic analysis of argument structure evolution in Germanic

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A major argument against the feasibility of reconstructing syntax for proto-stages is the widely discussed lack of directionality of syntactic change. In a recent typology of changes in argument structure constructions based on Germanic (Barðdal 2015), several different, yet opposing, changes are reported. These include, among others, processes sometimes called DATIVE SICKNESS, NOMINATIVE SICKNESS, and ACCUSATIVE SICKNESS. In order to tease apart the roles of the different processes, we have carried out a phylogenetic trait analysis on a predefined data set of twelve predicates found across the Germanic phyla using the MULTISTATE method. This is, as far as we are aware, the first application of the MULTISTATE method (Pagel et al. 2004) in historical syntax. The results clearly favor one of the models, the dative sickness model, over any other model, as this model is the only one that can accurately account for both the observed diversity of case frames and the independently proposed philological reconstructions. Methods of evolutionary trait analysis can be used to model evolutionary paths of argument structure constructions, and they provide the perfect testing ground for hypotheses arrived at through philological reconstruction, based on classical historical-comparative methods.\*

*Keywords:* syntactic reconstruction, noncanonical case-marked subjects, argument structure, phylogenetic methods, historical syntax, Germanic

**1. INTRODUCTION.** One of the problems of reconstructing syntax and grammar, and hence for modeling language change, is the alleged lack of directionality of syntactic change (Miranda 1976, Lightfoot 1979, 2002, Campbell & Mithun 1980, Pires & Thomason 2008). This alleged lack of directionality has, in fact, been argued to be a pseudo-problem by many scholars, who have suggested analyses where this purported problem is satisfactorily dealt with (cf. Harris & Campbell 1995, Gildea 1998, Kikusawa 2003, Eythórsson & Barðdal 2011, 2016, Willis 2011, Barðdal & Eythórsson 2012a, 2017, Barðdal 2013, 2015, Barðdal et al. 2013, Barðdal & Smitherman 2013, Walkden 2014, inter alia).

In an attempt to argue for the feasibility of syntactic reconstruction, a typology of changes relevant for the historical development of argument structure has recently been put forward (Barðdal 2015:351–52). This typology demonstrates changes in the case

\* We gratefully acknowledge the generous support of the funding bodies that have made this research possible. Jóhanna Barðdal received support from the ERC under their Starting Grant Schema (grant agreement 313416, EVALISA) and from the Norwegian NFR under their FRIHUM Schema (grant agreement 205007, NonCanCase) during Tonya Kim Dewey's affiliation with the University of Bergen, Norway. During the early stages of the research Michael Dunn was supported by the Max Planck Society through the Max Planck Research Group 'Evolutionary Processes in Language and Culture'. We also thank Michael Frotscher, Leonid Kulikov, associate editor George Walkden, three anonymous referees of this journal, and the audiences in Oslo (2013), Cambridge (2014), Ghent (2014), Bergen (2014), Tromsø (2014), Poznań (2014), Kviknes (2015), Naples (2015), Nijmegen (2016), and Manchester (2016) for valuable comments and discussions on different versions of this work. Contributions: JB, TKD, and MD planned and wrote the manuscript; JB, TKD, and CA compiled the data; TKD coded the data; MD designed and carried out the computational analysis; all authors contributed equally to the discussion and the interpretation of the results.

marking of noncanonically case-marked argument structure constructions, documented throughout the history of the Germanic languages. Specifically for subject case marking, these include the following.

- Accusative subjects changing into dative
- Nominative subjects changing into dative
- Dative subjects changing into accusative
- Accusative, dative, and genitive subjects changing into nominative
- Morphological case distinctions disappearing with the subsequent breakdown of the case system

Given these processes, the directionality of change in subject case marking appears to be unpredictable, raising the questions of (i) how we know which case to reconstruct for oblique subject predicates in Proto-Germanic, and (ii) how we may operationalize the directionality of these changes. With regard to the first question, evidence from different languages has different weight, of course, with Gothic carrying the most weight, being the oldest attested Germanic language. Also, Old Norse-Icelandic is the most archaic of both North and West Germanic with regard to case assignment, which means that when there is an overlap in case marking between Gothic and Old Norse-Icelandic, which is quite frequent, that case can safely be reconstructed for the proto-stage. We also know that dative sickness, the process by which accusative subjects change into dative, is more common than ‘accusative’ sickness, which involves the opposite process, namely dative subjects changing into accusative. More generally, however, nonnominative subjects have changed to nominative throughout the attested Germanic period.

The diachronic pathways of linguistic change described above can be expressed formally as a quantified model of structural evolution. The advantage of such a treatment of language change is that it renders a prose description of a process into a statistically testable—and falsifiable—model. This raises a further question of how to operationalize and model changes in noncanonical subject marking. We present a computational phylogenetic analysis that allows us to test different models of change in subject case marking from Proto-Germanic to the modern languages.

Phylogenetic methods for trait analysis were originally developed in evolutionary biology, where they are used to test hypotheses about the coevolution of brain and body size (Pagel 1994), evolution of genome size and structure (Organ et al. 2007), and others. A strand of anthropology has taken up these methods to test hypotheses about human behavior, such as the coevolution of human social systems with modes of subsistence (Holden & Mace 2003); postmarital wealth transfer and family structure (Fortunato et al. 2006); and the transmission of manufacturing traditions (Matthews et al. 2011). In linguistics, phylogenetic methods have been used to study dependencies in the evolution of grammatical features (Pagel & Meade 2006a, Dunn et al. 2011), lexical stability and rates of change (Pagel, Meade, & Barker 2004, Pagel & Meade 2006b, Pagel, Atkinson, & Meade 2007, Atkinson et al. 2008), and the evolution of terminological systems (Jordan 2011); see also Dunn 2015 for a review of these methods.

Collectively, the family of statistical techniques that use evolutionary models to explain diversity is called ‘comparative methods’, or ‘phylogenetic comparative methods’ to distinguish them from the (linguistic) *COMPARATIVE METHOD*. The *MULTISTATE* method is a phylogenetic comparative method used for examining evolution of characters, such as linguistic features, social characteristics, and biological phenomena, that vary between multiple states. Currie and colleagues (2010) used this method to test

competing hypotheses about the evolution of political complexity, and Jordan (2011) uses the same method to examine pathways of change in the evolution of kinship terminologies. While these anthropological studies tend to use linguistic data as a model of cultural phylogeny, this particular method has not previously been used in a purely linguistic investigation, despite being ideally suited for testing diachronic hypotheses about syntactic change.

We show how a single model of evolutionary change accounts for the history of an entire set of oblique subject verbs and how evolutionary trait analysis correctly infers reconstructed ancestral states arrived at by the traditional philological method, but only given the proper constraints. As such, phylogenetic comparative methods offer a way of testing the plausibility of the assumed directionality, hence confirming or disputing our reconstruction. It combines two different methods of studying linguistic change to answer a single question: (i) the PHILOLOGICAL method, through which a reconstruction of specific items may be carried out ('small details' view), and (ii) the PHYLOGENETIC method, through which processes of change are investigated ('big picture' view). By the term 'philological reconstruction', we refer to reconstruction based on the philological historical-comparative method, reconstruction that is philologically anchored in the study of historical texts, which is the standard method of historical-comparative linguistics, as opposed to 'phylogenetic reconstruction', based on computational phylogenetic comparisons.

This article is structured as follows: we first present subject case marking in Germanic (§2), illustrating with examples some of the diachronic pathways listed above. Section 3 contains an overview of the Germanic material used in the current study, including the twelve verbs, with their meanings and case-marking patterns, and describes the methods applied in this research. The quantitative results of the evolutionary trait analysis are presented in §4, showing beyond doubt how a constrained model, combining dative and nominative sickness, makes the best predictions about which subject case to reconstruct for each verb for Proto-Germanic. A discussion of how case variation in the earliest daughters should be reconstructed follows (§5), and §6 concludes.

**2. SUBJECT CASE MARKING IN GERMANIC.** One of the most well-known peculiarities of Modern Icelandic is that it allows grammatical subjects in morphological cases other than the nominative, such as in the accusative, dative, or genitive, with the relevant case frame being lexically assigned by each predicate.<sup>1</sup>

(1) Modern Icelandic

a. Accusative

**Mig** vantar túlk.  
**me.ACC** lacks.3SG interpreter.ACC  
 'I need an interpreter.'

b. Accusative

Jú, **þá** dreymdi drauminn fagra um ...  
 yes **them.ACC** dreamed dream.the.ACC beautiful.ACC about  
 'Yes, they had the beautiful dream about ...'

<sup>1</sup> The following abbreviations are used: ACC: accusative, DAT: dative, GEN: genitive, INF: infinitive, NEG: negation, NOM: nominative, OBL: oblique, SG: singular.

## c. Dative

**Mér** líkaði strax vel í sundinu og hætti fljótlega í  
**me.DAT** liked immediately well in swimming and quit soon in  
 dansi.  
 dancing

‘I immediately liked the swimming lessons and stopped soon thereafter  
 taking dance classes.’

## d. Genitive

**Skjálftans** varð vart í geimnum.  
**quake.the.GEN** became observed in space.the.DAT

‘The earthquake was observed in outer space.’

Structures of this type are also documented in all of the other Germanic languages, including during their earliest stages, although the grammatical status of the nonnominative argument has been subject to considerable debate in the syntactic community (cf. Allen 1995, Rögnvaldsson 1995, Falk 1997, Faarlund 2001, Barðdal & Eythórsson 2003, 2012b, Eythórsson & Barðdal 2005). Table 1 summarizes the argument structure constructions that are original for Germanic.

One-place predicate	NOM-Ø	ACC-Ø	DAT-Ø	GEN-Ø
Two-place predicate	NOM-ACC	ACC-NOM	DAT-NOM	GEN-NOM
	NOM-DAT	ACC-ACC	DAT-GEN	GEN-PP
	NOM-GEN	ACC-GEN	DAT-PP	GEN-CL
	NOM-PP	ACC-PP	DAT-CL	
	NOM-CL	ACC-CL		

TABLE 1. Argument structure constructions in Germanic (cf. Barðdal 2008:57).

Ø: no argument, CL: clause, PP: prepositional object.

For Modern Icelandic, the syntactic research of the last forty years or so has established beyond doubt that these noncanonically case-marked subject-like arguments are indeed grammatical subjects and not topicalized objects, and this has been shown on the basis of a host of syntactic properties and behaviors (Andrews 1976, Thráinsson 1979, Zaenen et al. 1985, Sigurðsson 1989, *inter alia*). Of the other modern Germanic languages, it is only Faroese and German that have maintained structures of this type (with the noticeable exception of the obsolete, or at least very stilted, expressions *methinks* and *meseems* in English and ‘OBL *dunkt*’ in Dutch). In the other Germanic languages, however, morphological case marking has generally been lost through history (cf. Barðdal 2009). There is no doubt that in Modern Faroese, the noncanonically case-marked subject-like argument is a syntactic subject (Barnes 1986), while opinions have been more divided about German (Zaenen et al. 1985, Eythórsson & Barðdal 2005, Barðdal 2006, Barðdal et al. 2014).

For the earlier stages of the Germanic languages, the traditional approach has been that these noncanonically case-marked subject-like arguments are ‘logical’ or ‘psychological’ subjects and not true grammatical subjects (cf. Nygaard 1905, Lindquist 1912, Jespersen 1927, Diderichsen 1941, Hennig 1957). Within modern scholarship, Kristofersen (1996) and Faarlund (2001) in particular have adopted the traditional approach. It has been shown in a series of publications, however, that only a subject analysis is sustainable for the first argument of these argument structures in Old Norse-Icelandic (Rögnvaldsson 1991, 1995, 1996, Barðdal 2000, Barðdal & Eythórsson 2003). Recent research has also revealed similar evidence in the other early Germanic languages, including Old Swedish, Early Middle English, and Gothic (Barðdal 2000, Barðdal &

Eythórsson 2003, 2012b, Eythórsson & Barðdal 2005). For an overview of dative subject predicates in other early Indo-European languages, see Barðdal et al. 2012, and for the latest overview of dative subject predicates in Germanic, see Barðdal et al. 2016.

Irrespective of the grammatical status of the noncanonically case-marked subject-like argument as either being the grammatical subject, or only exhibiting a subset of subject behaviors in some Germanic languages, there is agreement in the scholarly community about the order of the arguments in the argument structure, including the fact that these noncanonically case-marked subject-like arguments are the first argument of the argument structure. We here follow Eythórsson & Barðdal 2005 and Barðdal & Eythórsson 2012b, where a subject definition is suggested, applicable independently of the subject properties, and defined in terms of the internal order of the arguments in the argument structure, namely as being the first argument of the argument structure. Thus, in the remainder of this article, we refer to accusative and dative subject-like arguments as ACCUSATIVE and DATIVE SUBJECTS, respectively.

The choice of argument structure for a predicate is generally lexically based in the Germanic languages, such that different predicates have been inherited into the daughter languages with a given argument structure, like NOM-ACC, DAT-NOM, ACC-ACC, ACC-GEN, and so forth. But matters are not so simple, as considerable variation has also been found both within each language and across the Germanic languages (cf. Halldórsson 1982, Allen 1995, Falk 1997, Petersen 2002, Viðarsson 2009, Barðdal 2011, Dewey & Carey 2017). The best-known process affecting the case marking of accusative subjects is DATIVE SICKNESS (a.k.a. DATIVE SUBSTITUTION), which became well known among contemporary linguists due to its pervasive impact on Modern Icelandic, where it has been amply documented during the last decades (Svavarsdóttir 1982, Rögnvaldsson 1983, Svavarsdóttir et al. 1984, H. Smith 1994, M. Smith 2001, Jónsson & Eythórsson 2005). What is considerably less well known is that similar variation is found throughout the history of all the Germanic languages, albeit at different times (cf. Barðdal 2011).

The examples in 2 below with *vanta* ‘lack’ and *dreyma* ‘dream’ are two examples of accusative subject predicates that have started occurring with dative subjects in Modern Icelandic instead of the prescribed original accusative case marking (their accusative correspondences are given in 1a–b).

(2) Modern Icelandic: accusative → dative

a. **Mér** vantar svona fjarstýringu.

**me.DAT** lacks.3SG such remote.control.ACC

‘I need a remote control like that.’

b. **Mér** dreymdi lítinn draum, í draumnum vorum við!!

**me.DAT** dreamed little.ACC dream.ACC in dream.the were we

‘I dreamed a little dream, in the dream there was us!!’

The concept of dative sickness has also been applied to earlier language stages by Halldórsson (1982), who documents what appears to be fairly random variation between nominative, accusative, and dative subjects with a handful of verbs as early as in Old Norse-Icelandic. This variation has been further investigated by Viðarsson (2009), who has shown that there is considerably more variation found across accusative and dative subject predicates throughout the history of Icelandic than hitherto believed. As a clear tendency, however, dative sickness does not seem to take off until around the middle of the nineteenth century (cf. Halldórsson 1982:182, Barðdal 2011) and is amply documented into Modern Icelandic by several studies (Halldórsson 1982, Svavarsdóttir 1982, Svavarsdóttir et al. 1984, Jónsson & Eythórsson 2005, Friðriksson 2008).

Turning to Old English, the examples in 3 show that dative sickness was also at work during an early period of the English language and is not a phenomenon confined to later periods or to North Germanic.

## (3) Old English

## a. Accusative

& sæde þæt **hine** þyrste  
& said that **him.ACC** thirsted.3SG  
'and said that he was thirsty'

(Vercelli Homilies 24:242.258; late 9th–early 10th century AD)

## b. Dative

and **þam** ne þyrst on ecnysse þe of þam wætere  
and **the.one.who.DAT** NEG thirst.3SG in eternity that of the water  
drincð  
drinks

'and he who drinks of the water ... will never be thirsty in all eternity'

(Ælfric Homilies Supplementary 5:25.696)

In addition to dative sickness, there is also evidence of both nominative and dative subjects changing into accusative, although this is found more sporadically in the Germanic languages; see the following examples from Old Swedish and Old High German.

## (4) Old Swedish: nominative → accusative

a. hulchet **wij** inthet pa twile  
which **we.NOM** nothing on doubt

'which we do not doubt at all'

(STb 5:355, ca. 1430–1440 AD)

b. **mik** twiflar fasth och flere her nidre, som i fa well höra  
**me.ACC** doubts really and more here down which you get well hear

'I have serious doubts about more things down here, as you will hear'

(BSH 5:20, ca. 1504 AD)

## (5) Old High German: dative → accusative

a. soso **imo** rat thunkit  
as **him.DAT** advisable seems.3SG

'As he thought advisable'

(Otfrid II 12,42, ca. 863–871 AD)

b. sô hoh is gomaheit sin, thaz **mih** ni thunkit  
so high.NOM is.3SG being.NOM his.NOM that **me.ACC** not seems.3SG  
megi sîn theih suahriomon sine zimbintanne  
power.NOM be.INF thick.ACC shoestraps.GEN his.ACC buckles.ACC  
birine  
touch.INF

'So exalted is his being that I do not think it possible to touch the thick buckles of his shoestraps'

(Otfrid I 27,57–58, ca. 863–871 AD)

Examples of this change have also been documented in Middle English (Allen 1995: 250), although the accusative and the dative have merged at this time, yielding the new case as oblique.

## (6) Middle English: nominative → oblique

Wherefore **us** oghte ... have patience.  
why **us.OBL** ought have patience  
'Why we should ... have patience.'

(Chaucer B.Mel., 998 (2185–90), ca. 1400–1410 AD)

A third change has also been documented in the Germanic languages throughout their recorded history, namely a general change of accusative and dative subjects to

nominative, sometimes referred to in the literature as *NOMINATIVE SICKNESS* (Eythórsson 2000a, 2002, Barðdal & Eythórsson 2003). Examples of this change are given in 7–9 below from Icelandic and Faroese.

- (7) Icelandic: accusative → nominative  
**Ég** dreymdi einu sinni að ég fæddi strákk og hann hét tveimur  
**I.NOM** dreamed one time that I gave.birth boy and he had two  
 nöfnum  
 names  
 ‘I once dreamed that I gave birth to a boy and he had two names’
- (8) Faroese: accusative → nominative  
 Einaferð droymdi **eg** at Jesus kom aftur.  
 once dreamed **I.NOM** that Jesus came back  
 ‘I once dreamed that Jesus came back.’
- (9) Faroese  
 a. **teimum** batnaði (dative original)  
**them.DAT** got.better  
 ‘they got better’  
 b. **tær** skal batna eftir trimum døgum (dative → nominative)  
**they.NOM** shall get.better after three days  
 ‘they shall get better after three days’

The output of these three processes—dative, accusative, and nominative sicknesses—appears to correlate with the type frequency of the three constructions in the Germanic languages (Barðdal 2011), as the nominative subject construction is highest in type frequency and attracts the most predicates from the other constructions, the dative subject construction is next highest in type frequency, and the accusative subject construction is lowest in type frequency of the three (cf. Barðdal 2008:55–62).

Type frequency does not, however, explain the change from dative to accusative (cf. 5 above), manifested in the variation between the two cases, for instance, in Middle High German oblique subject constructions (von Seeffranz-Montag 1983:161–63); nor does type frequency explain the change from nominative to accusative or dative (cf. 10 below), which is also documented in Icelandic (Eythórsson 2000b, 2002:206, n. 15). These last two changes have been explained with reference to semantics, with different semantic analyses having been proposed in the literature. For Icelandic, and Germanic in general, Barðdal (2009) and Barðdal and Kulikov (2009) have suggested that the different argument structure constructions have merged because of an overlap in their semantics, while Dewey and Carey (2017) have suggested, for Middle High German, that replacement of the dative by an accusative is an indication of deeper affectedness of the subject.

- (10) Modern Icelandic  
 a. Nominative original  
**Ég** er 19 ára og er í vanda. **Ég** kvíði fyrir öllu.  
 I am 19 years and am in trouble **I.NOM** is.anxious.3sg for everything  
 ‘I’m 19 years and I have problems. I feel anxious about everything.’  
 b. Nominative → accusative  
**Mig** kvíðir fyrir þessum degi allt árið.  
**me.ACC** is.anxious for this day all year  
 ‘I feel anxious, throughout the whole year, when thinking about this day.’

## c. Nominative → dative

**Mér** kvíðir fyrir nákvæmlega öllu, og þá meina ég  
**me.DAT** is.anxious for exactly everything and then mean I  
 öllu.

everything

‘I feel anxious about everything, and with that I mean everything.’

The last change to be mentioned in this state of case variation in the Germanic languages involves the breakdown of the case-marking system altogether. The majority of the Germanic languages went through this process, with a concomitant merger of the different argument structure constructions (Barðdal 2009). This happened in English, Dutch, and the Mainland Scandinavian languages (cf. Delsing 1991, Allen 1995, Falk 1997, Enger 2010, *inter alia*). Case marking has also been reduced in both Faroese and German, while it remains intact in Icelandic.

It is generally assumed in the literature that the breakdown of the case system in Germanic is a consequence of (i) a lingua franca situation during medieval times, (ii) regulation of word order, (iii) phonological mergers, (iv) structural case ousting lexical case, or (v) the emergence of the definite article (see Barðdal 2009 for references and empirical arguments against all of these proposals). Here it is assumed that the breakdown of case marking is the last step, the endpoint, of a larger development where the functional distinction between different, but semantically overlapping, argument structure constructions is lost. In other words, when the different case and argument structure constructions become synonymous, the morphological cases become redundant.

Simply put, the breakdown of case marking in English, Dutch, and Mainland Scandinavian was characterized by a period where accusative and dative merged functionally and/or morphologically. First the pronouns merged, with different forms of the earlier accusative and dative pronouns forming a new oblique paradigm, a pronominal paradigm that was a mixture of the old accusative and dative forms. The endpoint of this development sees the morphological marking of full noun phrases disappearing altogether. Noncanonically case-marked subjects survived this period of morphological turmoil for a while, even up to a few centuries, but after the breakdown of morphological case marking, the predicates that had not fallen into disuse gradually started occurring with nominative subjects (cf. Barðdal 1998). Observe also that during this period of syncretism and amalgamation, the morphological marking of oblique subjects in English, Dutch, and Mainland Scandinavian is ambiguous between accusative and dative, as the two are in the process of merging both formally and functionally.

The different evolutionary paths of oblique subjects in Icelandic in particular and Germanic in general—changing in many instances to nominative, but also from accusative to dative, and sporadically from dative to accusative—have been well known in the field for a long time (Fischer & van der Leek 1983, von Seeffranz-Montag 1983, Allen 1986, 1995, Petersen 2002, Barðdal & Eythórssón 2003, Barðdal 2009, 2011, 2015, Viðarsson 2009). The pathways have also been fairly well documented in the literature, taking place at different times in different languages. Even so, no unified analysis of these developments has yet been carried out, one that takes into account both historical depth and the broad diversity of languages in the Germanic family. Our aim here is to measure the interaction among the three different forces, and to compare the effects they have had on (i) the case assignment of individual lexical predicates, and (ii) the evolution of the case and alignment system as a whole. Producing a testable model of how the three processes have progressed in the course of time not only will provide us with the opportunity to test the predictions following from their constraints, but will also bring us substantially closer

to evaluating the outcome of the interaction of the three forces on the evolution of the morphological case and alignment system in Germanic.

### 3. MATERIALS AND METHODS.

**3.1. THE VERBS.** The data for this study come from the database compiled by the Non-CanCase project at the University of Bergen and the EVALISA project at Ghent University (<http://www.evalisa.ugent.be/>). This is a collection of predicates that take a subject marked in a case other than the nominative across the Indo-European languages. All entries in the database include information about the predicate, etymological information, derivational morphology, the genetic classification of the language the predicate is found in, and the argument structure of the predicate—that is, the case of the first argument, the case of the second argument (if any), whether the predicate takes a complement clause or an infinitive, and so forth. At least one example, glossed, translated, and given in context, is provided for each predicate, and all entries are currently in the process of being verified by a second linguist with a specialization within the relevant language.

For this study we chose a subset of twelve cognate verbal lexemes, attested across the Germanic family (see Table 2 below for the reconstructed and attested forms).

- (11) ‘hunger’, ‘thirst’, ‘like’, ‘lack’, ‘dream’, ‘avail’, ‘lust’, ‘long’, ‘wonder’, ‘think/seem’, ‘suffice’, ‘fail’

These predicates were selected because (i) they represent an assortment of predicates with dative- and accusative-subject marking (see Table 2), (ii) their argument structures have been reconstructed or are reconstructable, and (iii) the lexical reconstructions of these items are largely uncontested. The reflexes of these verbs in the daughter languages were coded for the case of the first (= subject) argument: N(ominative), A(ccusative), or D(ative). For the languages where there is variation—for example, Old English *hyngran* ‘hunger’, which is primarily found with a dative-marked subject but is also attested with accusative and nominative—that variation has been coded as all three states being present. In order to limit the number of complicating factors, only subject case marking is coded and not object case marking.

For some languages, like Middle English, Middle Dutch, and Old Swedish, it is impossible to distinguish accusative from dative marking if the subject is only attested as a pronoun, due to merger of the dative and accusative cases in the pronominal system. This merger is not confined to subject pronouns, but is found throughout the grammatical system as a part of the general breakdown of the case system. For these languages, the verbs were coded as AD, implying variation, for two reasons. First, and most importantly, the merger of accusative and dative in these languages is a change that is independent of the change under investigation, and introducing a fourth state O(blique) unnecessarily complicates the data and the analysis. Second, the merger of the cases was likely perceived of as variation between the two cases in the minds of speakers, much like in Modern English, where *him* can be a direct (= accusative) object or an indirect (= dative) object. We therefore conflate instances where multiple discretely marked states exist with instances in which discrete marking of states has been lost; the end result of the two types of variation is, moreover, the same, so this conflation does not affect the analysis in any way. The same coding strategy has been used for the modern languages in which case distinctions have been lost altogether, like English, Dutch, Swedish, and Norwegian, which only exhibit remnants of case distinctions. Since these languages have also to a large extent lost nonnominative subjects (aside from certain frozen forms such as with Dutch *dunken* ‘think/seem’), this coding strategy does not constitute a problem for the analysis.

For the reconstruction of the Proto-Germanic lexical forms, we have relied on already existing reconstructions (Grimm & Grimm 1854, Feist 1909, de Vries 1962, Bennecke et al. 1990, and the *Oxford English Dictionary*,<sup>2</sup> inter alia). The reconstruction of the argument structures for the proto-stages is in part based on Barðdal & Eythórsson 2012a,b; for the predicates where an argument structure has not been reconstructed elsewhere, we present our own reconstructions based on the comparative method. In those instances where a Gothic (and therefore East Germanic) attestation is not available, the reconstruction is for Proto-North-West Germanic, as is standard practice.

All cognate sets have been semantically stable from the earliest documentation until the present day, with the partial exception of Old English *dreman*, which meant ‘re-joyce’, and Old English *brestan*, which has already shifted to ‘burst’ from the original meaning ‘lack’, staying ‘burst’ up to the present day. This means that Old English is excluded from our analysis of ‘dream’ and that the whole English branch is excluded from

	HUNGER	THIRST	LIKE	LACK	DREAM	AVAIL
GOTHIC	huggrjan A	þaursjan A	galeikan DN	—	—	—
OLD NORSE	hungra A	þyrsta A	líka D	bresta AD	dreyma A	duga D
FAROESE	hungra N	tyrsta N	líka D	bresta D	droyma DN	—
ICELANDIC	hungra A	þyrsta A	líka D	bresta AD	dreyma ADN	duga D
OLD SWEDISH	hungra DN	þörsta A	líka D	brista AD	dröma ADN	dugha D
SWEDISH	hungra N	törsta N	líka N	—	drömma N	—
NORWEGIAN	hungra N	tørste N	líka N	—	drømme N	—
OLD HIGH GERMAN	hungeran A	dursten A	galíhhên D	brestan DA	troumen D	tugen D
MIDDLE HIGH GERMAN	hungern A	dürsten A	lichen DN	brestan D	tröumen DA	tugen D
GERMAN	hungern AN	dürsten AN	—	bresten D	träumen N	taugen N
OLD SAXON	hungrian A	thurstian A	líkôn D	brestan D	—	dugen DN
MIDDLE DUTCH	hungeren AD	dorsten AD	lijken AD	brestan AD	dromen AD	doghen AD
DUTCH	hongeren N	dorsten N	lijken N	barsten N	dromen N	—
OLD ENGLISH	hyngrian DAN	þyrstan ADN	lician D	—	—	dugen D
MIDDLE ENGLISH	hungeren D	thirsten AD	lician AD	—	dremen AD	—
ENGLISH	hunger N	thirst N	like N	—	dream N	—
ANCESTRAL	*hungr- A	*þurst- A	*líkō/ē- D	*brestan D	*draum- A	*dugan D

(TABLE 2. *Continues*)<sup>2</sup> Online: <http://www.oed.com>

	LUST	LONG	WONDER	THINK/ SEEM	SUFFICE	FAIL
GOTHIC	luston A	—	—	þugkjan D	ganôhjan D	—
OLD NORSE	lysta AD	langa A	undra A	þykkja D	nægja D	þrjóta A
FAROESE	lysta AD	langa D	undra N	tykja D	—	tróta DN
ICELANDIC	lysta AD	langa AD	undra A	þykja D	nægja D	þrjóta A
OLD SWEDISH	lysta AD	langa AD	undra A	þyckia D	nöghia DA	tryta AD
SWEDISH	lusta N	—	undra N	tycka N	nöja N	tryta N
NORWEGIAN	lyste N	—	undre N	tykke N	nøgie N	tryte N
OLD HIGH GERMAN	lustan AD	langen A	wuntarôn N	thunkian DA	ginuogian DA	-driozan A
MIDDLE HIGH GERMAN	lûsten AN	langen A	wundern A	dunken DAN	genüegen DA	verdzieren A
GERMAN	lûsten AND	—	wundern AN	dünken DAN	genügen DA	verdzießen A
OLD SAXON	lustian A	langian A	uundrôn N	thunkian D	—	—
MIDDLE DUTCH	lusten ADN	langen AD	wonderen AD	dunken AD	ghenoeghen DA	verdzieten AD
DUTCH	lusten N	verlangen N	verwonderen NAD	dunken AD	genoegen AD	verdzieten AD
OLD ENGLISH	lystan A	langian A	wundrian N	þyncan D	genogian N	apreotan A
MIDDLE ENGLISH	lesten AD	longen AD	wundren N	thincan AD	—	—
ENGLISH	lust N	long N	wonder N	—	—	—
ANCESTRAL	*lustjan A	*lang- A	*wunþarôn A	*þunkjan D	*ga-nah- D	*þreutan A

TABLE 2. Listing of verbal cognate sets and reconstructed Proto-Germanic forms with subject case coding. The order of A, D, and N reflects the chronological order of the cases, or, when no such chronology can be detected within a synchronic stage, it reflects the differences in frequency between the cases.

our analysis of ‘lack’. This has been dealt with in the following way: we coded ‘dream’ as unattested in Old English, since the method models syntactic change in COGNATE SYNONYMS rather than simple cognates. This makes it appear that the lexical item ‘dream’ suddenly appeared in Middle English and Middle Dutch with variable case marking (recall that Middle English and Middle Dutch have merger of the dative and accusative, independent of changes in subject case marking), which complicates the reconstruction. This certainly makes it appear as if both accusative and dative are original for ‘dream’ in the English taxon of the data set. The same is true for *brestan*.

**3.2. THE REFERENCE TREE.** The family tree being used here, representing the genetic relatedness between the Germanic languages, is based on the consensus arrived at by comparative Germanic linguists as to the grouping of the Germanic languages (Figure 1). North and West Germanic are grouped together, as opposed to a North-East vs. West or East-West vs. North grouping, because while convincing isoglosses exist for all

groupings, the isoglosses shared between North and West Germanic are the most striking and point to a period of shared development (Fulk 2008:147, Salmons 2012:84).



FIGURE 1. The Germanic tree.

The branch length in the tree in Fig. 1 is proportional to time. The dates are calculated on the basis of the historical record where possible, for example, by defining Old High German by the High German Consonant Shift. Prehistoric dates are adopted from Ringe 2006 and Fortson 2010; in other words, the dates are generally agreed upon by the linguistic community. Not all Germanic languages are included, nor are dialectal varieties indicated.

A comment on the type of node representing the relationship between two historical varieties of the same language is in order here. In our view, two historically different varieties of the same language, such as Old English and Middle English, can never share a ‘direct’ genealogical link, since the language called *Middle English* cannot be a ‘direct’ descendant of the language called *Old English*. This is because the scribes writing in Middle English cannot be shown to be direct descendants of the scribes who wrote in Old English. In the same manner, different historical varieties of a language may be documented in different geographical regions; Old English, for instance, may represent the dialect spoken in Winchester, while Middle English may represent the dialect spoken in London several centuries later. This means that documented ancient varieties are never the precise ancestors of later varieties of the same languages, hence the branching off of Middle English from Old English in the tree, and so forth. All representations in historical linguistics of direct lineages serve as abstractions, which at the same time draw attention away from real geographical, sociocultural, and genealogical differences found between different historical varieties of any given language.

**3.3. PHYLOGENETIC TRAIT ANALYSIS.** The MULTISTATE method is a phylogenetic technique for estimating the parameters of an evolutionary model of trait change, implemented in the software package BayesTraits (<http://www.evolution.rdg.ac.uk/BayesTraits.html>; Pagel 1999, Pagel & Meade 2006a). It is used to investigate the historical behavior of a trait that varies over the members of a family. The input to the program is (i) a phylogenetic tree—or phylogenetic tree sample—representing the genealogical interdependencies of the taxa under investigation, in this case, ‘languages’; (ii) a list of observed values of one or more traits, or ‘features’, of these languages; and (iii) a model of evolutionary change, specified by the researcher.

The model of change is a set of probabilities for each state of a feature to turn into each other state. Some of these transition parameters may be prespecified by the researcher; the values of the remaining free parameters are estimated by the MULTISTATE method. Apart from these parameter values, the MULTISTATE method also

reports the likelihood of the given model, indicating the model fit, that is, how well the model explains the observed diversity of character states. It is possible to compare the likelihoods of analyses of the same data using different models, and thereby to infer whether one model is a statistically better fit to the observed data than the other. Given a specified model, tree, and set of observations, it is further possible to infer ancestral states at any desired node of the tree. These ancestral state inferences are expressed as a set of probabilities for each ancestral character value.

In this analysis a maximum likelihood method is used to examine the evolution of traits over the philological reference tree, described above. The taxa in the analysis are the sixteen contemporary and older Germanic languages, the characters under investigation are the cognate verbs, and their character states are the subject case markers N, D, A, or combinations of these (cf. Table 2). As in the linguistic description of change in subject case marking in Germanic ('dative sickness' etc.), we adopt a model which presumes that a single evolutionary process underlies change in the argument structure of all these verbs. In terms of a MULTISTATE analysis, this means that we need to estimate a single set of transition probabilities between states that best explains the diversity of subject coding for the entire sample of verbs. As we are using maximum likelihood, a likelihood ratio test is used to determine which model of change best explains the entire set of subject case strategies present in our sample.

The models of evolution are defined by parameters representing the probability of change between two states. There are three states: N(ominative), D(ative), and A(ccusative); a model description ' $q_{DN}$ ', for example, means 'the rate that D becomes N' (i.e. the probability that D changes into N per unit branch length on the tree). Predicates can be coded as having multiple states, which we use to indicate instances where a particular predicate has variation in its subject case marking, as well as instances where two subject case markers are morphologically collapsed.

Apart from the basic model where every state has a probability (to be determined) of turning into every other state, we additionally test a range of models defined by specifying that certain transitions are impossible, that is, they have a rate of zero. We tested all of the logically possible models of evolution according to these constraints and compared their likelihood and fit to known historical linguistic facts. Particular attention will be given to the four models in Figure 2.

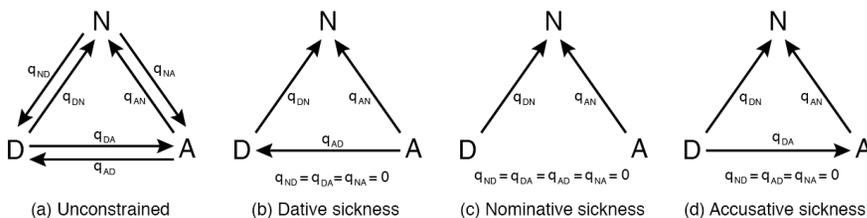


FIGURE 2. Some relevant models of the evolution of subject case marking in Germanic.

We start with an examination of the UNCONSTRAINED MODEL, which entails that MULTISTATE is allowed to estimate the most likely transition probabilities if any state is allowed to change to any other. The three other models introduce further constraints on this. The DATIVE SICKNESS MODEL (more properly 'the dative-nominative' sickness model) combines the dative sickness model proper—that accusative subjects can turn into datives, but not vice versa, with nominative sickness—that accusative and dative subjects can turn into nominatives, while nominative subjects remain unaffected. The

NOMINATIVE SICKNESS MODEL only allows change directly from dative or accusative to nominative. This model is included in order to test whether the dative sickness model is necessary to explain the diversity of outcomes, or whether the simpler process suffices. Finally, we test an ACCUSATIVE SICKNESS MODEL, which is the inverse of the dative sickness model described above. There is no suggestion that this model is a regular process across the family (though German seems to have undergone a period of accusative sickness; see Dewey & Carey 2017); rather, this model is intended to serve as a validation of the other tests.

A methodologically more elegant way to carry out this analysis would be to use Bayesian Markov chain Monte Carlo (MCMC) methods to estimate model parameters, using a ‘reverse jump hyperprior’ to explore the space of possible models. However, to do this adequately would require either coestimation of the tree topology or use of a tree sample independently inferred from, for example, lexical data (as presented in Bouckaert et al. 2012). The MAXIMUM LIKELIHOOD analysis here presented allows us to treat the language phylogeny as a known factor, reflecting the consensus of the field, and it eliminates a major—but largely irrelevant—source of potential controversy in interpretation of the results.

**4. RESULTS.** The complete numerical results are presented in supplementary materials available online.<sup>3</sup> There are two main outcomes. The first is a failure: naive application of the MULTISTATE algorithm does not select the dative sickness model as most likely. Several other models representing implausible historical pathways are inferred to have a higher likelihood. But the second outcome is a success: the dative sickness model is overwhelmingly superior at reconstructing the ancestral states, and the model agrees with the human expert on the reconstruction of subject case for all twelve predicates. This confirms that the dative sickness model is the best explanation of the philological observations.

There are sixty-two possible models defined by constraining one or more transitions to zero, in addition to an unconstrained model. The likelihood scores of the four models discussed above are given in Table 3. Likelihood scores can be compared using the LIKELIHOOD RATIO (LR) test.

$$(12) \text{ LR} = 2(L(A) - L(B))$$

$L(A)$  and  $L(B)$  represent the log likelihoods of the two models. The likelihood ratio can be interpreted as a chi-squared distribution with degrees of freedom equal to the difference in the number of parameters of the two models. Thus, the LR of ‘unconstrained’ to ‘dative sickness’ in Table 3 is 9.2, with three degrees of freedom (dative sickness has three fewer rate parameters than the unconstrained model), which according to the standard interpretation of this statistic is a significant difference,  $p < 0.025$ .<sup>4</sup> While it is impossible to work out a  $p$ -value for the statistical significance of the difference between the dative sickness and accusative sickness models (since they have the same number of parameters), a log LR of 12.8 is clearly strong evidence favoring the dative sickness model over accusative sickness.

<sup>3</sup> Supplementary materials: All materials necessary to replicate this study may be downloaded from a public repository at <https://github.com/evolving/dative-sickness> (permanent archive at <https://doi.org/10.6084/m9.figshare.4625941>). A noninteractive version may be viewed at <http://evolving.github.io/dative-sickness>.

<sup>4</sup> In R, `pchisq(9.2, 3, lower.tail=FALSE)`.

MODEL	LOG LIKELIHOOD
Unconstrained	-105.6
Dative sickness	-110.2
Accusative sickness	-116.6
Nominative sickness	-162.7

TABLE 3. Log likelihood scores of the four models.

If all models are ranked in order of likelihood, the dative sickness model comes in at the sixteenth position out of sixty-three. As some rates are estimated as zero (rather than being constrained to zero), the total number of distinct models is smaller. For instance, the model with  $q_{DN}$  set to zero estimates the rate  $q_{AD}$  as zero, and so is indistinguishable from the model with both  $q_{DN}$  and  $q_{AD}$  set to zero a priori. Likewise, the unconstrained model has zero rate estimates for  $q_{AD}$  and  $q_{DA}$ . If we merge such instances, the dative sickness model is eleventh out of fifty-three distinct models. The dative sickness model does not stand out by virtue of a higher likelihood score. But the dative sickness model is clearly superior if we turn to the ancestral state reconstructions inferred by the MULTISTATE method. For example, the ancestral state reconstructions produced by the unconstrained model are implausible and/or uncertain: compare the MULTISTATE reconstructions in Figure 3 with the philological reconstructions in Table 2.

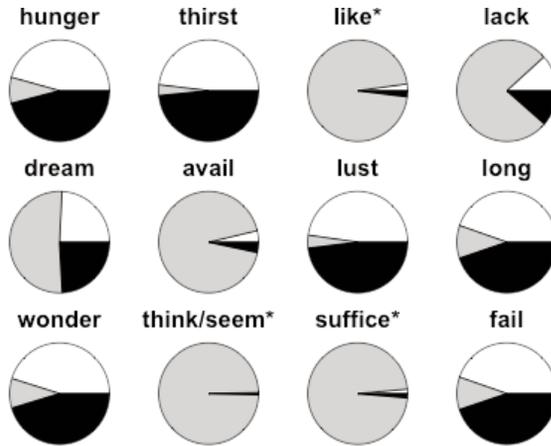


FIGURE 3. Probability of different ancestral states as reconstructed by MULTISTATE under the unconstrained model. Key to cases: gray: dative; white: accusative; black: nominative. An asterisk indicates greater than 95% confidence in a single reconstruction.

In contrast, the dative sickness model performs the reconstructions better than any other model: all of the reconstructions are correct ('avail' at 94.8%, the remainder > 95%); see Figure 4. The higher likelihood models have on average more than seven failures to reconstruct the correct ancestral state. Only one other model reconstructs the ancestral states with the same low failure rate as the dative sickness model, but this model is ranked fifty-four out of sixty-three, with an extremely low likelihood of -522. Thus we can conclude that only the dative sickness model can plausibly account for both the observed diversity of case frames for these predicates and the philological reconstructions.

The only model comparable to the dative sickness model in terms of accuracy of reconstruction is the model with two constraints,  $q_{NA} = q_{ND} = 0$ . This model shares with

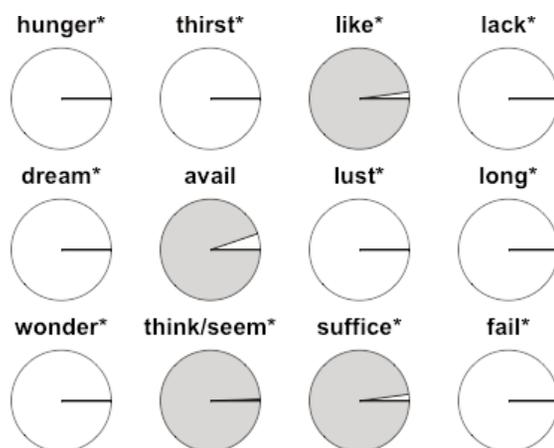


FIGURE 4. Reconstructed ancestral case for the twelve predicates under the dative sickness model. Key to cases: gray: dative; white: accusative. An asterisk indicates greater than 95% confidence in a single reconstruction.

dative and accusative sickness the constraints against change away from nominative, but it does not constrain changes between dative and accusative. This model correctly reconstructs all but two of the ancestral states. However, the slight improvement of the model likelihood ( $LR = 0.9$ ) comes at the cost of adding an extra parameter, and the improvement is not statistically significant ( $p = 0.34$ ).

**5. DISCUSSION.** Given the variation in case marking found in the earliest layers of these languages, the question arises as to whether it is reasonable to assume that the subject case marking of our twelve verbs was constant in the proto-language and did not show variation of the type we find in some of the later daughters, that is, between accusative and dative, or even nominative, for that matter. Indeed, it is justified to assume that a proto-stage showed the same behavior as is found in its daughters, given the absence of any other evidence. And, of course, if variation in subject case marking existed in Proto-Germanic, such variation might well have been carried down to the daughters, and hence be documented in the earliest language layers. Or, put differently, given these considerations, variation in later layers of the daughters would count as much less compelling evidence for variation in the proto-language than variation in the earliest layers.

Observe, now, that there is systematic variation between Old/Middle English, on the one hand, and the other early Germanic languages on the other. Our MULTISTATE analysis does not take this variation as showing anything about the ancestral state, exactly because this variation is uniformly attested internally within Old/Middle English, on the one hand, and between English and the other languages, on the other, suggesting rather that, with regard to functional mergers of the case markers, English had progressed (or ‘decayed’) further than the other languages at this given time in history. This is in line with the comparative chronological overview of the decay of case marking across Germanic, outlined in Barðdal 2008:156–58.

Moreover, of our twelve verbs, six show consistent case marking between Gothic and Old Norse-Icelandic: ‘hunger’, ‘thirst’, ‘like’, ‘lust’, ‘think’, and ‘suffice’. For the remaining verbs, where there is no Gothic attestation, three show consistent behavior between Old Norse-Icelandic and Old High German: ‘avail’, ‘long’, and ‘fail’. One

additional verb, ‘wonder’, shows consistent behavior across Old Norse-Icelandic, Old Swedish, and Middle High German. One verb, ‘dream’, occurs consistently with an accusative in Old Norse-Icelandic, while in Old High German it is documented with a dative. However, ‘dream’ in Middle High German occurs with both accusative and dative. This may suggest that accusative also existed in Old High German, but that it is undocumented because of the sparsity of the Old High German data. The antiquity of case marking in Old Norse-Icelandic is, however, the main reason for assuming that accusative is original for ‘dream’ in Germanic.

The last verb, ‘lack’, indeed shows variation across the early daughters, as well as language-internally, although our MULTISTATE analysis assumes that accusative is original with ‘lack’, presumably because of the known process of dative sickness. The other option is, of course, to reconstruct variation in the subject case marking of ‘lack’ in Proto-Germanic. In that case, one would reconstruct two different argument structures for ‘lack’, one with an accusative subject and the other with a dative subject.

**6. SUMMARY AND CONCLUSIONS.** It is a well-known fact that there is competition between dative, accusative, and nominative subjects in Icelandic, with accusatives being replaced by datives (dative sickness) and with datives/accusatives being replaced by nominatives (nominative sickness). What is less well known is that (i) dative sickness is found across the Germanic languages at different times in their history, (ii) dative was also replaced with accusative for subjects in Old High German (accusative sickness), (iii) nominative subjects were replaced by accusatives in Old Swedish and Modern Icelandic, and finally (iv) nominative subjects were replaced by obliques in Middle English and by datives in Modern Icelandic. The final step of this merger of different argument structure constructions is the total breakdown of the morphological cases, resulting in a generalized nominative case for subjects, a generalized accusative case for objects, and a generalized dative case for indirect objects in the modern Germanic languages that have lost case morphology.

In order to disentangle the different forces at work and the strength of each force, we have carried out phylogenetic trait analysis on a set of data consisting of twelve predicates found across the three Germanic subbranches, seven of which are reconstructed with an accusative subject and five with a dative subject. The analysis is based on cognate synonyms across the branches, hence excluding cognates with different meanings. The timeline includes (roughly) four different points in time, with Gothic being the oldest attested language; Old High German, Old Saxon, and Old English being more or less contemporary; Old Norse, Old Swedish, Middle High German, Middle Dutch, and Middle English coexisting at approximately the same time; and Modern Icelandic, Faroese, Norwegian, Swedish, German, Dutch, and English representing the present state of the evolution.

The quantitative phylogenetic analysis compares different models of change, of which four are a priori interesting given the current research problem. The first of these models is the unconstrained model, where the likelihood of any state changing into any other state has the same probability; the other models are the dative sickness model, the nominative sickness model, and finally the accusative sickness model, where further constraints on probability are introduced. The nominative sickness model allows changes directly from accusative or dative to nominative; the dative sickness model combines the nominative sickness model and also allows changes from accusative to dative. The accusative sickness model, predicting that datives turn into accusatives, is not widely at-

tested; hence it more or less serves as a validation of the other models. Several different models were compared, with only the dative sickness model accurately accounting for the diversity of case frames and at the same time largely complying with the philologically reconstructed subject case of the twelve predicates under investigation.

It follows from the present research that not only is it possible to reconstruct the individual lexical predicates that selected for nonnominative subjects in Proto-Germanic (etymological reconstruction), but it is also possible to reconstruct argument structure constructions and their case frames for that same proto-stage (syntactic reconstruction). As such, it is clear that not only can directionality of change be identified, but it can also be tested and modeled, and competing forces compared, resulting in a model of the evolution of argument structure constructions in Germanic that is more reliable than any philological reconstruction on its own. As such, syntactic reconstruction appears feasible—in fact, considerably more feasible than hitherto assumed.

Through an analysis with the MULTISTATE method, we have reported on a single model of evolutionary change accounting for the history of an entire set of oblique subject predicates. The MULTISTATE method has correctly inferred the ancestral states, reconstructed by the traditional philological method, but only given the proper constraints. Hence, we have combined two different ways of investigating linguistic change to answer a single research question.

- Philology: Reconstruction of specific linguistic items on the basis of the standard linguistic historical-comparative method ('small details' view)
- Phylogeny: Investigation of processes of change ('big picture' view)

A quantitative tool such as the MULTISTATE method constitutes a formal model of a philological reconstruction, giving an independent test of the plausibility of a reconstructed process of syntactic change, providing the opportunity to corroborate or refute the reconstruction and to compare it against other possible processes. In general, the fusion of traditional philological methods with phylogenetic techniques in an explicit hypothesis-testing framework can be expected to enrich and validate the inferences of traditional philology. Further applications of the method testing grammaticalization pathways in argument structure may include modeling the changes in oblique subject marking, and the breakdown of morphological case systems.

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[Received 14 June 2015;

revision invited 13 September 2015;

revision received 24 March 2016;

accepted 9 October 2016]