



**University of
Zurich**^{UZH}

**Zurich Open Repository and
Archive**

University of Zurich
Main Library
Strickhofstrasse 39
CH-8057 Zurich
www.zora.uzh.ch

Year: 2019

Evidence for Britain and Ireland as a linguistic area

Dedio, Stefan ; Ranacher, Peter ; Widmer, Paul

Abstract: Approaches to linguistic areas have largely focused either on purely qualitative investigation of area formation processes, on quantitative and qualitative exploration of synchronic distributions of linguistic features without considering time, or on theoretical issues related to the definition of the notion "linguistic area". What is still missing are approaches that supplement qualitative research on area formation processes with quantitative methods. Taking a bottom-up approach, we bypass notional issues and propose to quantify area formation processes by a) measuring the change in linguistic similarity given a geographical space, a socio-cultural setting, a time span, a language sample, and a set of linguistic data, and b) testing the tendency and magnitude of the process using Bayesian inference. Applying this approach to the expression of reflexivity in a dense sample of languages in northwestern Europe from the early Middle Ages to the present, we show that the method yields robust quantitative evidence for a substantial gain in linguistic similarity that sets the languages of Britain and Ireland apart from languages spoken outside Britain and Ireland and cross-cuts lines of linguistic ancestry.

DOI: <https://doi.org/10.1353/lan.2019.0054>

Posted at the Zurich Open Repository and Archive, University of Zurich

ZORA URL: <https://doi.org/10.5167/uzh-178974>

Journal Article

Published Version

Originally published at:

Dedio, Stefan; Ranacher, Peter; Widmer, Paul (2019). Evidence for Britain and Ireland as a linguistic area. *Language. Journal of the Linguistic Society of America*, 95(3):498-522.

DOI: <https://doi.org/10.1353/lan.2019.0054>

EVIDENCE FOR BRITAIN AND IRELAND AS A LINGUISTIC AREA

STEFAN DEDIO

PETER RANACHER

PAUL WIDMER

University of Zurich

University of Zurich

University of Zurich

Approaches to linguistic areas have largely focused either on purely qualitative investigation of area-formation processes, on quantitative and qualitative exploration of synchronic distributions of linguistic features without considering time, or on theoretical issues related to the definition of the notion ‘linguistic area’. What is still missing are approaches that supplement qualitative research on area-formation processes with quantitative methods. Taking a bottom-up approach, we bypass notional issues and propose to quantify area-formation processes by (i) measuring the change in linguistic similarity given a geographical space, a sociocultural setting, a time span, a language sample, and a set of linguistic data, and (ii) testing the tendency and magnitude of the process using Bayesian inference. Applying this approach to the expression of reflexivity in a dense sample of languages in northwestern Europe from the early Middle Ages to the present, we show that the method yields robust quantitative evidence for a substantial gain in linguistic similarity that sets the languages of Britain and Ireland apart from languages spoken outside of Britain and Ireland and cross-cuts lines of linguistic ancestry.*

Keywords: language contact, linguistic areas, area-formation processes, northwestern Europe, quantitative historical linguistics, Bayesian inference, reflexivity

1. INTRODUCTION. In areal linguistics and dialectology, both qualitative and quantitative methods are well-established procedures for exploring synchronic distributional patterns in linguistic data (e.g. Donohue & Whiting 2011, Lameli 2013, Michael, Chang, & Stark 2014, Muysken et al. 2015). When investigating the diachronic dynamics of area-formation processes, however, research almost exclusively relies on qualitative methods. Without aiming at exhaustivity, this qualitative approach usually sketches area formation in a small sample of languages based on a handful of carefully selected features (see e.g. for the Balkans, Friedman & Joseph 2017:57; for Britain and Ireland, Hickey 2017a; for the Baltic-Slavic contact zone, Wiemer, Seržant, & Erker 2014; for a different approach to large areas, however, see Bickel 2017). What is still missing here is a complementary quantitative method that explicitly implements time, can deal with large language samples, and does not rely on deterministic diagnostic values of certain linguistic traits.

We propose to implement such a method that tracks the emergence of areal patterns using the changes in similarity over time between a dense sample of languages in a given sociogeographical configuration. The robustness and magnitude of the signal from these changes in similarity is assessed (i) by comparing it to signals obtained from another, adjacent, sociogeographical setting and (ii) by controlling for random effects. The configurations used as an application case for this method are Britain and Ireland as the configuration suspected of areal convergence and the surrounding coastal regions of northwestern Europe as a contrast group. The data on which the similarity measures are based in this case study are fine-grained descriptions of the various expressions used to encode reflexivity.

* This research was supported by the Swiss National Science Foundation under grant agreement CRSII1_160739 ‘Linguistic Morphology in Time and Space’ (LiMiTS) and by the UZH Research Priority Program ‘Language and Space’. We are grateful to the many colleagues who advised us, in particular Max Wahlström, Christian Furrer, Jürg Fleischer, Rik van Gijn, Balthasar Bickel, Florian Sommer, and Andreas Säuberli, and to the associate editor and the referees for helpful comments. Author contributions: SD, PR, PW designed the research; PW and SD undertook the theoretical framing; SD supervised data collection; PR and SD performed the quantitative analysis; and all authors discussed the results and contributed to the final version of the article. SD and PR are equal contributors.

This article is organized as follows: we first explain the linguistic reasoning behind this method (§2), and then lay out the extralinguistic parameters, that is, the configuration of our application case (§3). Section 4 gives an overview of the data, while §5 explains the quantitative methods used to track the formation of areal signals. In §§6 and 7, we explore and analyze the results, and summarize and discuss them in §8. We close with some general remarks (§9). A full description of methods and data is made available in the supporting materials, which can be accessed online at <http://muse.jhu.edu/resolve/76>.

2. LINGUISTIC AREAS. Among the many problems related to the notion of linguistic areas, four major issues prove to be particularly troublesome (Stolz 2006:34–39, Campbell 2017:24–26, van Gijn & Wahlström 2018, van Gijn 2019).

- (i) It is almost impossible to define geographical boundaries of a presumed area because the distributions of feature-value specifications do not converge.
- (ii) The (minimum) number of languages and/or language varieties needed to speak of an area cannot be determined.
- (iii) The diagnostic value of a specific feature (for example, presence or absence of subject-verb agreement, consonant-inventory size, placement of units relative to each other, etc.) is unclear, and the number of features required for establishing an area is based on arbitrary assumptions.
- (iv) The specifics of the sociocultural settings that foster, or inhibit, area-formation processes are elusive, if retrievable at all.

These enduring problems are partly ontological in nature and as such probably insoluble, since there is, for the time being, no reason to assume that a nondeterministic ‘linguistic area’ exists as an abstract, natural entity that is a predestined *tertium comparationis* for comparing linguistic data (Stolz 2006:35f.). Therefore, instead of asking what the nature of a linguistic area is and the extent to which a specific areal configuration conforms to some deterministic notion of ‘linguistic area’, it seems more fruitful to look at various manifestations of linguistic divergence and convergence, that is, evolution of similarity, under specific circumstances and to explore emerging patterns.

In line with recent proposals for circumventing categorial dead ends (e.g. Bickel & Nichols 2006, Muysken et al. 2015, van Gijn 2019), we advocate an approach drawing on the basic assumption of areal linguistics: over time, the sharing of associated geographical and sociocultural¹ spaces tends to increase the observable degree of linguistic similarity between languages because structures are selected, replicated, and diffused by speakers for sociolinguistic reasons (Trudgill 2011). We take it for granted that there are a multitude of possible geographical spaces with their specific sociocultural properties formed by historical contingencies, and for every space, the degree of areality can be retrieved empirically. Furthermore, it has repeatedly been highlighted (most recently, for example, in Campbell 2017, Friedman & Joseph 2017) that a proper understanding of linguistic areas hinges on the answer to the question ‘What happened?’, that is, on the dynamics of linguistic evolution behind degrees of similarity that are determined by change and maintenance of specifications given historical events. Therefore, time is given center stage in our approach; it is the dimension in which features acquire values under given circumstances and area formation becomes manifest.

Following the geography-first approach advocated by van Gijn (2019), an areal investigation thus begins with selecting what we call a CONFIGURATION—that is, select-

¹ The term ‘sociocultural’ encompasses all variables that relate to human interaction, that is, political, economic, scientific, cultural, sociolinguistic, historical, and so forth.

ing a geographical space (in this case study, Britain and Ireland) and compiling its historical, sociocultural, and sociolinguistic properties, which will act as a background against which the formation of areal signals should emerge. This configuration also defines the maximum number of languages that can participate in area-formation processes within its boundaries, there being only a finite number of languages inside a specific geographical space. Language subsamples can be drawn based on factors such as research question, linguistic concept(s), availability of data, shape of the area, sampling principles, and so forth. In this article, we zoom in on Britain and Ireland, a configuration with a long history in areal linguistics. Linguistic areas containing or intersecting with Britain and Ireland have, for example, been proposed in Morris-Jones 1900, Pokorny 1927, Wagner 1959, 1964, Haspelmath 2001, Wehr 2005, and Hickey 2012, 2017a, to mention but a few, and accounts of possible Celtic influence on English include Preusler 1938, Tolkien 1963, Tristram 1999, Vezzosi 2005, Lange 2007, Lutz 2009, Poppe 2009, Schumacher 2009, and Irslinger 2013, 2014. This configuration is ideal for this kind of investigation because the sociocultural context is well understood, the geospatial setting is easily definable, and the languages spoken in this configuration are rather well documented over a long span of time.

Since we do not aim at (dis)proving that a configuration is an instantiation of a deterministic category ‘linguistic area’ but rather seek to identify noteworthy developments of areal distributions in and across configurations, there is no need to select a particular linguistic feature with a deterministic or presumed diagnostic power that serves the purpose of diagnosing whether the investigated configuration instantiates an abstract concept ‘linguistic area’. The selection of linguistic features is first and foremost driven by the need to achieve descriptive accuracy and comparability across all languages in the sample. This means that we use a set of purely descriptive features that is tailored to this specific sample and that captures the principal variance encountered therein.²

We start from the basic assumption that no feature is a priori exempt from the effects of language contact (Thomason & Kaufman 1988, Matras 2009) and predict that every feature has the potential to bear signals of area-formation processes; the diagnostic power of a feature is best established bottom-up in specific configurations and time spans. Thus, the question we pose is as follows.

- (1) Given a set of linguistic features and a configuration, are the sampled languages more similar than one would expect when compared to other language samples and checked against driving forces behind distributional patterns, such as phylogenetic autocorrelation (constraints related to genealogical dependency), universal biases (constraints related to cognition, physiology, communication, etc.), and chance?

The answer is expected to differ across configurations in the same way as in a qualitative approach. Object coindexing, for instance, is generally considered to contribute to the Balkan sprachbund (Friedman & Joseph 2017:57), but is usually not invoked when claiming a linguistic area in Britain and Ireland, as its diagnostic value is deemed negligible. The upshot of this approach is a number of statements about specific sets of linguistic features in a given configuration, and in the spirit of fine-grained multivariate typological description followed here (Bickel 2007, 2010), patterns of areality are expected to emerge from the data when aggregating them. For example, we may observe that over a specific span of time in a configuration under examination, a set of features

² For the reasoning behind descriptive theory, see, among others, Dryer 2006, Haspelmath 2010, Bickel 2015, Dahl 2016.

involved in expressing grammatical relations displays an increase in similarity. But evolution of similarity over another, or the same, span of time may be different (e.g. no increase, or decrease) when we examine grammatical relations in another configuration using the very same set of features.

For our case study, we select a set of morphological, morphophonological, and morphosyntactic devices that are utilized in our language sample to express reflexivity, that is, constructions where the A and P arguments have the same reference and cover almost the whole field of Kemmer's (1993) middle situation types, excluding constructions that (i) have only reciprocal or passive semantics or (ii) lack overt morphological or morphosyntactic marking (see §4 for a full description of the variables). This means that the structures in example 2 are in the scope of this study, while those in 3 are not.³

- (2) a. ar-nda·cumcabat
for-3PL.P·raise.PRS.3PL
'in order that they may raise themselves'
(Old Irish; Griffith & Stifter 2009–2013:46a.12)
- b. They saw themselves in the mirror.
- c. Sie machten sich davon.
3PL.NOM make.PST.3PL REFL away
'They eloped.'
(Modern High German)
- d. Sie waschen sich.
3PL.NOM wash.PRS.3PL REFL
'They wash.'
(Modern High German)
- (3) a. They wash.
- b. imo-narnaicc iarum do Chongal 7 do Chonall
RECP-meet.PST.3SG then to Congal and to Conall
'then, Congal and Conall met'
(Middle Irish; Marstrander 1911:240, l. 136)
- c. dius-et ez-aedi
choose-PPL AFF-be.PRS.3SG
'he is chosen'
(Middle Breton; Ernault 1887:240, l. 5)

While the method is supposed to work on an arbitrarily chosen set of features, our choice—that is, reflexive constructions—is not entirely random for two reasons. First, there is much recent qualitative research on reflexives from an areal northwest European perspective (Tristram 1999, Haspelmath 2001, Lange 2005, Vezzosi 2005, Poppe 2009, Vennemann 2013, Irlinger 2014). Second, two conflicting hypotheses have been proposed based on this qualitative research: some scholars hypothesize that the contemporaneous emergence of at least some reflexivization strategies is indicative of areal convergence in Britain and Ireland (Tristram 1999, Haspelmath 2001, Vezzosi 2005, Vennemann 2013, and in particular Irlinger 2014:196–99), while others take a much more cautious stance (Lange 2005, Poppe 2009). We capitalize on this work and apply our method in order to (i) test whether there is a signal of areal convergence in Britain and Ireland and (ii) assess the strength of the signal across configurations.

As for the heuristics, we propose to measure the dynamics of area formation as the change in similarity between the languages in the sample regarding the chosen feature(s) over time given the configuration. Time is implemented by connecting the sam-

³ Abbreviations used in glosses: 1: first person, 2: second person, 3: third person, A: first argument of a two- or three-place predicate, ACC: accusative, AFF: affirmative, ART: article, DAT: dative, F: feminine, GEN: genitive, INF: infinitive, INT: intensifier, IPF: imperfect, M: masculine, MP: mediopassive, NEG: negative, NOM: nominative, NPST: nonpast, P: second argument of a two-place predicate, PASS: passive, PL: plural, PPL: past participle, PRS: present, PST: past, RECP: reciprocal, REFL: reflexive, SG: singular.

pled languages to their phylogenetic ancestors within a given temporal space and subtracting the similarity values of the ancestor pairs from those of their successors. The resulting numerical value can be negative, which points toward divergence, or positive, hinting at convergence and possibly contact-driven area formation. The signal may also be close to zero, which indicates that the overall similarity remains unchanged (e.g. because contact inhibits divergence, all languages develop in the same direction, or the configuration contains more than one group of converging languages).

3. BRITAIN AND IRELAND AS A CONFIGURATION. Britain and Ireland are geographically separated from the European mainland by the North Sea and the English Channel, which—to a greater or lesser extent—have been sailed by humans since their formation at the end of the Holocene. As the archaeological and historical records show, the flow of people and goods was not constant—periods of strong trade connections and low-scale migrations alternate with periods of low-scale trade and large-scale migrations throughout history. This means that although the amount and type of contact between people living in and around Britain and Ireland were subject to constant fluctuation, these bodies of water have never been impermeable barriers but rather allowed for at least some amount of contact (Van de Noort 2011:146–77).

Prior to the period relevant for this study, Britain and Ireland saw the immigration of Celtic-speaking people from the European mainland in the first millennium BCE, the Roman invasion in 43 CE followed by the establishment of a Roman province that was abandoned in 410 CE, and the arrival of Germanic-speaking people (Angles, Saxons, and Jutes) from the north-west of present-day Germany and Denmark from the fifth to seventh centuries CE (Higham 2013a,b, Cassidy et al. 2016).

The first large-scale population movements to Britain and Ireland that coincide with a sufficiently large linguistic record are the Viking Age invasions. After initial raids in the late eighth century CE, seafaring people from modern-day Denmark and Norway established settlements in large parts of present-day England, northwest Scotland, and the Hebrides, on the Isle of Man, and in the coastal regions of Ireland in the ninth and tenth centuries. The Viking influence on these areas lasted between fifty and 300 years, after which original speakers of Old Norse usually shifted to the local linguistic varieties. In some parts of northern Scotland, the presence of North Germanic lasted even longer—the North Germanic language Norn was spoken on Orkney and Shetland up until the eighteenth century CE (Ó Cróinín 1995:233–71, Woolf 2007:275–311, Downham 2008, Hadley 2008, Ó Corráin 2008, Wilson 2008).

The second series of population movements of interest for this study begins with the Norman Conquest of England in 1066. This was followed by several invasions of Wales, Scotland, and Ireland in the subsequent centuries, bringing speakers of both Anglo-Norman and English to all areas of Britain and Ireland. While the first waves of English-speaking immigrants assimilated to the Celtic inhabitants of these areas and—at least partly—shifted to the respective vernaculars, later migrational processes such as the plantations of Ireland, the Highland clearances of the eighteenth and nineteenth centuries, and the migration of workers during the industrial revolution led to a more persistent presence of the English language in former Celtic-speaking areas (Davies 2000, Doyle 2015, Black 2017:94–245).

Naturally, this eventful migrational history features prominently in the linguistic literature on contact and areality—be it in the detailed study of the possible outcomes of language shift (the emergence of Irish English: Hickey 2007, Filppula, Klemola, & Paulasto 2008), the mechanisms of language death (Scottish Gaelic: Dorian 1981), the

possible structural impact of sustained bilingualism (Welsh: Baker 1985), or the various areal linguistic studies listed above (§2).

4. DATA. The data used in this study were collected from grammars and linguistic descriptions, supplemented by corpus searches, of forty-three linguistic varieties (twelve Insular Celtic, twenty-four Germanic, seven Romance; see Table 1) around the North Sea and adjacent areas, and span from the eighth century CE to the present. The varieties were not chosen to achieve a genealogically balanced sample but to provide a high areal resolution that represents the actual genealogical distribution within the configuration. Genealogy is thus not controlled for in a systematic way, and we start from the simple assumption that the areal signal has the potential for overriding the genealogical signal. Given the scarcity of records for several languages and varieties before the high Middle Ages, the sample is not temporally balanced.

LANGUAGE	PERIOD	LANGUAGE	PERIOD
Goidelic		West Germanic	
Old Irish	700–900	Old English	700–1100
Middle Irish	900–1250	Middle English	1150–1500
Modern Irish	modern	Modern British English	modern
Modern Scottish Gaelic	modern	Older Scots	1150–1650
Late Manx	1800–1974	Scots	modern
Brythonic		Irish English	modern
Middle Welsh	1150–1450	Old Saxon	700–1150
Northern Modern Welsh	modern	Middle Low German	1200–1550
Southern Modern Welsh	modern	Mod. Low German (East Frisian)	modern
Middle Breton	1150–1700	Mod. Low German (Dithmarschen)	modern
Central Breton	modern	Old Frisian	1200–1450
Middle Cornish	1150–1600	Fering	modern
Late Cornish	1600–1800	Modern West Frisian	modern
Gallo-Romance		Old Dutch	650–1150
Old French (Francien)	750–1300	Middle Dutch	1150–1500
Old French (Norman)	750–1300	Modern Dutch	modern
Jèrriais	modern	Old High German	750–1050
Normand	modern	Middle High German	1050–1350
Ancien Picard	1000–1350	Modern High German	modern
Picard	modern	North Germanic	
Modern Standard French	modern	Old Norse	700–1150
		Danish	modern
		Norwegian	modern
		Icelandic	modern
		Faroese	modern

TABLE 1. Sampled languages with their period of attestation.

To calculate the change in similarity between languages and configurations, each variety in our sample is assigned to one of three periods (c. 800, c. 1200, and c. 1900 CE, ± 150 years; see §5 below). A more equal periodization (e.g. 800/1200/1600/2000) would have been desirable, but is rendered impossible by the lack of available linguistic data and pertinent information for the early modern era.

The features used to describe the expressions of reflexivity aim to break the constructions down into a range of fine-grained descriptors (following the principles laid out in Bickel 2015, Bickel & Nichols 2017), span a range of binary morphological, morphophonological, and morphosyntactic properties, and are designed to be symmetric, which means that all states bear a more or less equal amount of information. They capture the relevant diversity we encounter in the sampled languages at clause level.

As several languages in the sample employ more than one construction, the additional value BOTH has been added to cover these instances instead of reducing relevant variation by arbitrarily picking a structure that is considered ‘normal’, ‘basic’, or ‘less marked’ in a given language.⁴ The variables are described in the following. The full description of our data with all references can be found in the online Supporting Material 1 for this article.

Positional dependency. Is the position of the reflexive marker directly dependent on the position of the verb? That is, is there a rule that the marker must be placed relative to the verb? This includes basic rules like ‘the reflexive marker is the innermost marker left of the verbal root’ or more complex ones like ‘with regular inflected verbs, the marker is in slot 3 of the verbal template, but in slot 1 with infinitives’.

In Middle Welsh (4a), the position of the reflexive marker *ym-* is determined by the position of the verb, whereas, for example, the Icelandic reflexive pronoun can be positioned freely (4b–c).

- (4) a. *yd-ym-dengys*
AFF-REFL-show.PRS.3SG
‘it reveals itself’ (Middle Welsh; Peniarth 14, 63; Isaac et al. 2010)
- b. *ég skammast mín*
1SG.NOM be.ashamed.PRS.SG 1SG.GEN
‘I am ashamed’ (Icelandic; Kress 1982:105)
- c. *Sér þvoði María fyrr í dag*
REFL.3.DAT wash.PST.3SG M.NOM earlier today
‘María washed earlier today’ (Icelandic; J. G. Jónsson 2011:109)

Stress. Can the reflexive marker establish its own stress domain? We have opted for splitting stress and phonological interaction into two values since stress domains tend to be larger than other domains of phonological and prosodic interaction (Bickel, Hildebrandt, & Schiering 2009:72) and this distinction helps capture variation in our data.

The *p*-pronouns used in Old English to denote reflexivity (*hie* in 5a) establish their own stress domain—that is, they need not attach to another stressed formant—while the mediopassive verbal endings of Old Norse (*-sk* in 5b) always attach to a fully stressed verb.

- (5) a. *hi hie þa up ahofon*
3PL.NOM 3PL.ACC then up raise.PST.PL
‘then, they raised themselves’ (Old English; Sweet 1883:94.34)
- b. *bjó-sk hann þa til hólmgöngu*
prepare.PST-2/3SG.MP.PASS 3SG.M then to duel.GEN.SG
‘he then prepared for the duel’ (Old Norse; F. Jónsson 1924:235.21)

Interaction. Does the reflexive marker interact phonologically with surrounding linguistic items (i.e. vowel harmony, liaison, mutations etc.)? This includes the whole range of phonological integration like syllabification patterns, vowel harmony phenomena, liaison, and so forth, but excludes stress (see above).

⁴ The number of instances of the value BOTH increases between epoch 1 and epoch 2 from 6.9% to 23.5% and then decreases again to 8.1%, which indicates that the possible greater availability of data for modern languages (and therefore the greater probability of finding constructions with conflicting values) does not skew the data toward BOTH.

A case without interaction is the Standard British English *X-self*-reflexives (6a). The P-markers used in Old Irish, by comparison, mutate following initial consonants and take part in syllabification processes operating left of the formant (6b).

- (6) a. He hit himself. (Standard British English)
 b. no-m·ísligur
 Ø-1SG.P·abase.PRS.1SG
 ‘I abase myself’ (Old Irish; Stokes & Strachan 1901–1903:17d.22)

Allomorphy. Does the reflexive marker display phonologically, morphologically, syntactically, or lexically conditioned allomorphy if all relevant features (i.e. number, person, case, tense-aspect-mood of the verb) remain the same?

The prime example of a construction with no allomorphy whatsoever is the Low German dialect of Dithmarschen, which uses the marker *sik* in all positions and with all possible formants (7a). The Old Irish P-pronouns employed as reflexive markers, in contrast, alternate according to both the element preceding them and the sentence type (main/subordinate clause, polarity) (7b–c). Purely phonological alternations are considered under INTERACTION.

- (7) a. Wir wüllt sik eerst mol waschen.
 1PL.A want.PRS.PL REFL first wash.INF
 ‘We want to wash ourselves first.’ (Dithmarschen; Lindow 1998:158)
 b. no-m·ísligur
 Ø-1SG.P·abase.PRS.1SG
 ‘I abase myself’ (Old Irish; Stokes & Strachan 1901–1903:17d.22)
 c. ar-nda·cumcabat
 for-3PL.P·raise.PRS.3PL
 ‘in order that they may raise themselves’
 (Old Irish; Griffith & Stifter 2009–2013:46a.12)

Inflection. Is the reflexive marker specified for (i) person, (ii) number, and/or (iii) case?

Positioning. Where is the marker positioned with respect to the verbal root (pre or post)? The marker may be positioned to the left of the verbal root or to its right or, as in some cases, both. The reciprocal marker of Modern Breton, for example, is strictly preverbal (8a), while the mediopassive endings of Old Norse are strictly postverbal (8b). The P-pronouns of Old English may occur on both sides of the verb (8c–d).

- (8) a. me nōm zi'ven
 1SG.A REFL defend.PRS
 ‘I defend myself’ (Modern Breton; Wmffre 1998:28)
 b. bjó-sk hann þa til hólmgöngu
 prepare.PST-2/3SG 3SG.M then to duel.GEN.SG
 ‘he then prepared for the duel’ (Old Norse; F. Jónsson 1924:235.21)
 c. hi hie þa up ahofon
 3PL.NOM 3PL.ACC then up raise.PST.PL
 ‘then, they raised themselves’ (Old English; Sweet 1883:94.34)
 d. Þa æteowode se deofol hine þam
 then show.PST.3SG ART.NOM.SG devil.NOM.SG 3SG.M.ACC ART.DAT.SG
 halgan were
 holy.DAT.SG man.DAT.SG
 ‘Then the devil showed himself to the holy man.’
 (Old English; Ælfric of Eynsham 1979:11.206–7)

Equivalence set. Does the marker form an equivalence set with passive or reciprocal? That is, is the reflexive marker also used to express passives or reciprocals? Both functional overlaps are widely attested in the languages of the world and are present in our sample (e.g. the Old Norse ‘mediopassive’ is used to form reflexives, reciprocals, and antipassives). As with reflexive marking in general, we do not distinguish between ‘normal’ or ‘unmarked’ ways to express these two functions, but also include marginal strategies.

The Modern Standard French *se* construction can be used to encode all three functions (9a–c), while Middle Welsh *X-hun(an)* is reflexive only (9d).

- (9) a. Il se lave.
3SG.M.A 3.REFL wash.PRS.3SG
‘He washes.’ (Modern Standard French)
- b. Il ne se trouvait pas de linguiste pour traduire
3SG.M.A NEG 3.REFL find.IPF.3SG NEG of linguist for translate.INF
le document.
ART document
‘You couldn’t find a linguist to translate the document.’
(Modern Standard French; Batchelor & Chebli-Saadi 2011:321)
- c. Alors nous nous battons?
so 1PL 1PL beat.PRS.1PL
‘So, we’re going to fight, aren’t we?’
(Modern Standard French; Guentchéva & Rivière 2007:583)
- d. o-ny-led-y du-hun
if-NEG-kill-NPST.2SG 2SG-INT
‘unless you kill yourself’ (Middle Welsh; Jones 1939–1941:10.24.35)

Expandable. Can the reflexive construction be expanded with an intensifier or a similar formant for stress, clarification, or similar ends? For most languages in our sample this is identical to the reflexive-intensifier distinction variable of Standard American English, but we wanted this variable to have a broader scope in the event that one of the languages without this distinction developed the ability to use an additional reflexive/intensifier (e.g. **I myself hurt myself*). Compare Modern Standard German (10a) and Standard British English (10b).

- (10) a. Sie schlägt sich (selbst).
3SG.F.NOM hit.3SG.PRS REFL.3 INT
‘She hits herself.’ (Modern Standard German)
- b. She hits herself (*herself). (Standard British English)

Third-person number syncretism. Does the reflexive marker distinguish number values in the third person? With this variable, we try to capture a common variation in our data, for example, zero differentiation with Modern High German *sich* (11a) or full differentiation like in Modern Standard English (11b), or whether there is one marker that is used for singular and plural while another encodes plural only, like in Fering, where the singular P-pronoun can also be used in plural constructions (11c–d).

- (11) a. Sie wäscht sich. Sie waschen sich.
3SG.F.NOM wash.PRS.3SG 3.REFL 3PL wash.PRS.3PL 3.REFL
‘She washes. They wash.’ (Modern High German)
- b. He sees himself. They see themselves. (Modern Standard English)
- c. Diartu sköömet ik me altu dol.
to.that feel.shame I me too much
‘I’m too ashamed to do that.’ (Fering; Arfsten & Vanselow 2014:36)

d. jo feel ham muar (...) tu Deenemark hentonjen
 3PL.A feel.PRS REFL more to Denmark draw.to.PPL
 ‘they feel stronger drawn toward Denmark’ (Fering; Drabek 2007:12.39)

The above variables are, to the best of our knowledge, linguistically independent from each other; that is, there is no a priori linguistic reason to assume a universal correlation of these features. As the whole data set consists of Indo-European languages from three different subphyla, certain correlations might be expected to appear (e.g. between number and person marking). Interestingly, the correlation in our data seems to be dependent on time, which we take to be a sign that our variables are essentially independent (see §6.1 below).

5. METHODS. The following gives an overview of the statistical methods used to examine the data, beginning with those used in the explorative analysis in §6, followed by those used in the Bayesian inference in §7. In-depth descriptions, including the R code, can be found in the online Supporting Material 2.

5.1. EXPLORATIVE ANALYSIS. We first compute the pairwise correlation of variables for each point in time using a chi-squared test. To counter the impact of genealogical splits on the amount of correlation in the data, we keep the number of languages constant during an epoch: that is, if a language splits, the ancestral state is included several times to balance out the influence of its offspring. This has been done, for example, with Middle Irish, which forked into Modern Irish, Scottish Gaelic, and Manx between 1200 and 1700 CE. We interpret the development of the correlation between features as a proxy for changes in entropy and therefore as a first indicator of areal signals in the data.

To measure the evolution of similarity we proceed as follows. We compute the pairwise similarity of the languages in our sample for three different points in time (± 150 years)—namely $t_1 = 800$ CE, $t_2 = 1200$ CE, $t_3 = 1900$ —using an adapted version of the simple matching coefficient (Cheetham & Hazel 1969). Then we compute the changes in similarity between successive stages (i.e. between t_1 and t_2 and t_2 and t_3).

Change between ancestor and successor languages is implemented by connecting the sampled languages at t_2 and t_3 to their phylogenetic ancestors within the given temporal space. Lineages are adopted from traditional classifications that ultimately rely on lexical and phonological data. Along the time axis, lineages may fork into new sublineages, and therefore an ancestor language can have multiple successor languages at a given point in time. For example, Old English is the ancestor of both Middle English and Older Scots, and so on; see Table 2.

We then first compute the pairwise similarity between all languages that belong to the same t (e.g. Old English and Old Irish), and subsequently the change over time between pairings of identical ancestry, for example, between pairing 1 (Old Irish/Old English) at t_1 and pairing 1' (Middle Irish/Middle English) at t_2 , and so on.

The simple matching coefficient is designed to calculate the similarity between vectors of binary data. As the variables in our sample can assume the additional value BOTH, we changed the procedure to yield a partial match for the value pairings BOTH/

t	GOIDELIC BRANCH	ENGLISH BRANCH	PAIRINGS
t_1 (800)	Old Irish	Old English	1 2
t_2 (1200)	Middle Irish	Middle English	1'
	Middle Irish	Older Scots	2'
t_3 (1900)	Modern Irish	Modern English	1''
	Modern Irish	Scots	2''

TABLE 2. Example of pairings and lineage connections over time.

TRUE and BOTH/FALSE and a full match for the value pairing BOTH/BOTH (see Supporting Material 2, §2.3.1).

For the calculation of the change in similarity during an epoch, we calculate the similarities of all ancestor–successor pairs of languages present at both points in time. To keep the size of the similarity matrices constant, ancestor languages appear multiple times if they fork into multiple varieties. The change in similarity is calculated by simply subtracting the similarity matrix for the older epoch from that of the newer epoch, that is, $t_2 - t_1$ and $t_3 - t_2$, and visualized in levelplots showing the pairwise change in similarity.

To assess how the developments relate to possible area-formation processes, we split the measurements of changes in similarity into groups according to whether (i) both languages of a pair are part of our configuration (ISLES–ISLES), (ii) both languages of a pair are part of the contrast group (CONTINENT–CONTINENT), or (iii) only one of the pair is part of the configuration (ISLES–CONTINENT). The distributions of values inside of each of the resulting groups are visualized as violin plots. Despite recent advances at macro-levels (e.g. Freckleton & Jetz 2009, Nelson-Sathi et al. 2010, Willems et al. 2016, Kelly & Nicholls 2017, Murawaki & Yamauchi 2018), there are no well-established quantitative methods to distinguish between spatial and phylogenetic signals in language change that would be applicable in this case. We therefore need to rely on qualitative examination of whether the observed developments cross-cut phylogenetic affiliations.

5.2. BAYESIAN ANALYSIS. Distance or similarity measurements in pairwise matrices are correlated. This means that if—given three points A , B , and C —the distances between points A and B ($d(AB)$) and between points B and C ($d(BC)$) are known, the possible values of the distance between points A and C ($d(AC)$) are limited to the interval $[d(AB)+d(BC), |d(AB)-d(BC)|]$. To avoid this correlation influencing the results of our Bayesian inference models, we draw the 1000 samples for each group in such a way that each sample contains only independent measurements. To account for the difference in size between the groups, the language sample size is limited to the size of the smallest group minus one—in our case, this is the group inside of our configuration with its nine members.

To find out how strong the signal of convergence or divergence seen in the explorative analysis is, we carry out Bayesian inference to estimate the posterior probability of p given the observed pairwise change in similarity in each sample. Due to its simplicity, we choose a Bernoulli model and model the change in similarity as a Bernoulli process $Y \sim \text{Bernoulli}(p)$, where p is the probability of success. A Bernoulli random variable can take two states, success and failure, which in our case map to gain and loss in similarity. For the Bernoulli model we binarize the data, setting all negative values (i.e. a loss in similarity) to 0, and all positive values (i.e. a gain in similarity) to 1. The few pairs for which the change in similarity is zero (zero-difference pairs) are randomly set to either 0 (i.e. loss) or 1 (i.e. gain); their influence on the results is small (see Supporting Material 2, §5.2). We estimate the posterior predictive distribution of p in each sample using a uniform prior in the interval $[0,1]$.

The resulting distribution of states in a sample allows for inference on the stochastic process and its implications, in our case a tendency for convergence or divergence of linguistic phenomena in a given area. However, the simplicity of the Bernoulli model comes at a cost. The model does not capture the magnitude of the process, that is, the change in similarity. For this reason we combine the Bernoulli model with the beta model, which enables us to gain insight into the magnitude of the stochastic process.

The beta model alone, in turn, would not be powerful enough, since the posterior predictive distribution could be caused by a few positive or negative outliers. Together, the Bernoulli and beta models make for a robust estimation both of the tendency and of the magnitude of the process.

To explore the actual convergence between languages seen in the explorative analysis of the languages within our configuration, we therefore model the change in similarity as a transformed beta distribution $Y \sim \text{beta}(\alpha, \beta)$ in the interval $[-1, 1]$, where α and β are the shape parameters of the distribution. We then estimate the posterior predictive distribution of Y given the observed, nonbinarized pairwise change in similarity in each sample, using uniform priors for α and β . The posterior predictive distribution of Y provides an estimate of the expected change in similarity for a hypothetical previously unexplored pair of languages during the respective epoch, taking into account the change in similarity already observed in the data.

6. EXPLORATIVE ANALYSIS.

6.1. FEATURE CORRELATIONS. The first interesting finding of the study is the development of feature correlations over time. The correlation matrix for 800 CE (see figure 4 in Supporting Material 2) does not show any significant correlation at all. In 1200 CE (Figure 1a), a small amount of significant correlation becomes manifest, and in 1900 CE (Figure 1b) a total of sixteen pairwise significant correlations between features occur. We take this steep increase over time to be indicative of a decrease of entropy in the sample—that is, the distribution of feature values across the sample becomes more uniform over time. This in turn hints at at least one significantly large group of languages becoming more similar during our epoch 2.

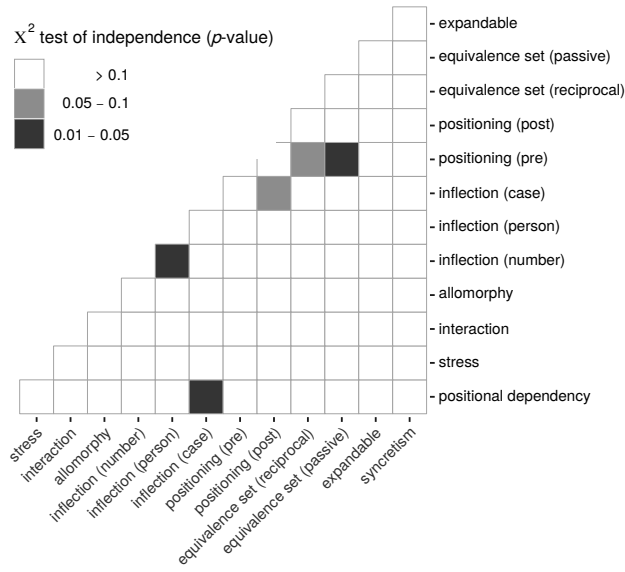
6.2. CHANGES IN SIMILARITY BETWEEN LANGUAGES. To uncover the relative developments between the languages in our sample, that is, whether individual languages become more or less similar over time, we calculate the change in similarity between language pairs at the beginning and end of each of our two epochs and visualize the changes in a levelplot.

In our first epoch (Figure 2), the changes are only slight (as indicated by the overall low intensity of the shading in the plot). We see some increases in similarity between Irish and several Germanic varieties (most prominently Middle High German and Old Norse), and a decrease in similarity between High German and most other languages attested during the epoch, but no systematic convergences or divergences.

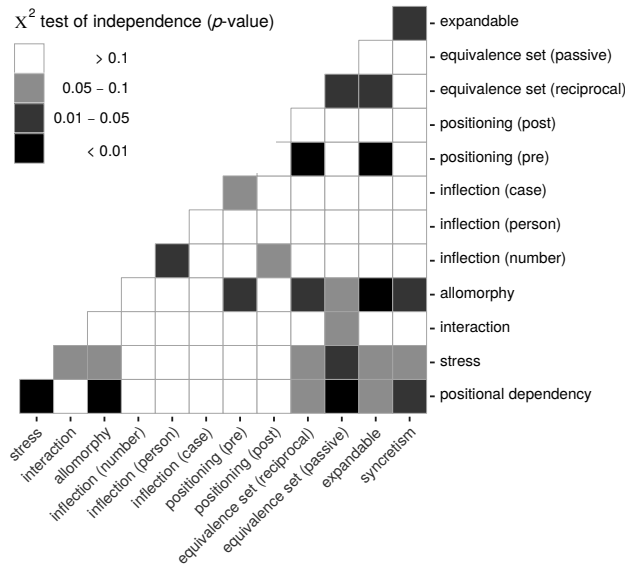
In the second epoch, the picture is vastly different (Figure 3): the most striking feature is the block of converging languages in the bottom left corner consisting of Insular Celtic and insular West Germanic varieties. The one language in this block not adhering to this tendency is Central Breton, the only Insular Celtic language spoken outside of Britain and Ireland. It shows a strong divergence from its closest genealogical relatives, Welsh and Cornish, and seems to side with some varieties of French, its closest geographical neighbors.

Late Cornish in turn shows the strongest convergence with the other languages inside this cluster, especially with the Goidelic branch of Insular Celtic and insular West Germanic varieties. The expansion of the latter during the Middle Ages and the modern era ultimately led to the extinction of Cornish in the eighteenth or early nineteenth century.

The right-hand side of the levelplot shows mostly divergences or developments close to zero. What is of interest here is the divergence between insular West Germanic and continental West Germanic. The development of the insular West Germanic varieties (Modern British English, Irish English, Scots) toward their Celtic neighbors in Britain



a. Correlation matrix for 1200 CE.



b. Correlation matrix for 1900 CE.

FIGURE 1. Correlation matrices for the two later periods of our language sample. Each square represents the *p*-value of the chi-squared test of independence for these two specific variables. The darker the shading of a square, the stronger the correlation between the two variables.

and Ireland sets them apart from their closest West Germanic relatives spoken outside of Britain and Ireland, and again the areal gain in similarity cross-cuts genealogical links.

6.3. CHANGES IN SIMILARITY WITHIN AND ACROSS CONFIGURATIONS. The emergent clusters of individual changes in similarity between language pairs become even more prominent if we split the language sample into two groups (inside our configuration,

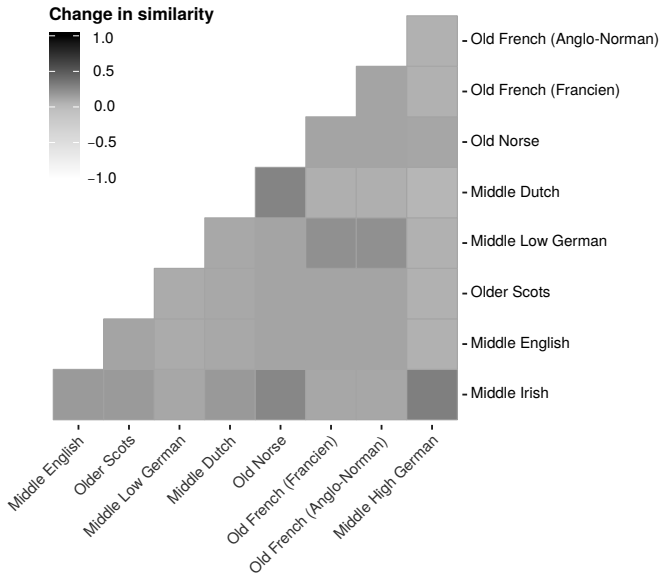


FIGURE 2. Levelplot of the changes in similarity during epoch 1 (labels refer to the languages at t_2). Each square represents the change in similarity between two languages. Negative values (i.e. divergences) are coded light gray to white; positive values (i.e. convergences) are coded dark gray to black.

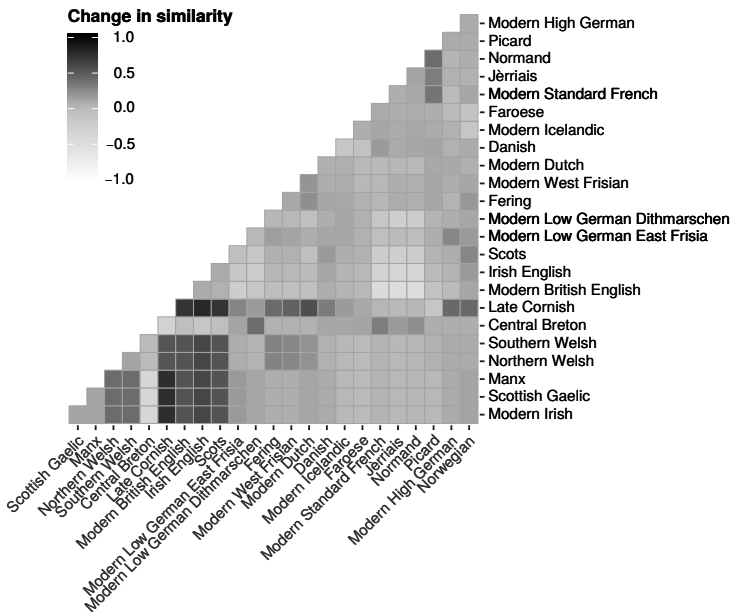
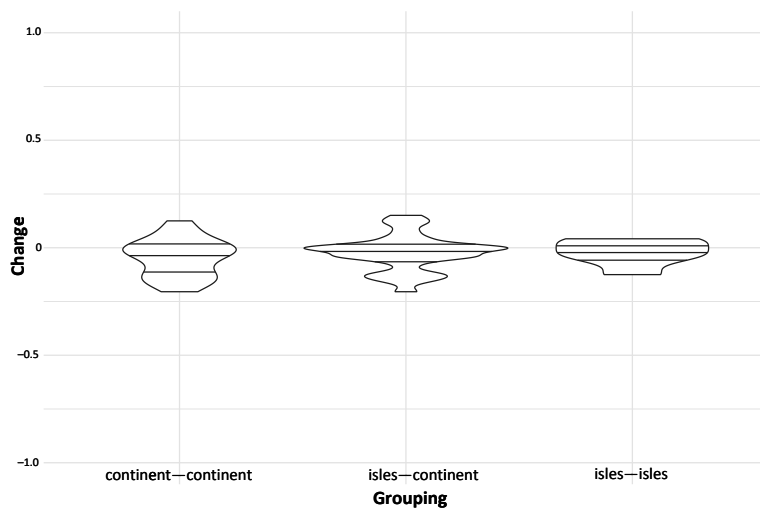


FIGURE 3. Levelplot of the changes in similarity during epoch 2 (labels refer to the languages at t_3). Each square represents the change in similarity between two languages. Negative values (i.e. divergences) are coded light gray to white; positive values (i.e. convergences) are coded dark gray to black.

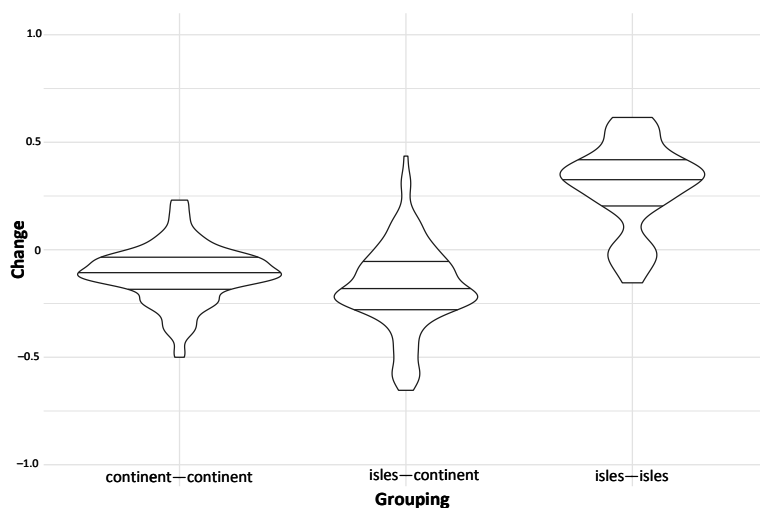
‘isles’, and outside, that is, on the continent and in Scandinavia, ‘continent’) and plot the density of the calculated changes in similarity both within groups and between them.

In the first epoch—from the early to high Middle Ages (Figure 4a)—not much change in similarity is detectable. The median convergences of the languages on the

continent and in Britain and Ireland as well as between the two groups center around zero, with only slight changes in one or the other direction.



a. Density distribution of the calculated changes in similarity in 800–1200 CE.



b. Density distribution of the calculated changes in similarity in 1200–1900 CE.

FIGURE 4. Violin plots of the density distribution of the calculated changes in similarity in both epochs, that is, how many language pairs in the respective group have a certain value of change in similarity. The horizontal lines in the plot represent quartiles; that is, between two of these horizontal lines are exactly 25% of the data points. The proportion of the y-axis covered and the number and position of peaks in the violins are indicators of the compactness and internal structure of each group.

The second epoch reveals a substantial amount of positive change happening in Britain and Ireland: the isles–isles group in Figure 4b has one peak at c. 0.3 and a smaller peak at c. 0 and covers an approximate interval of $[-0.15, 0.6]$, indicating that the vast majority of languages converge more or less strongly, but a small group does not converge or diverge at all. The isles–continent group in the same plot, however, has only one peak at c. -0.2 and covers an approximate interval of $[-0.6, 0.45]$, indicating

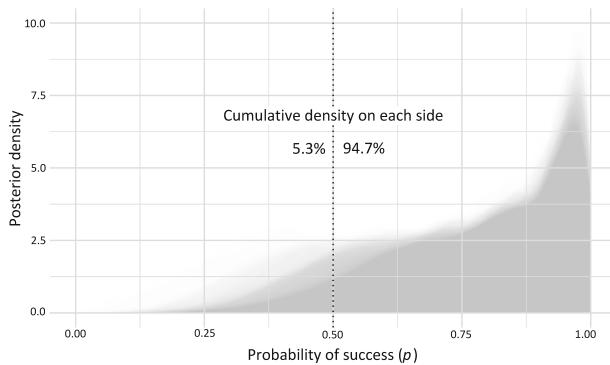
that the vast majority of languages diverge, some more strongly, some less so, while a small group of languages also converges.

In sum, the sampled languages spoken in Britain and Ireland are more similar at the end of epoch 2 than at its beginning, and the similarity between them and the sampled languages on the continent decreased during the same period of time.

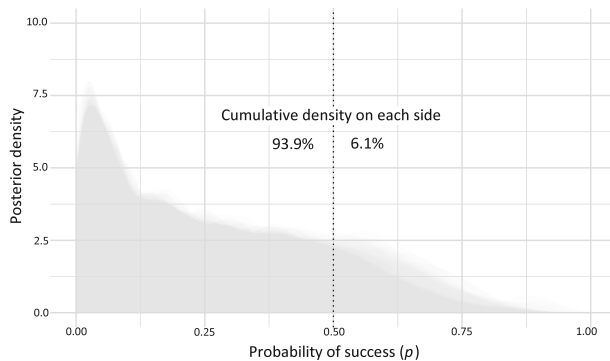
We interpret these patterns of change as an indicator of contact-induced gain in linguistic similarity in our configuration in Britain and Ireland between 1200 and the present, and we test this hypothesis in the next section.

7. BAYESIAN ANALYSIS. For the Bayesian inference, we use only the data for the second epoch because the developments in the first epoch have not proven indicative of area-formation processes and the language sample is too small.

The posterior probabilities of gain in similarity inferred for Britain and Ireland (Figure 5a) indicate that the change in similarity between languages in Britain and Ireland is strongly biased toward an increase in similarity (94.7% probability of success, i.e. gain in similarity). In contrast, the change between languages in Britain and Ireland and languages in continental Europe and Scandinavia is biased toward a decrease in similarity as per Figure 5b (6.1% probability of success, i.e. gain in similarity). We take this as evidence that the observed increase of similarity in pairings within our configuration and the concomitant decrease of similarity between pairs across configurations is not random.



a. Posterior density of a gain in similarity for isles–isles pairs (1000 random samples).



b. Posterior density of a gain in similarity for isles–continent pairs (1000 random samples).

FIGURE 5. Posterior densities of gains in similarity. If the data pointed toward an equal opportunity of a gain or loss in similarity, the plotted curve would have its peak close to the dotted vertical line. A skewness of the curve toward either end of the x-axis is indicative of a trend in the respective direction.

The developments on the continent and Scandinavia are also biased toward a decrease in similarity (6.2% probability of success; see Supporting Material 2, figure 15), which suggests that this configuration is not homogeneous.

The range of probable changes in similarity resulting from the predictive beta distribution (Figure 6) also shows a strong trend toward convergence in Britain and Ireland: it predicts that if we were to observe a previously unexamined language pair in Britain and Ireland between 1200 and 1900 CE, we would expect the similarity between the two languages to increase by a mean of 0.3.

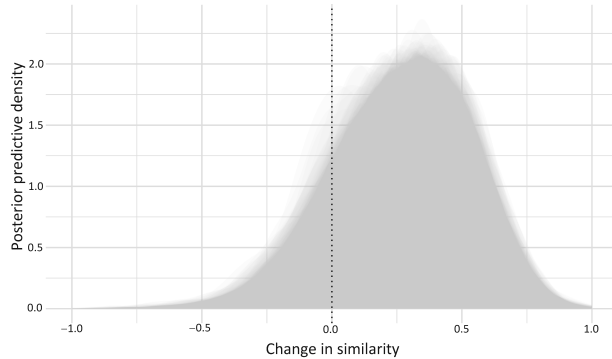


FIGURE 6. Posterior predictive distribution of change in similarity for isles-isles pairs (1000 random samples). The curve represents the likelihood of a previously unobserved language pair situated in Britain and Ireland to exhibit the respective change in similarity between 1200 and 1900 CE.

8. SUMMARY AND DISCUSSION. In this article we proposed a method for quantifying area-formation processes using a similarity measure that explicitly implements time. In a case study, we applied this method to Britain and Ireland, a region with a long and much-debated history in areal linguistics, and sampled forty-four language varieties from three subbranches of Indo-European situated around the North Sea and adjacent areas, covering a time span from the eighth century to the present. As linguistic input we collected data on thirteen fine-grained variables that are used in the expression of reflexivity, a domain claimed by some scholars to bear signals of areal convergence. We examined the evolution of the linguistic similarity in two time spans: from 800 CE to 1200 CE, and from 1200 CE to 1900 CE.

We found that the overall similarity between all sampled languages remained largely unchanged between 800 CE and 1200 CE. From an areal perspective, this finding suggests that not much change happened or that all languages drifted into the same direction. Given the small language sample size and the short time span, this result does not allow for far-reaching conclusions. Between 1200 CE and 1900 CE, we observed that the similarity increased significantly between pairs of languages in Britain and Ireland, while at the same time the similarity between languages spoken outside versus inside Britain and Ireland decreased substantially. As a possible cause for this finding we first examined the impact of phylogenetic autocorrelation: that is, the fact that in the transmission from ancestor to successor languages, the feature specifications of the ancestor and the successor are not independent. This bias predicts that languages that belong to the same lineage tend to evolve in a similar way because of shared ancestry. Our findings show, however, that such a phylogenetic bias cannot possibly account for all of the observed increase because the gain in similarity systematically affects languages across

lineages (Celtic, Germanic). Moreover, we also noted the inverse effect, viz. a substantial decrease in similarity within a single lineage across configurations. A case in point is Brythonic: Central Breton (continent) and Late Cornish (Britain) are genealogically very closely related, but diverge strongly.

In order to exclude chance as a major cause, we estimated the tendency and magnitude of the observed change between 1200 CE and 1900 CE using Bayesian inference. We first modeled the change in similarity as a Bernoulli process. The inferred posterior probabilities of gain in similarity indicate a strong tendency toward gain for language pairs within Britain and Ireland, and an almost reversed picture, that is, a strong bias toward decrease, for language pairs that cross the boundaries of our configuration. Furthermore, we modeled the change as a transformed beta distribution and estimated the posterior predictive distribution given the observed pairwise changes. The results show that the magnitude of the process, that is, gain in similarity in Britain and Ireland, is substantial. We take this as evidence that the observed changes are not simply due to chance.

As for the influence of universal trends on language change, we are not able, for the time being, to estimate the extent to which such trends possibly contribute to the observed changes in our data. This issue cannot be resolved here and needs to be framed in a larger context (see Maslova & Nikitina 2007, Cysouw 2010, Bickel 2017). What we can say is that, all things being equal, the likelihood of universal trends influencing a language in the sample is equal to that of any other language being affected. This predicts an even distribution of these cases on the continent and in Britain and Ireland, which is clearly not the case. The highly uneven geographical distribution that we observe can, at this point, mean two things: (i) the distribution is—to a yet to be determined degree—due to areal-formation phenomena, or (ii) the languages in Britain and Ireland had something in common that made them more susceptible to the influence of universal trends.

One common property that sets the earlier insular languages apart from many of the earlier continental varieties is the complete loss of the inherited specialized reflexive markers (< PIE **s(w)e-*) in Old English and Insular Celtic before the first attestations of these languages (as opposed to their preservation as, for example, Old High German *si-h*, Old Norse *si-k*, and Old Frisian *se*).⁵ It is conceivable that this gap in the grammatical system facilitated the emergence of new grammatical markers along crosslinguistically common paths of grammaticalization (see e.g. Heine & Kuteva 2002, s.vv. *intensive-reflexive*, *reflexive*), leading to independent language-internal developments all over Britain and Ireland, but not on the continent. However, the continental West Germanic languages Old Low German, Old Frisian, and Old Dutch shared the loss of PIE **s(w)e-* in reflexive function with the insular languages, but developed in a distinct ‘continental’ direction (Harbert 2006:179–81, Postma 2012); this is difficult to account for without recourse to spatial factors, especially if it is known that there has been contact between the languages in question.

In her qualitative account, Irlinger (2014) suggests that the development of what could be called the ‘insular type’ of reflexivization is an areal phenomenon that happens more or less contemporaneously in Irish, Welsh, and English (most probably in the early modern period), and this hypothesis finds quantitative support from the areally constrained increase in similarity in our data during the second period between 1200 CE and 1900 CE. We conclude that the observed areal convergence is to a significant degree

⁵ We thank an anonymous referee for bringing this to our attention.

driven by historical contingencies, that is, demographic and sociocultural developments that happened in Britain and Ireland during or slightly before the period under investigation. The most obvious facilitators of the areal convergence observed during the second period are the Norman Conquest of England and the many subsequent expansions into Celtic-speaking areas, in particular the Anglo-Norman invasion of Wales and Ireland in the centuries following the Conquest of England, the Cornu-Norman rule over Cornwall, the Wars of Scottish Independence between the Kingdom of England and the Kingdom of Scotland in the late thirteenth and early fourteenth centuries, and the English expansions during the sixteenth and seventeenth centuries, including the incorporation of Wales into the Kingdom of England with the Acts of 1535 and 1542, and the Union between Scotland and England in 1707. These events, which ultimately led to a persisting presence of the English language, are known to have initiated many complex and fundamental sociocultural changes and increased opportunities for manifold language-contact events that led to language shift (e.g. rapid language shift as in mid-nineteenth-century Ireland, extinction of Cornish) and widespread bi-/multilingualism (e.g. L2 admixture as in seventeenth- and eighteenth-century Ireland, bi- or multilingual language acquisition as in present-day Wales).

A number of open questions remain. Our method is designed to detect areal signals and to evaluate observations that have been made in qualitative research. It quantifies spatiotemporal patterns of change in similarity in linguistic data, and as such, it captures linguistic change from an ex-post perspective by averaging over countless speaker and speaker community interactions in diverse social and environmental contexts. What it is not able to capture are the particular linguistic mechanisms of contact-induced change (e.g. borrowing, replica grammaticalization, sub-/adstrate effects, relexification, etc.; see Heine & Kuteva 2003, 2005, Lefebvre 2004, Matras 2009, Matthews & Yip 2009) and their precise cognitive, sociolinguistic, cultural, and environmental correlates (cf. e.g. Milroy & Milroy 1992, Dahl 2004, Bornkessel-Schlesewsky & Schlesewsky 2009, Fagyal et al. 2010, Trudgill 2011, Maddieson & Coupé 2015, Clarke & Heyes 2017, Nichols 2018).

As for the impact of genealogical biases, our case study shows that affiliations with different configurations can cause two very closely related languages, such as Breton and Cornish, to develop in opposite directions even in close geographical proximity. However, our method is not able to estimate the remaining degree of phylogenetic signal in the data.

With respect to areality, it is important to bear in mind that our method yields results that are valid with respect to the configuration, the language sample, the particular linguistic data, and the time interval to which it is applied, and generalizations should be made with due caution. For example, in our study we observe that in Britain and Ireland the expression of reflexivity captures a robust signal of gain in similarity between 1200 and the present, but not in the earlier epoch between 800 and 1200. This does not, however, exclude the possibility that there is an area-formation process going on in the earlier epoch, nor does it indicate that in the later epoch results will necessarily converge when exploring different linguistic data. Even within the same setting and time interval, different (sets of) linguistic features are likely to display different signatures. Therefore, when comparing configurations with respect to their overall degree of areality, it is advisable to do so based on as many linguistic features as possible.

We presume that different ways of choosing linguistic features and defining configurations of various sizes and structures will produce contradicting degrees of convergence and divergence. At first glance, this might appear to be a weakness of the method,

but again, this multifaceted picture is what emerges *prima facie* under given conditions and probably accords with the intuitions of many a linguist. Put differently, rather than providing final judgments about possible linguistic areas, for example, Britain and Ireland, this approach serves as a basis for testing hypotheses about the contribution of specific linguistic and nonlinguistic factors to area-formation processes.

The method is designed for geographical settings with an attested linguistic history. The number of such linguistic contact zones is limited. But even for the regions of the world with a less well-documented linguistic past, language documentation increases in the early modern period, and therefore the applicability of this method is by no means restricted to western Europe. Promising candidates such as the Balkans, eastern Europe, the Ancient Near East, South Asia, Japan, or areas along the Silk Road are easily identified. In view of the fact that the method has no systematic lower time boundary, its application to any other kind of longitudinal data in a wide sense is expected to yield interesting results.

9. CONCLUSIONS. Our approach to area-formation processes provides a simple quantitative method that is applicable to various types of linguistic data and complements well-established qualitative approaches. Applying this method, we presented robust quantitative evidence that a linguistic area—that is, a sociocultural space with an increasing level of linguistic similarity—formed in Britain and Ireland over the past 800 years with respect to the features chosen here. From a historical perspective, this area-formation process can be related to a series of historical events that followed the Norman Conquest of England. We assume that the many subsequent sociocultural changes afforded new opportunities and increased the need for interaction between speakers of the languages in the area, which drove the overall gain in linguistic similarity. This gain in linguistic similarity sets the languages of Britain and Ireland apart from languages spoken outside of Britain and Ireland and cross-cuts lineages of linguistic ancestry: Modern British English diverges from Continental West Germanic and Gallo-Romance, while converging with Insular Celtic. On the continent, a growth in similarity between Modern Breton and Gallo-Romance varieties contrasts with a remarkable divergence between Modern Breton and Cornish, its closest relative, once spoken in close geographical vicinity in Cornwall.

REFERENCES

- ÆLFRIC OF EYNHAM. 1979. *Ælfric's catholic homilies: The second series, text*, ed. by Malcolm Godden. London: Oxford University Press.
- ARFSTEN, ANTJE K., and WENDY VANSELOW. 2014. *Friisk tekstaamling: Fering*. Bredstedt: Nordfriisk Instituut.
- BAKER, COLIN. 1985. *Aspects of bilingualism in Wales*. Clevedon: Multilingual Matters.
- BACHELOR, RONALD E., and MALLIGA CHEBLI-SAAFI. 2011. *A reference grammar of French*. Cambridge: Cambridge University Press.
- BICKEL, BALTHASAR. 2007. Typology in the 21st century: Major current developments. *Linguistic Typology* 11(1).239–51. DOI: 10.1515/LINGTY.2007.018.
- BICKEL, BALTHASAR. 2010. Capturing particulars and universals in clause linkage: A multivariate analysis. *Clause linking and clause hierarchy: Syntax and pragmatics*, ed. by Isabelle Bril, 51–102. Amsterdam: John Benjamins.
- BICKEL, BALTHASAR. 2015. Distributional typology: Statistical inquiries into the dynamics of linguistic diversity. *The Oxford handbook of linguistic analysis*, 2nd edn., ed. by Bernd Heine and Heiko Narrog, 901–23. Oxford: Oxford University Press. DOI: 10.1093/oxfordhb/9780199677078.013.0046.
- BICKEL, BALTHASAR. 2017. Areas and universals. In Hickey 2017b, 40–54. DOI: 10.1017/9781107279872.004.

- BICKEL, BALTHASAR; KRISTINE A. HILDEBRANDT; and RENÉ SCHIERING. 2009. The distribution of phonological word domains: A probabilistic typology. *Phonological domains: Universals and deviations*, ed. by Janet Grijzenhout and Barış Kabak, 47–78. Berlin: Mouton de Gruyter. DOI: 10.1515/9783110217100.1.47.
- BICKEL, BALTHASAR, and JOHANNA NICHOLS. 2006. Oceania, the Pacific Rim, and the theory of linguistic areas. *Berkeley Linguistics Society* 32.3–15. DOI: 10.3765/bls.v32i2.3488.
- BICKEL, BALTHASAR, and JOHANNA NICHOLS. 2017. The goals and principles of AUTOTYP (revised version). Zurich: University of Zurich, and Berkeley: University of California, Berkeley, MS. Online: <http://www.autotyp.uzh.ch/theory.html>.
- BLACK, JEREMY. 2017. *A history of the British Isles*. 4th edn. London: Palgrave.
- BORNKESSEL-SCHLESEWSKY, INA, and MATTHIAS SCHLESEWSKY. 2009. The role of prominence information in the real-time comprehension of transitive constructions: A cross-linguistic approach. *Language and Linguistics Compass* 3(1).19–58. DOI: 10.1111/j.1749-818X.2008.00099.x.
- BRINK, STEFAN (ed.) 2008. *The Viking world*. London: Routledge.
- CAMPBELL, LYLE. 2017. Why is it so hard to define a linguistic area? In Hickey 2017b, 19–39. DOI: 10.1017/9781107279872.003.
- CASSIDY, LARA M.; RUI MARTINIANO; EILEEN M. MURPHY; MATTHEW D. TEASDALE; JAMES MALLORY; BARRIE HARTWELL; and DANIEL G. BRADLEY. 2016. Neolithic and Bronze Age migration to Ireland and establishment of the insular Atlantic genome. *Proceedings of the National Academy of Sciences* 113(2).368–73. DOI: 10.1073/pnas.1518445113.
- CHEETHAM, ALAN H., and JOSEPH E. HAZEL. 1969. Binary (presence-absence) similarity coefficients. *Journal of Paleontology* 43(5).1130–36. Online: <https://www.jstor.org/stable/1302424>.
- CLARKE, ELLEN, and CECILIA HEYES. 2017. The swashbuckling anthropologist: Henrich on *The secret of our success*. *Biology & Philosophy* 32(2).289–305. DOI: 10.1007/s10539-016-9554-y.
- CYSOUW, MICHAEL. 2010. On the probability distribution of typological frequencies. *The mathematics of language: MOL 2009, MOL 2007*, ed. by Christian Ebert, Gerhard Jäger, and Jens Michaelis, 29–35. Berlin: Springer. DOI: 10.1007/978-3-642-14322-9_3.
- DAHL, ÖSTEN. 2004. *The growth and maintenance of linguistic complexity*. Amsterdam: John Benjamins.
- DAHL, ÖSTEN. 2016. Thoughts on language-specific and crosslinguistic entities. *Linguistic Typology* 20(2).427–37. DOI: 10.1515/lingty-2016-0016.
- DAVIES, R. REES. 2000. *The first English empire: Power and identities in the British Isles 1093–1343*. (The Ford Lectures delivered in the University of Oxford in Hilary Term 1998.) Oxford: Oxford University Press.
- DONOHUE, MARK, and BRONWEN WHITING. 2011. Quantifying areality: A study of prenasalisation in Southeast Asia and New Guinea. *Linguistic Typology* 15(1).101–21. DOI: 10.1515/lity.2011.005.
- DORIAN, NANCY C. 1981. *Language death: The life cycle of a Scottish Gaelic dialect*. Philadelphia: University of Pennsylvania Press.
- DOWNHAM, CLARE. 2008. Vikings in England. In Brink, 341–49.
- DOYLE, AIDAN. 2015. *A history of the Irish language: From the Norman invasion to independence*. Oxford: Oxford University Press.
- DRABEK, IRENE. 2007. Fering: Analyse einer europäischen Minoritätensprache unter dem Einfluss des Deutschen im Jahr 2007. Zurich: Universität Zürich Lic. phil.
- DRYER, MATTHEW S. 2006. Descriptive theories, explanatory theories, and basic linguistic theory. *Catching language: The standing challenge of grammar writing*, ed. by Felix K. Ameka, Alan Dench, and Nicholas Evans, 207–34. Berlin: Mouton de Gruyter.
- ERNAULT, ÉMILE. 1887. La vie de sainte Nonne. *Revue Celtique* 8.230–301, 405–91.
- FAGYAL, ZSUZSANNA; SAMARTH SWARUP; ANNA MARÍA ESCOBAR; LES GASSER; and KIRAN LAKKARAJU. 2010. Centers and peripheries: Network roles in language change. *Lingua* 120(8).2061–79. DOI: 10.1016/j.lingua.2010.02.001.
- FILPPULA, MARKKU; JUHANI KLEMOLA; and HELI PAULASTO. 2008. *English and Celtic in contact*. London: Routledge.

- FRECKLETON, ROBERT P., and WALTER JETZ. 2009. Space versus phylogeny: Disentangling phylogenetic and spatial signals in comparative data. *Proceedings of the Royal Society B: Biological Sciences* 276.21–30. DOI: 10.1098/rspb.2008.0905.
- FRIEDMAN, VICTOR A., and BRIAN D. JOSEPH. 2017. Reassessing Sprachbunds: A view from the Balkans. In Hickey 2017b, 55–87. DOI: 10.1017/9781107279872.005.
- GRIFFITH, AARON, and DAVID STIFTER. 2009–2013. *A dictionary of the Old-Irish glosses in the Milan Codex Ambrosianus C 301 inf.* Vienna: Institut für Sprachwissenschaft, Universität Wien. Online: http://www.univie.ac.at/indogermanistik/milan_glosses.htm.
- GUENTCHÉVA, ZLATKA, and NICOLE RIVIÈRE. 2007. Reciprocal and reflexive constructions in French. *Reciprocal constructions*, ed. by Vladimir P. Nedjalkov, 561–607. Amsterdam: John Benjamins.
- HADLEY, DAWN M. 2008. The creation of the Danelaw. In Brink, 375–78.
- HARBERT, WAYNE. 2006. *The Germanic languages.* (Cambridge language surveys.) New York: Cambridge University Press.
- HASPELMATH, MARTIN. 2001. The European linguistic area: Standard Average European. *Language typology and language universals: An international handbook*, ed. by Martin Haspelmath, Ekkehard König, Wulf Oesterreicher, and Wolfgang Raible, 1492–1510. Berlin: De Gruyter.
- HASPELMATH, MARTIN. 2010. Comparative concepts and descriptive categories in crosslinguistic studies. *Language* 86(3).663–87. DOI: 10.1353/lan.2010.0021.
- HEINE, BERND, and TANIA KUTEVA. 2002. *World lexicon of grammaticalization.* Cambridge: Cambridge University Press.
- HEINE, BERND, and TANIA KUTEVA. 2003. On contact-induced grammaticalization. *Studies in Language* 27(3).529–72. DOI: 10.1075/sl.27.3.04hei.
- HEINE, BERND, and TANIA KUTEVA. 2005. *Language contact and grammatical change.* Cambridge: Cambridge University Press.
- HICKEY, RAYMOND. 2007. *Irish English: History and present-day forms.* Cambridge: Cambridge University Press.
- HICKEY, RAYMOND (ed.) 2012. *Standards of English: Codified varieties around the world.* Cambridge: Cambridge University Press.
- HICKEY, RAYMOND. 2017a. Britain and Ireland. In Hickey 2017b, 270–303. DOI: 10.1017/9781107279872.011.
- HICKEY, RAYMOND (ed.) 2017b. *The Cambridge handbook of areal linguistics.* Cambridge: Cambridge University Press. DOI: 10.1017/9781107279872.
- HIGHAM, NICHOLAS J. 2013a. Britain in and out of the Roman Empire. *The Anglo-Saxon world*, ed. by Nicholas J. Higham and Martin J. Ryan, 20–69. New Haven, CT: Yale University Press.
- HIGHAM, NICHOLAS J. 2013b. The origins of England. *The Anglo-Saxon world*, ed. by Nicholas J. Higham and Martin J. Ryan, 70–125. New Haven, CT: Yale University Press.
- IRSLINGER, BRITTA. 2013. Standard Average European and the Western fringe—A reconsideration. *Historische Sprachforschung* 126(1).33–88. DOI: 10.13109/hisp.2013.126.1.33.
- IRSLINGER, BRITTA. 2014. Intensifiers and reflexives in SAE, Insular Celtic and English. *Indogermanische Forschungen* 119(1).159–206. DOI: 10.1515/if-2014-0010.
- ISAAC, GRAHAM R.; SIMON RÓDWAY; SILVA NURMIO; KIT KAPPAHN; and PATRICK SIMS-WILLIAMS. 2010. *Rhyddiaith gymraeg o lawysgrifau'r 13eg ganrif: Fersiwn 1.0.* Aberystwyth: Prifysgol Aberystwyth. Online: <https://cadair.aber.ac.uk/dspace/handle/2160/5813>.
- JONES, GWENAN. 1939–1941. Gwyrtheyu y wynvydedic veir. *Bulletin of the Board of Celtic Studies* 9(4).144–48, 334–41; 10.21–33.
- JÓNSSON, FINNUR. 1924. *Egils Saga Skallagrímssonar: Nebst den grösseren Gedichten Egils.* (Zweite neu bearbeitete Auflage.) Halle (Saale): Niemeyer.
- JÓNSSON, JÓHANNES GÍSLI. 2011. Reflexive *sig* is an argument. *Nordlyd* 37.99–118. DOI: 10.7557/12.2025.
- KELLY, LUKE J., and GEOFF K. NICHOLLS. 2017. Lateral transfer in stochastic Dollo models. arXiv:1601.07931 [stat.AP]. Online: <https://arxiv.org/abs/1601.07931v3>, accessed March 16, 2017.
- KEMMER, SUZANNE. 1993. *The middle voice.* Amsterdam: John Benjamins.

- KRESS, BRUNO. 1982. *Isländische Grammatik*. Munich: Hueber.
- LAMELI, ALFRED. 2013. *Strukturen im Sprachraum: Analysen zur arealtypologischen Komplexität der Dialekte in Deutschland*. Berlin: De Gruyter.
- LANGE, CLAUDIA. 2005. Reflexivity and intensification in Irish English and other New Englishes. *The Celtic Englishes IV: The interface between English and the Celtic languages: Proceedings of the fourth International Colloquium on the 'Celtic Englishes' held at the University of Potsdam in Golm (Germany) from 22–26 September 2004*, ed. by Hildegard L. C. Tristram, 259–82. Potsdam: Universitätsverlag Potsdam.
- LANGE, CLAUDIA. 2007. *Reflexivity and intensification in English: A study of texts and contexts*. Frankfurt: Lang.
- LEFEBVRE, CLAIRE. 2004. *Issues in the study of pidgin and Creole languages*. Amsterdam: John Benjamins.
- LINDOW, WOLFGANG. 1998. *Niederdeutsche Grammatik*. Leer: Schuster.
- LUTZ, ANGELIKA. 2009. Celtic influence on Old English and West Germanic. *English Language & Linguistics* 13(2).227–49. (Special issue: *Re-evaluating the Celtic hypothesis*, ed. by Markku Filppula and Juhani Klemola.) DOI: 10.1017/S1360674309003001.
- MADDIESON, IAN, and CHRISTOPHE COUPÉ. 2015. Human spoken language diversity and the acoustic adaptation hypothesis. *The Journal of the Acoustical Society of America* 138(3).1838. DOI: 10.1121/1.4933848.
- MARSTRANDER, CARL. 1911. A new version of the battle of Mag Rath. *Ériu* 5.226–47. Online: <https://www.jstor.org/stable/30007571>.
- MASLOVA, ELENA, and TATIANA NIKITINA. 2007. Stochastic universals and dynamics of cross-linguistic distributions: The case of alignment types. Stanford, CA: Stanford University, ms. Online: <http://another.summa.net/Publications/Ergativity.pdf>.
- MATRAS, YARON. 2009. *Language contact*. Cambridge: Cambridge University Press.
- MATTHEWS, STEPHEN, and VIRGINIA YIP. 2009. Contact-induced grammaticalization: Evidence from bilingual acquisition. *Studies in Language* 33(2).366–95. DOI: 10.1075/sl.33.2.06mat.
- MICHAEL, LEV; WILL CHANG; and TAMMY STARK. 2014. Exploring phonological areality in the circum-Andean region using a naive Bayes classifier. *Language Dynamics and Change* 4(1).27–86. DOI: 10.1163/22105832-00401004.
- MILROY, LESLEY, and JAMES MILROY. 1992. Social network and social class: Toward an integrated sociolinguistic mode. *Language in Society* 21(1).1–6. DOI: 10.1017/S0047404500015013.
- MORRIS-JONES, JOHN. 1900. Appendix B: Pre-Aryan syntax in Insular Celtic. *The Welsh people: Chapters on their origin, history, laws, language, literature, and characteristics*, 2nd and revised edn., by John Rhys and David Brynmor-Jones, 617–41. New York: Macmillan. Online: <https://archive.org/details/welshpeoplechapt00rhys/page/617>.
- MURAWAKI, YUGO, and KENJI YAMAUCHI. 2018. A statistical model for the joint inference of vertical stability and horizontal diffusibility of typological features. *Journal of Language Evolution* 3(1).13–25. DOI: 10.1093/jole/lzx022.
- MUYSKEN, PIETER; HARALD HAMMARSTRÖM; JOSHUA BIRCHALL; RIK VAN GIJN; OLGA KRASNOKHOVA; and NEELE MÜLLER. 2015. Linguistic areas, bottom-up or top-down? The case of the Guaporé-Mamoré. *Language contact and documentation/Contacto lingüístico y documentación*, ed. by Bernard Comrie and Lucía Golluscio, 205–38. Berlin: De Gruyter Mouton.
- NELSON-SATHI, SHIJULAL; JOHANN-MATTIS LIST; HANS GEISLER; HEINER FANGERAU; RUSSELL D. GRAY; WILLIAM MARTIN; and TAL DAGAN. 2010. Networks uncover hidden lexical borrowing in Indo-European language evolution. *Proceedings of the Royal Society B: Biological Sciences* 278.1794–1803. DOI: 10.1098/rspb.2010.1917.
- NICHOLS, JOHANNA. 2018. Non-linguistic conditions for causativization as a linguistic attractor. *Frontiers in Psychology* 8:2356. DOI: 10.3389/fpsyg.2017.02356.
- Ó CORRÁIN, DONNCHADH. 2008. The Vikings in Ireland. In Brink, 428–33.
- Ó CRÓINÍN, DÁIBHÍ. 1995. *Early medieval Ireland, 400–1200*. London: Longman.
- POKORNY, JULIUS. 1927. Das nicht-indogermanische Substrat im Irischen (part 2). *Zeitschrift für celtische Philologie* 16.231–66. DOI: 10.1515/zcph.1927.16.1.231.
- POPPE, ERICH. 2009. Standard Average European and the Celticity of English intensifiers and reflexives: Some considerations and implications. *English Language & Linguistics*

- 13(2),251–66. (Special issue: *Re-evaluating the Celtic hypothesis*, ed. by Markku Filpula and Juhani Klemola.) DOI: 10.1017/S1360674309003013.
- POSTMA, GERTJAN. 2012. Language contact and linguistic complexity—The rise of the reflexive pronoun *zich* in a fifteenth-century Netherlands border dialect. *Grammatical change: Origins, nature, outcomes*, ed. by Dianne Jonas, John Whitman, and Andrew Garrett, 139–59. Oxford: Oxford University Press. DOI: 10.1093/acprof:oso/9780199582624.003.0007.
- PREUSLER, WALTER. 1938. Keltischer Einfluß im Englischen. *Indogermanische Forschungen* 56.178–91. DOI: 10.1515/9783110242973.178.
- SCHUMACHER, STEFAN. 2009. Lexical and structural language-contact phenomena along the Germano-Celtic transition zone. *Kelten am Rhein: Akten des dreizehnten internationalen Keltologiekongresses/Proceedings of the Thirteenth International Congress of Celtic Studies, 23. bis 27. Juli 2007 in Bonn. Vol. 2, Philologie: Sprachen und Literaturen*, ed. by Stefan Zimmer, 247–66. Mainz: Philipp von Zabern.
- STOKES, WHITLEY, and JOHN STRACHAN. 1901–1903. Codex paulinus wiziburgensis. *The-saurus palaeohibernicus: A collection of Old-Irish glosses, scholia prose and verse*, 499–712. Cambridge: Cambridge University Press.
- STOLZ, THOMAS. 2006. All or nothing. *Linguistic areas: Convergence in historical and typological perspective*, ed. by Yaron Matras, April McMahon, and Nigel Vincent, 32–50. Basingstoke: Palgrave Macmillan.
- SWEET, HENRY. 1883. *King Alfred's Orosius: Old-English text and Latin original*, vol. 1. London: The Early English Text Society.
- THOMASON, SARAH GREY, and TERRENCE KAUFMAN. 1988. *Language contact, creolization, and genetic linguistics*. Berkeley: University of California Press.
- TOLKIEN, JOHN R. R. 1963. English and Welsh. *Angles and Britons: O'Donnell lectures*, 1–41. Cardiff: University of Wales Press.
- TRISTRAM, HILDEGARD L. C. 1999. *How Celtic is Standard English?* St. Petersburg: Nauka.
- TRUDGILL, PETER. 2011. *Sociolinguistic typology: Social determinants of linguistic complexity*. Oxford: Oxford University Press.
- VAN DE NOORT, ROBERT. 2011. *North Sea archaeologies: A maritime biography, 10,000 BC – AD 1500*. Oxford: Oxford University Press.
- VAN GIJN, RIK. 2019. Separating layers of information: The anatomy of contact zones. *Aspects of contact*, ed. by Norval Smith, Tonjes Veenstra, and Enoch Olade Aboh. Amsterdam: John Benjamins, to appear.
- VAN GIJN, RIK, and MAX WAHLSTRÖM. 2018. Linguistic areas. Zurich: University of Zurich, and Helsinki: University of Helsinki, ms. (Version dated January 23, 2018.)
- VENNEMANN, THEO. 2013. Concerning myself. *Lexical and structural etymology: Beyond word histories*, ed. by Robert Mailhammer, 121–46. Berlin: De Gruyter Mouton.
- VEZZOSI, LETIZIA. 2005. The development of *himself* in Middle English: A 'Celtic' hypothesis. *Rethinking Middle English: Linguistic and literary approaches*, ed. by Nikolaus Ritt and Herbert Schendl, 228–43. Frankfurt: Peter Lang.
- WAGNER, HEINRICH. 1959. *Das Verbum in den Sprachen der britischen Inseln*. Tübingen: Niemeyer.
- WAGNER, HEINRICH. 1964. Nordeuropäische Lautgeographie. *Zeitschrift für celtische Philologie* 29.225–98. DOI: 10.1515/zcph.1964.29.1.225.
- WEHR, BARBARA. 2005. Focusing strategies in Old French and Old Irish. *Opening windows on texts and discourses of the past*, ed. by Janne Skaffari, Matti Peikola, Ruth Carroll, Risto Hiltunen, and Brita Wårvik, 353–79. Amsterdam: John Benjamins.
- WIEMER, BJÖRN; ILJA SERŽANT; and AKSANA ERKER. 2014. Convergence in the Baltic-Slavic contact zone: Triangulation approach. *Congruence in contact-induced language change: Language families, typological resemblance, and perceived similarity*, ed. by Juliane Besters-Dilger, Cynthia Dermarkar, Stefan Pfänder, and Achim Rabus, 15–42. Berlin: De Gruyter. DOI: 10.1515/9783110338454.15.
- WILLEMS, MATTHIEU; ETIENNE LORD; LOUISE LAFOREST; GILBERT LABELLE; FRANÇOIS-JOSEPH LAPOINTE; ANNA MARIA DI SCIULLO; and VLADIMIR MAKARENKO. 2016. Using hybridization networks to retrace the evolution of Indo-European languages. *BMC Evolutionary Biology* 16(1):180. DOI: 10.1186/s12862-016-0745-6.
- WILSON, DAVID M. 2008. The Isle of Man. In Brink, 385–90.

WMFFRE, IWAN. 1998. *Central Breton*. Munich: LINCOM Europa.

WOOLF, ALEX. 2007. *From Pictland to Alba*. Edinburgh: Edinburgh University Press.

[stefan.dedio@uzh.ch]

[peter.ranacher@geo.uzh.ch]

[paul.widmer@uzh.ch]

[Received 30 May 2018;

revision invited 2 October 2018;

revision received 10 December 2018;

revision invited 16 February 2019;

revision received 25 February 2019;

accepted pending revisions 23 April 2019;

revision received 1 June 2019;

accepted 5 June 2019]