Language Change for the Worse

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Studies in Diversity Linguistics

language science press

Studies in Diversity Linguistics

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ISSN: 2363-5568

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Enke, Dankmar, Larry Hyman, Johanna Nichols, Guido Seiler & Thilo Weber (eds.). 2020. *Language Change for the Worse* (Studies in Diversity Linguistics). Berlin: Language Science Press.

This title can be downloaded at:
http://langsci-press.org/catalog/book/000

Indexed in EBSCO
ISBN: no digital ISBN
no print ISBNs!
ISSN: 2363-5568
no DOI
ID not assigned!

Cover and concept of design: Ulrike Harbort
Fonts: Libertinus, Arimo, DejaVu Sans Mono
Typesetting software: XƎLaTeX

Language Science Press
Xhain
Grünberger Str. 16
10243 Berlin, Germany
langsci-press.org

Storage and cataloguing done by FU Berlin

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Language change for the worse?

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Human languages are in a constant state of change. While this observation itself is uncontroversial, the same is not true for many of the questions raised by it. This includes, for example, the question of why a language undergoes change, the question of how and when a change begins, how it spreads across the linguistic system as well as the speech community and how and when it comes to a stop. It also includes the question of whether change can be evaluated in terms of its quality, and, if so, under what circumstances a particular change may be said to lead to an improvement or, conversely, have a worsening effect. The present volume focuses on this last set of questions.

Conceptions of language change have varied considerably over time, and still today we find numerous competing views (see e.g. Aitchison 2001 for an overview).

Dankmar Enke, Larry Hyman, Johanna Nichols, Guido Seiler & Thilo Weber. 2020. Language change for the worse? In Dankmar Enke, Larry Hyman, Johanna Nichols, Guido Seiler & Thilo Weber (eds.), *Language Change for the Worse*, 1–16. Berlin: Language Science Press. DOI: ??

Aitchison (2001: 251) gives a quotation by Curtius (1877) (quoted by Kiparsky 1972: 35) as an example of many nineteenth century scholars' conception of language change as decay:

> A principal goal of this science [i.e. comparative historical linguistics] is to reconstruct the full, pure forms of an original stage from the variously disfigured and mutilated forms which are attested in the individual languages. (Curtius 1877; quoted by Aitchison 2001: 251)

A more optimistic view is advocated by Jespersen (1922). Looking at the loss of inflectional endings in English and Danish and their replacement by word order as a means of expressing grammatical relations, Jespersen views this as an increase in efficiency, and thus as a manifestation of progress:

> In the evolution of languages the discarding of old flexions goes hand in hand with the development of simpler and more regular expedients that are rather less liable than the old ones to produce misunderstanding. (Jespersen 1922; quoted by Aitchison 2001: 7)

De Saussure (2011[1916]), by contrast, refrains from viewing language change as either progress or decay. Instead, he emphasizes its non-teleological nature. According to him, the linguistic system is, in fact, not even directly changeable at all. If it changes, it does so only as an indirect – and unintended – consequence of a change in one of its elements:

> A diachronic fact is an independent event; the particular synchronic consequences that may stem from it are wholly unrelated to it. [...] never is the system modified directly. In itself it is unchangeable; only certain elements are altered without regard for the solidarity that binds them to the whole. (de Saussure 2011[1916]: 84)

Other non-teleological conceptions of language change include, for example, that by Hockett (1958), who views change as random drift, or that by Postal (1968), who compares language change to stylistic changes in fashion:

> It is just this sort of slow drifting of expectation distributions, shared by people who are in constant communication, that we mean to subsume the term ‘sound change’ [⋯]. The drift might well not be in any determinate direction (Hockett 1958: 443-445; quoted by Aitchison 2001: 135-136)

> There is no more reason for language to change than there is for automobiles to add fins one year and remove them the next, for jackets to have three buttons one year and two the next [···]. The 'courses' of sound change [···] lie in the general tendency of human cultural products to undergo 'non-functional' stylistic change (Postal 1968: 283; quoted by Aitchison 2001: 135)

As a final example, we may look at the perspective taken by generative grammar. Here, the central locus of change is seen in the transition from one generation of speakers to the next, i.e. a key role is played by language acquisition. Language change can thus be conceived of as a learning error:

> The child has to analyze and interpret the linguistic phenomena in her language-acquisition environment in order to be able to acquire the grammar of the previous generation [···]. Now, if the surface is analyzed incorrectly, the child's goal is also incorrect. In other words, if the child's task is to match her input data, she is bound to fail as she sets out with wrong conclusions. She has misinterpreted the final state. (Hróarsdóttir 2009: 119)

Aitchison (2001) herself arrives at the conclusion that language change has no *global* improving or worsening effect:

> We must conclude therefore that language change is ebbing and flowing like the tide, but neither progressing nor decaying, as far as we can tell [···]. As the famous Russian linguist Roman Jakobson said over fifty years ago: 'The spirit of equilibrium and the simultaneous tendency towards its rupture constitute the indispensable properties of that whole that is language (Aitchison 2001: 254-255)

Nonetheless, many theories of language change hold that at least on a *local* level, changes are motivated by improvement. Langacker (1977) uses the term "optimality", and he not only expresses the idea that that there are different categories or types of optimality, but he also assumes that these different types may be in conflict with one another:

> I believe we can isolate a number of broad categories of linguistic optimality. Languages will tend to change so as to maximize optimality in each of these categories [···]. The tendencies toward these various types of optimality will often conflict with one another. (Langacker 1977: 102; quoted by Haspelmath 1999: 181)

Naturalness Theory (Wurzel 1984; Mayerthaler 1988), too, assumes that structural features of language can be evaluated in terms of their "naturalness"/ "markedness", and it predicts that over time, natural/unmarked structures will win out over unnatural/marked ones. Another example is Vennemann's (1988; 1993) preference theory, which holds that every syllable structure change will lead to an improvement of syllable structure.

Haspelmath (1999), finally, relates functionalist/usage-based approaches to language change with an evolutionary perspective, interpreting local changes as functional adaptations to the needs of language users:

> In language change, variants are created from which speakers may choose. Being subject to various constraints on language use, speakers tend to choose those variants that suit them best. These variants then become increasingly frequent and entrenched in speakers' minds, and at some point they may become obligatory parts of grammar. (Haspelmath 1999: 203)

Changes for the worse, or maladaptive changes, on the other hand, are often considered a mere side effect of a change for the better in some other area. This idea is expressed, for example, by Vennemann (1988):

> Every change in a language system is a local improvement relative to a certain parameter. For instance, every syllable structure change is an improvement of syllable structure as defined by some preference law for syllable structure. If a change worsens syllable structure, it is not a syllable structure change, by which I mean change motivated by syllable structure, but a change on some other parameter which merely happens also to affect syllable structure. (Vennemann 1988: 1-2)

In other words, pejorative or maladaptive changes are due to the fact that there are different types of optimality (see Langacker 1977: 102 above), and the fact that what may be an optimization with respect to one type, may well amount to a pejoration with respect to some other type. The idea that the criteria defining optimality may conflict with each other is also present in naturalness, and, perhaps most prominently, in optimality theory (OT) (Prince & Smolensky 1993). As regards naturalness, something that may be natural in terms of phonology (e.g. loss of a word-final unstressed vowel), for instance, may well be unnatural in terms of morphology (e.g. if, along with the vowel, an entire affix is lost, which may lead to syncretism). As regards OT, grammar is explicitly conceived of as a set of competing, violable and hierarchically ordered constraints. If an output violates a given constraint A, this violation will always have to be justified by the fulfilment of a higher-ranking constraint B. From a diachronic perspective, then, language change is nothing but a re-ranking of constraints. Constraint reranking, too, expresses the idea that "worsening" outputs are a side effect of some other local improvement, i.e. promotion of some other output constraint.

The present volume aims to explore to what extent there are phenomena of language change that seem to run counter to the hypothesis outlined above: Are there changes for the worse that do not readily follow from an improvement in some other area of the language system? And if so, how could this type of change be explained and what would it mean for our models of change?

In order to speak of "improvement" or "worsening", it is, first of all, necessary to establish the relevant criteria: What exactly is meant by "meliorative" and "pejorative" changes, respectively? Does it refer to constraints on construction and planning (speaker's perspective)? Or to constraints on perception and parsing (hearer's perspective)? Does it refer to economy and efficiency (such as inventory size, complexity (see below) and idiosyncrasy)? Does it refer to an increase or decrease in communicative value? Or does it refer to an increase or decrease in transparent symbolization (such that formal contrasts reflect functional contrasts and vice-versa)?

The question of meliorative vs. pejorative changes is closely related to the debate on complexification and, conversely, simplification: This idea surely has more than dubious roots, namely the nineteenth century notion that some (mostly European) languages are more advanced than others. It is a small wonder, then, that twentieth century linguistics more or less reached a consensus that human languages are constant and very much alike in their overall degree of complexity. However, this basic tenet has recently been called into question and has received considerable attention ever since (e.g. Dahl 2004; Miestamo et al. 2008; Garrett 2008; Albright 2008; Sampson et al. 2009; Trudgill 2011; Newmeyer & Preston 2014; Seiler & Baechler 2016). The leading idea is that complexity is not a global property of grammatical systems, but instead stems from the interaction of its different parts. Crucially, an increase in complexity seems to violate the markedness principles postulated by Naturalness or Optimality Theory. Typical questions that have been raised in this context and that are also immediately relevant to the topic of the present volume include the question of how complexity (and the processes associated with it) can be measured, the question of whether complexification in one sub-system (e.g. morphology) is always balanced out by simplification in another sub-system (e.g. syntax) and the question of what determines (de-)complexification.

The question of pejorative changes is interesting also from an evolutionary approach to language change (see e.g. Eckardt et al. 2008), in particular, perhaps, to the question of whether language change is more similar to a "Darwinian" or to a "Lamarckian" conception of evolution (de Vogelaer 2007). Under an evolutionary perspective, the guiding mechanisms in language change are variation and selection. While this is true for both the Darwininan and the Lamarckian view, the two differ with respect to the role played by functional factors. Under the Darwinian view, the emergence of new variants is essentially random, i.e. variants are being produced irrespective of any potential (dis)advantages in selection; only the selection process itself is guided by functional factors, i.e. by the extent to which a variant is adapted to its environment (cf. McMahon 1994: 318). Under the Lamarckian view, by contrast, it is the very emergence of variants that is driven by functional factors. This latter view is advocated by Croft (2000: 38): "Functional factors [...] are responsible only for innovation, and social factors provide a selection mechanism for propagation." Haspelmath (1999: 192-193), too, argues that "the source of linguistic variation is often nonrandom [⋯]. In this sense, the evolution of linguistic structures is in part "Lamarckian"". The Lamarckian view thus predicts that there should be no such thing as dysfunctional change, as dysfunctional variants do not emerge in the first place. Under the Darwinian view, by contrast, the emergence of dysfunctional variants is fully expected – even though they are predicted not to last.

To set the scene, we would like to give a few examples of diachronic developments (taken from the history of German) that might be candidates for pejorative change.

A well-known change (and one that is unproblematic in this context) is open syllable lengthening, which took place from Middle High German to Early New High German (Lahiri & Dresher 1999). Whereas Middle High German allowed for light stressed syllables, viz. [ˈfo.ɡəl] 'bird', later stages of German eliminated light stressed syllables by lengthening the vowel (thus making the syllable bimoraic), resulting in [ˈfoː.ɡəl]. Vennemann (1988) motivates this change as an optimization of syllable structure, stating that:

> Weight law: In stress accent languages an accented syllable is the more preferred, the closer its syllable weight is to two moras, and an unaccentuated syllable is the more preferred the closer its weight is to one mora. (Vennemann 1988: 30)

Thus, open syllable lengthening can be seen as a classical example of language change for the better (local improvement of syllable structure), and consequently anti-open syllable lengthening (if it exists) would be a "worsening" change. Bernese Swiss German did not undergo open syllable lengthening (Seiler 2005). Short stressed vowels in open syllables retained their original quantity. We might think at first glance that this dialect is simply conservative, but there are quite a few examples where Bernese shortened previously (i.e., Middle High German) long vowels in stressed open syllables, viz. [ˈhyː.sər] > [ˈhʏ.z̥ər] 'houses', [ˈbliː.bən] > [ˈb̥lɪ.b̥ə] 'stay', [ˈɪ̯æː.rek] > [ˈɪ̯æ.rɪg̊] 'a year old' (Seiler 2005: 477). This change, open syllable shortening, is not only unexpected in the light of Vennemann's Weight Law, it even runs counter to it. If it is correct that open syllable lengthening must be interpreted as a local optimization of syllable structure, then we must conclude that Bernese open syllable shortening worsens syllable structure.

To take an example from morphology, Old High German had accusative case marking on proper nouns, e.g. *Hartmuot* (nom) vs. *Hartmuotan* (acc) (cf. Braune 2004: 186–187. This feature can most likely be considered "user-friendly" (to use a term by Haspelmath 1999: 191): After all, the default-function associated with proper nouns is that of subject rather than direct object (cf. their high degree of animacy and definiteness). Accusative marking will thus help the hearer identify those cases that deviate from the expected. Nonetheless, Modern German has completely given up accusative case marking on proper nouns.

Finally, to take an example from syntax, another potential case of dysfunctional change might be the emergence of the well-known verb-second constraint of most modern Germanic languages: In Modern German, independent declarative clauses are characterized by the requirement that the finite (part of the) verb be preceded by exactly one XP. This XP *may* be the topic, but it needn't be. In fact, according to Frey (2004: 9), one way of filling the first position is through a mechanism labelled "formal movement", a mechanism that "does not seem to be related to any semantic or pragmatic property". In Old High German, by contrast, verb-second was only one of several options. Alternatively, declaratives could show verb first or "verb late" (i.e. third or even later position) order, and the choice was governed by information-structure (cf. Hinterhölzl & Petrova 2010; 2011). One way of looking at modern verb second, then, is that it is a fossilized information-structural pattern, explainable on the basis of functional factors only with respect to its history, but not with respect to its synchronic functioning.

About this volume

The present volume aims to approach the topic of change for the worse (and for the better) from a wide range of perspectives: It addresses phenomena from different domains of grammar (phonology, morphosyntax, semantics), and it explicitly aims to avoid a bias towards particularly well-studied languages by considering a large variety of (often underresearched) languages. Indeed, the languages dealt with include, among others, Albanian, English, German, Marathi, Panará, Tungusic and Wu. In addition, the volume is not committed to any one particular theoretical orientation. It does, however, intend to contribute to ongoing theoretical debates and discussions between linguists with a different theoretical background. The book is thought to appeal equally to anyone interested in diachronic and historical linguistics, typology, and theoretical modelling. Likewise, it will be of interest to phonologists, morphologists, syntacticians and semanticists.

The first two contributions discuss (potentially) pejorative change in the field of phonology.

Matthew Faytak embeds the question of potentially pejorative language change in an explicitly evolutionary framework by comparing the claim of language change always being optimizing with the strict adaptationist stance in biology, which has been challenged e.g. by Gould & Lewontin (1979). Whereas non-adaptive change is not uncommon in biology (cf. the development of "spandrels"), and can certainly be found in language, too, Faytak goes one step further and raises the question whether there are examples of mal-adaptive language change. He discusses high vowel fricativization in the Northern Wú dialect, (Sūzhōu Chinese) as a possible example of the latter. The production of fricativized vowels requires a high degree of articulatory precision without any obvious functional gain in the specific case of the Northern Wú dialect. After presenting phonetic evidence from an ultrasound tongue imaging study, Faytak turns to the diachrony of high vowel fricativization, which is to be analyzed as an example of transphonologization (one acoustic signal of a phonological category is used in place of another), but crucially, the process in question cannot be functionally motivated as a strategy for contrast maintenance. Therefore, the change seems to have occurred and spread across a relatively small area by chance. However, it is very likely that high vowel fricativization has had a chance to spread due to a social function attached to it. If this is right, social factors favoring a change may well overrule factors of communicative efficiency (disfavoring the change), an antagonism that cannot easily be replicated in the field of biological evolution. (We might even speculate that "unnatural" forms, i.e. forms that are mal-adaptive in terms of communicative efficiency, are particularly prone to developing social meanings in terms of prestige *because* they are difficult to produce?)

Myriam Lapierre discusses postoralized and devoiced nasals in Panãra (Jê), where ND sequences turned into NT. Typological and diachronic crosslinguistic evidence is very robust that this change is unnatural insofar as it is the opposite of the much more common (and for aerodynamic reasons phonetically well-grounded) process NT > ND. Examples of ND > NT from other languages can be explained as the result of a telescoping sequence of individual but more natural sound changes. However, Lapierre convincingly shows that from Proto-Northern Jê to Panãra ND directly turned into NT (i.e., as a single sound change). Lapierre's solution to the puzzle is based on two arguments. First, instead of looking at ND > NT in isolation she analyzes it in the context of the Panãra phonological system as a whole. Panãra has a phonemic contrast between oral and nasal vowels. Postoralization of nasal consonants is analyzed as an allophonic realization of nasal stops when they are followed by an oral vowel. Second, she argues that phonetic naturalness may be grounded either in articulation or in perception. In the case at hand, devoicing of denasalized nasal stops enhances the perceptive salience of the phonemic contrast between oral and nasal vowels following them.

Possible examples of language change for the worse in the domain of morphosyntax are discussed in the next three contributions.

Christine Elsweiler and Judith Huber examine the loss of the number contrast in the English second person pronoun. As is well-known, English used to distinguish a singular form *thou* and a plural form *you*, but it lost the distinction through the extension of *you* to the singular and the subsequent loss of *thou*, a development completed by the eighteenth century. Elsweiler and Huber first establish that the loss of the number contrast may legitimately be labelled a change for worse; evidence is seen in the fact that most spoken varieties have developed repair strategies, i.e. new plural forms such as *you guys* or *you'all*. However, the authors also hypothesize that the pejoration in question may be viewed as a by-product of two changes for the better: First, at least initially (viz. until the eventual demise of *thou*) the extension of *you* to the singular led to a two-term address system allowing for nuanced pragmatic distinctions with respect to e.g. politeness, intimacy and distance – an improvement from the perspective of sociopragmatics. Second, once *you* was available as a form for singular address, its increasing use may have been driven by deflexion: It allowed speakers to avoid the verbal suffix *-st* triggered by *thou*, resulting in a simplified inflectional paradigm – a change for the better from a structural perspective, particularly against the background of the language and dialect contact situation in early modern London.

Veton Matoshi investigates the use of clitic doubling in Albanian dialects from the perspective of functional transparency. In Albanian, as in other Balkan languages, an object may additionally be marked by a depronominal clitic. Crucially, however, not all objects trigger clitic doubling; thus a key question is to determine the conditions under which it does or does not occur. Matoshi first provides the relevant theoretical and typological background on agreement and transitivity, pointing out that Albanian clitic doubling constitutes a manifestation of the more general phenomenon of differential object marking. It is expected i) that object marking is prone to occur where the object shows characteristics typical of subjects (such as +animate/human, +definite, +specific, +given, +topic, -foc) and ii) that in the course of a grammaticalization process, object marking may be generalized to all objects, thus loosing its original functional motivation. In an empirical section, Matoshi analyzes a newly-compiled Albanian dialect corpus comprising data not only from the Republic of Albania but also from the Albanian-speaking regions of neighboring countries. He shows that there are areal differences in the usage frequency of clitic doubling, which are taken to reflect different degrees of grammaticalization. In particular, the varieties spoken outside Albania use clitic doubling more frequently than most varieties spoken in Albania. In some varieties (specifically Montenegro and Kosova) doubling tends towards a loss of any pragmatic, morphological or semantic restrictions, amounting to an increasing degree of functional opaqueness.

Tabea Reiner investigates a verb construction in German whose very existence is disputed: a pattern whereby the infinitive-selecting auxiliary *werden*, which itself usually only occurs in finite form, occurs in the infinitive. Given that *werden* is often (though not undisputedly) analyzed as a future auxiliary, the construction in question is viewed as a (potential) posterior infinitive. After conducting a typological survey, Reiner concludes that this temporal category seems to be rare in the languages of the world, which raises the questions of *why* it is rare and what functions it serves in those languages where it does occur. The latter question is then addressed on the basis of the German construction. Reiner first shows that non-finite *werden* can indeed be attested in corpora (if only rarely), and after an analysis of its structural, semantic and distributional properties, Reiner defends the view that it constitutes a posterior infinitive. However, she also concludes that it does not appear to offer any merits compared to the "simple" (viz. *werden*-less) infinitive. Consequently, Reiner argues that the emergence of the construction is tough to motivate functionally (be it as a means of disambiguation, on the basis of Haspelmath's 1999 notion of "extravagance" or as an example of hypercorrection). Instead, she proposes that it is motivated by analogy, with two constructions serving as models: i) the (much more common) anterior infinitive, i.e. another temporally marked infinitive, and ii) the passive infinitive, which, involving the same auxiliary, provides a model for non-finite *werden*. According to Reiner, the analogy is "functionally blind", but, crucially, this blindness is only local. From a global perspective, analogical extensions of the type in question are considered to increase systematicity and processability.

The following contribution deals with language change on the semantic level exploring the morpho-syntactic marking of a particular–characterizing meaning contrast.

Ashwini Deo considers a previously uninvestigated semantic contrast conveyed by copulas/auxiliaries that is common in several New Indo-Aryan languages. She shows that the contrast in question can be best analyzed as lexicalizing particular vs. characterizing meanings. By investigating the origin of this contrast, based on historical data mostly drawn from Marathi, Deo provides evidence indicating that the expression of this contrast is found to be grammatically categorical through the interpretational possibilities for the *bhū* copula and its cognates in the Modern New Indo-Aryan languages. While Middle and Old Indo-Aryan appear to show sensitivity to the semantic distinction between particular and characterizing claims, there is no specialized morpho-syntactic device for conveying particular claims in these systems. Thus, Deo proposes that the New Indo-Aryan languages may have transitioned into a strategy in which the contrast is categorically expressed as a secondary consequence of a change in their broader tense marking systems. Deo uses this observed categoricalization to reflect on whether the morpho-syntactic marking of the particular–characterizing contrast represents a change for the better or for the worse.

Issues of complexification as a potential change for the worse are discussed in the next two contributions.

Andreas Hölzl investigates the reconstruction of the proto-Tungusic phoneme **K* and its implications for Tungusic interrogative systems. **K-* served the function of an interrogative submorpheme (or "resonance"), similar to English *wh-*, but in most Tungusic subbranches (with the exception of Nanaic) it is lost, a change that led to very incoherent and opaque interrogative systems. Based on rediscovered data from Alchuka, Hölzl proposes a new reconstruction of the proto-Tungusic phoneme **K-* (and its loss). The consequences of the loss of **K-* for interrogative systems are discussed in the context of a general framework for complexity, for which Hölzl proposes seven distinct dimensions (regularity, redundancy, analyzability, amount, organization, coherence, delineation), whereby the dimension of coherence turns out to be the most relevant one for the issues discussed in the paper. Hölzl concludes with a critical discussion of the evaluative flavor of classifying a change as "for the better" or "for the worse".

Johanna Nichols,in her programmatic paper, discusses the complexity of paradigms, more specifically inflectional marking of argument roles in verbal paradigms. These paradigms are notorious for their great degree of complexity especially in polysynthetic languages. Nichols argues that while recent years have seen much progress in measuring the complexity of paradigms understood as outputs (e.g. in the light of canonical typology), little is known yet about the "blueprint" the complex output is based on. The paper pursues the hypothesis that whereas most existing work on morphological complexity has focused on the paradigmatic axis only, the blueprint underlying participant marking in verbal inflection is best approached from the perspective of the relational (or, in Saussure's terms, syntagmatic) axis. Nichols then applies complexity measures originally developed for the paradigmatic axis (such as biuniqueness) to the relational axis. What is canonical and what is complex turns out to be quite different depending on a paradigmatic or relational perspective. Relational canonicality is analyzed as the result of two general principles, namely the reduction of informational complexity (by drawing on universal patterns such as person hierarchies) on the one hand and (from a processing perspective) the salience of relational markers on the other.

Modelling language change: This section deals with how change for the worse may be accounted for within different theoretical models.

Gerhard Jäger investigates the overall question of this volume whether languages can change for the worse from an evolutionary theoretical perspective, arguing that evolving systems can be compared with regard to their fitness, and that "worse" can be translated as "less fit". From this point of view, the paper pursues the hypothesis that the initial question has an analogy to the issue of whether biological Darwinian evolution can lead to the reduction of fitness. Following much recent work in historical and evolutionary linguistics, Jäger assumes that biological evolution and language change are two instances of an overarching principle of evolution via replication and selection. He then applies George Price's mathematical model of Darwinian evolution to conceptual questions such as the one discussed here and spells out why Price's approach is useful for the study of language change in general; Price (1995) sees selection as a very general mechanism that has been studied intensely in biology but is also at work in other domains. Jäger shows that parts of the language system can become worse in the sense that they are changed towards or replaced by alternatives that would be less fit than the original version under similar circumstances.

Roland Mühlenbernd presents an introduction to and a tutorial on game theoretic approaches within an evolutionary framework in the study of language variation and change. He discusses Jäger's (2007) Case game and Deo's (2015) Imperfective game as two pioneering and influential applications of evolutionary game theory (EGT) to phenomena in diverse grammatical domains and to problems of language change within the context of diachrony and stability aspects of grammar: Following Jäger (2007), he focuses on case-marking patterns that help disambiguate syntactic core roles (such as nominative and accusative) in transitive sentences. Following Deo (2015) he addresses the diachrony of the Imperfective aspect and its cross-linguistically attested distinct sub-readings, the progressive and the habitual. After presenting the grammatical and empirical background to these two games, he exemplifies how individual grammars, namely grammatical systems, can be modeled within a model-theoretic approach by proposing a step-by-step application of important key notions and concepts of EGT in the process, such as *evolutionary stability* or the *replicator dynamics*. Mühlenbernd concludes by situating the framework of EGT within the broader context of language change for the worse and extends this perspective to the explanatory potential of how language use might drive grammatical change.

Gerhard Schaden makes and investigates three major claims in his study: First, linguistic resources such as phonemes and constructions can be analyzed as Public Goods; second, under some circumstances and for some linguistic entities, the socially differentiating use of these expressions makes them Common Pool Resources; and third, communication is seen as a cooperative endeavor where systematic and intrinsic conflicts between speaker and hearer will lead to a Tragedy of the Commons. Schaden shows how this optimization problem can be modeled within a game-theoretic framework as a signaling game. He discusses the consequences of his approach in the context of two case studies of the Tragedies of Commons: the loss of syllable-final -s in Western Romance Languages and the aoristic drift of the present perfect. As for the present perfect, Schaden's model predicts that the more frequent the present perfect is, the less it denotes current relevance. Consequently, he argues that simple past tenses do not trigger any inference that the event will have current relevance. Schaden concludes within the broader context of language change for the worse by arguing that such Tragedies of the Commons constitute cases where short-term advantages of the speaker lead to a long-term complication for successful communication.

Acknowledgements

The present volume is the result of a highly collaborative endeavor in which not only the editors and authors of the chapters were involved. We would like to thank in particular our external reviewers for their critical and constructive assessment whose comments have contributed to considerable improvement of all chapters: Artemis Alexiadou, Raffaela Bächler, Rajesh Bhatt, Walter Bisang, Ellen Brandner, Miriam Butt, Dan Dediu, Elvira Glaser, Dalina Kallulli, Henri Kauhanen, Götz Keydana, Felicitas Kleber, Christian Langstrof, Matti Miestamo, Tatiana Nikitina, Andrey Nikulin, Svetlana Petrova, Gareth Roberts, Björn Rothstein, Peter Trudgill, Søren Wichmann, and Alan Yu. Moreover, we thank Florian Fleischmann and Stefan Pfister for their invaluable help with typesetting. We would also like to thank the editorial board of the series Studies in Diversity Linguistics, in particular, series' editor, Martin Haspelmath, whose words of encouragement have been very important from the outset to the final stages of the volumes' production. This book project originated from a transatlantic workshop on "Language Change for the Worse", jointly held by the LMU Germanic Linguistics Section and the UC Berkeley Linguistics Department at LMU Munich on 27-28 May 2017. We thank the IBZ Munich (The International Encounter Center for Science in Munich) for hosting the workshop, as well as the participants and the audience for contributing to an inspiring and stimulating discussion venue. The workshop was ultimately made possible thanks to the financial support through the LMU-UCB Research in the Humanities scheme (LMUexcellent), a funding program for collaborative research in the humanities between LMU Munich and the University of California, Berkeley.

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Chapter 2

High vowel fricativization in Northern Wu Chinese and its neighbors

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Language change has been argued to be optimizing as a rule, which parallels a strict ADAPTATIONIST stance formerly common in evolutionary biology; both have seen their share of critique, and the time is ripe for a reassessment in the linguistic sciences. The goal of this chapter is to discuss the possibility that an intracategorical sound change, a shift in the typical phonetic implementation of some phonological category, might unambiguously reduce the fitness of the category at issue in some sense, such that we might declare it *maladaptive*. I argue that HIGH VOWEL FRICATIVIZATION (HVF) is a strong candidate for just such a sound change, mainly due to the nature of the FRICATIVE VOWELS that it produces. After confirming the nature of the contrast between fricative vowels and high front vowels in a representative Northern Wú dialect, Sūzhōu Chinese, with an ultrasound tongue imaging study, I present evidence that HVF introduces a relative reduction in fitness for the affected vowels in the Northern Wú context. This reduction in fitness, which can mainly be attributed to the phonologization of a fricative noise source in fricative vowels, is not found to be balanced by some larger functional improvement, although a social function of HVF cannot be ruled out.

1 Introduction

In response to the strong proposition that language change always acts to improve or optimize a changing linguistic system (Giacalone Ramat 1985; Vennemann 1993), the overarching goal of this volume (as I have understood it) is to ask whether any language change can be taken to represent some worsening of the language it affects. The task at hand is essentially to “recognize a pejoration … this being the only way to invalidate the theory” (Vennemann 1993: 13). In my

Matthew Faytak. 2020. High vowel fricativization in Northern Wu Chinese and its neighbors. In Dankmar Enke, Larry Hyman, Johanna Nichols, Guido Seiler & Thilo Weber (eds.), *Language Change for the Worse*, 17–52. Berlin: Language Science Press. DOI: ??

view, this task can be approached more fruitfully in an explicitly evolutionary framework, in which innovative variants in a linguistic system are successful inasmuch as they are well-adapted for communicative purposes (Wedel 2006; Blevins 2006). One might then seek out a maladaptive language change, then, on the basis of its stability and "survival", with maladaptive changes (a useful redefinition of changes "for the worse") tending to "go extinct". After elaborating these ideas in this section, I propose HIGH VOWEL FRICATIVIZATION (HVF) to be a candidate for just such a language change and describe it in detail as it affects the northern dialects of Wú Chinese and its neighbors.

1.1 Adaptationist thinking and language change

Early research into language change as improvement generated much debate (Lass 1980; Samuels 1987; Lass 1987), and many strong positions were taken in favor of the concept (Giacalone Ramat 1985; Vennemann 1993). I find that there are striking, and perhaps unexamined, parallels between the strongest accounts in favor of change as optimization and early research into biological evolution's adaptive mechanisms. Both could be argued to have followed a theoretical program of adaptationism at all costs: all developments of the systems being studied have, at some point in the history of both linguistics and evolutionary biology, been argued to improve fitness; in the case of biology, this is usually by way of natural selection. In linguistics, the mechanism has often been less specifically defined, but the parallels between Vennemann (1993)'s position and the early adaptationist program critiqued by Gould & Lewontin (1979) are still quite clear.

Particularly striking is the shared assumption that any local reduction in fitness cannot be pinned on natural selection, but rather on the need to implement local trade-offs to effect global optimization. As Vennemann (1993) notes, "…it is impossible to optimize a language in all domains at once. There cannot be a perfect language but only languages in which certain parameters are optimized at the expense of others" (14). Nearly a decade before, Gould and Lewontin had criticized a remarkably similar viewpoint prevalent in evolutionary biology and noted its major fault:

> … an organism cannot optimize each part without imposing expenses on others. The notion of "trade-off" is introduced, and organisms are interpreted as best compromises among competing demands. […] Any suboptimality of a part is explained as its contribution to the best possible design for the whole. *The notion that suboptimality might represent anything*

> *other than the immediate work of natural selection is usually not entertained* (Gould & Lewontin 1979: 585-6, emphasis mine).

Now is as good a time as any to reassess suboptimality in language change: evolutionary characterizations of language change at various levels of structure have become more frequent in recent years (Croft 2000; Mufwene 2008; Blevins 2006; Wedel 2006). The role of natural selection is sometimes explicitly foregrounded in this line of linguistic research: well-adapted innovations in word forms and the substantive makeup of phonemes, for instance, are more "successful" in terms of increased usage in the speech community due to their increased fitness at signalling linguistic contrast (Wedel 2006: 261–63).

But these newer typologies of language change also give prominent roles to non-adaptive change, such as language contact in Blevins (2006) or pruning of lines of descent in the case of Wedel (2006), a view much closer to mainstream evolutionary biology today: in many cases developmental structures in biology can be demonstrated to have a non-adaptive origin, such as the well-known evolutionary "spandrels" that have coincidentally developed as a side effect or interaction of unrelated adaptive developments (Gould & Lewontin 1979; Gould 1997). I take it as uncontroversial that, likewise, not every language change is adaptive in the sense that it improves speech communication in some way. Such non-adaptive changes abound in biological systems – most biological mutations are in fact neutral from an adaptive standpoint (Orr 1998) – and should also be commonly seen in linguistic systems upon further inspection.

1.2 Maladaptive language change

It may also be possible to find evidence for another phenomenon: sound change that is not merely non-adaptive, but MALADAPTIVE, or causing deviation from known adaptive peaks (Schluter & Nychka 1994; Crespi 2000). Maladaptation is in fact discussed in the evolutionary biology literature but is under-studied relative to adaptation (Brady et al. 2019), likely owing to the difficulty of picking out true maladaptations in biological organisms. What constitutes fitness for a given trait in a given context must first be determined to evaluate the degree of adaptation or maladaptation that an innovation introduces (Lewontin 1979; Crespi 2000), and there are competing interpretations of how to evaluate this fitness (Hendry & Gonzalez 2008).

One way of pinpointing a maladaptive outcome of change, in theory, is to document an innovative variant that, once it appears, tends to immediately be selected against and eliminated from the organism (or language) in question.

This approach is similar to the methodology suggested in Baum & Larson (1991) in that the examination is essentially phylogenetic, examining the inheritance of an innovative character over time (here, transmission of some novel linguistic variant within a lexicon and across a speaker population). In language, such a change should carry clear disadvantages for speech communication, perhaps in terms of contrast maintenance, so as to present a strong case. A relatively unambiguous "change for the worse" might be, as such, a change that clearly moves from a local optimum of performance (in terms of communicative efficiency) to a local non-optimum (Crespi 2000). Below, I put forward a candidate for just such a language change, on the grounds that the variant it creates is unambiguously unstable and results in a difficult-to-maintain contrast, an ecological situation that can be observed to result in relatively fast "extinction" (within a language) of the new variant.

The reader should note that I am eschewing terms like "worse" in favor of *maladaptive*. The term *maladaptive* not only identifies the concept at issue here with the one explored in evolutionary biology, but also eliminates the value judgment implicitly cast by the term "worse", in that it has a more limited and precise definition related to local fitness of a novel linguistic variant within a language. Sloppily characterizing maladaptivity of particular linguistic innovations as a general worsening that characterizes the broader linguistic system may serve to perpetuate popular conceptions of some languages as "primitive" or poorly adapted to the modern world (Harlow 1998; Evans 1998). As we breach the topic of maladaptive change, it is important to remain clear-eyed about the racist foundations of evolutionary biology and linguistics (for an especially lurid example of both, see the portion of Ernst Haeckel's writings presented in Koerner (1983)) and to be careful that we do not plant the seeds for further unscientific mischaracterizations of linguistic diversity.

Furthermore, no language is perfectly optimal: language has been conceptualized as an complex adaptive system (Gell-Mann 1992; Lindblom et al. 1995), but no one language can be said to be perfectly adapted to speech communication. Any biological organism can be thought of as slightly maladapted in certain respects (Crespi 2000); analogously, I assume that all languages exhibit local non-optimality from time to time as a consequence of random drift being randomly amplified. The task at hand is thus not (trivially) demonstrating that language encompasses inefficiencies, rather to highlight a linguistic change which appears to produce, for all intents and purposes, a variant of a linguistic feature that is less fit than its predecessor.

1.3 A possible maladaptive sound change: high vowel fricativization

An unusual sound change affects numerous varieties of Northern Wú Chinese, spoken in central coastal China in and near Shànghǎi, as well as a handful of dialects in closely related families. Based on comparison among related Wú varieties, reconstructible high front vowels **i* and **y* have come to exhibit fricative noise resembling that of a [ʑ] across much of Northern Wú, with the latter reflex also retaining its lip rounding. Given the spectral properties of the frication in these segments and the fact that they are fully and modally voiced, the fricative noise cannot be attributed to non-modal phonation or devoicing, and is more readily attributable to the postalveolar constriction thought to characterize both sounds (Ling 2007; 2009). As such, I transcribe these FRICATIVE VOWELS throughout as /i̻/ and /y̻/, respectively.[1] These two vowels typically contrast phonemically with each other and with the high front vowels /i/ and /y/, which in modern Wú dialects are usually developments of lower, diphthongized, or nasalized rhymes **jen* and **ɥɤn* (see Section 3.1 for further details).

There is reason to label this sound change, which I will refer to as HIGH VOWEL FRICATIVIZATION (HVF), as maladaptive. The fricative vowels which result from HVF could be argued to be less well-adapted to speech communication than their reconstructible starting states. Under HVF, high front vowels, which are noted for the stability of their motor-articulatory and articulatory-acoustic mappings (Fujimura & Kakita 1979; Stevens 1989), become fricative vowels, which are more aerodynamically fickle and demanding of high articulatory precision (Ohala 1983); they are accordingly especially prone to merging with acoustically similar vowels. It is difficult to find a motivation in phonetic substance for HVF in the Sūzhōu Chinese case: based on comparison with neighboring dialects, HVF does not appear to contribute to maintenance of contrasts between the reflexes of **i*, **y*, and other vowels. Rather, HVF seems to have occurred by chance, with no apparent adaptive advantage conferred on the affected segments.

In Section 2, I present basic information on the Sūzhōu Chinese vowels as a descriptive example; I include evidence from an ultrasound tongue imaging study which confirms that the Sūzhōu Chinese fricative vowels differ in tongue shape from high front vowels (i.e., /i/) and are in fact more similar to postalveolar fricatives in tongue shape (i.e., /ɕ/). Following Section 3, which outlines a historical-comparative account of how HVF has proceeded in Northern Wu and nearby dialect families, in Section 4 I provide several arguments from phonetic

[1] These ad hoc transcriptions use the IPA's laminal subscript diacritic, in an extension of its typical use on coronal consonants.

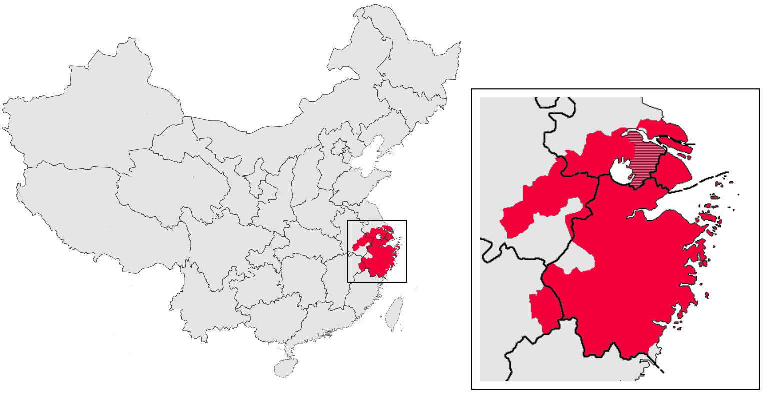

Figure 1: The Wú Chinese area (red) (Yan 1981; 1988; Zhao 2008), and the location of Sūzhōu within it (shaded, right). Map derived from https://commons.wikimedia.org/wiki/File:China_County-level.png under the image's CC BY-SA 3.0 license.

substance for viewing HVF in this geographical area as a maladaptive change. In Section 5, I speculate on the possible role of language contact in triggering HVF, but note that any social advantage that HVF confers on speakers is offset by the apparent reduction of fitness of speech sounds affected by HVF in communication. I conclude by considering the implications of maladaptive change for adaptationist theories of sound change.

2 High vowel fricativization in Northern Wú

The present study examines *high vowel fricativization* (HVF) in Northern Wú Chinese. I use the variety of Sūzhōu Chinese to exemplify the results of the change in detail. Sūzhōu Chinese here refers specifically to the variety of Wú Chinese spoken in the urban core of the city of Sūzhōu 苏州 and its immediate surroundings (Figure 1); the specific variety at issue is spoken in and around the district containing the old city (Gūsū qū 姑苏区). Below, I provide some relevant details on the vowel system of Sūzhōu Chinese in Section 2.1, followed by a discussion of HVF in Sūzhōu Chinese and neighboring Wú dialects in Section 2.2.

2.1 Sūzhōu Chinese apical and fricative vowels

The vowel inventory of Sūzhōu Chinese, given in Figure 2, is noteworthy for including two FRICATIVE VOWELS and two APICAL VOWELS (Ling 2009; Wang 2011).

		Unrounded	Rounded		
Coronal	Anterior (“apical”)	ɿ	[ʯ]		
	Posterior (“fricative”)	ɨ	ʉ		
		Front		Central	Back
		Unrounded	Rounded		
Dorsal	High	i	y		
	Mid	ɛ	ø	ə əʔ	o oʔ
	Low	a aʔ			ɑ ɑʔ
Other: Diphthongs əu, eɪ ~ øʏ; Labial [ɯ^{v}], [ɯ^{β}]					

Figure 2: The vowel phonemes of Sūzhōu Chinese, after Wang (1987; 2011) and Ling (2009). The four glottalized vowels are treated as separate phonemes, as in Chen (2008). Vowel qualities not phonemic on distributional grounds are given in square brackets [ ].

As described below, both sets of vowels are produced with a coronal constriction, which is particularly unusual given that a dorsal constriction location is typical of the lingual contribution to the articulation of most attested vowels (Lindblom & Sundberg 1971; Lindau 1978; Honda 1996). Some articulatory and acoustic characteristics of these two vowel types in Sūzhōu Chinese and other languages further afield are discussed in this section. The focus here is on the fricative vowels, which are phonotactically less restricted than the apical vowels and are described as typically exhibiting a posterior coronal (i.e., postalveolar) constriction.

Some disambiguation of the apical vowels and the fricative vowels is in order. Apical vowels (shéjiān yuányīn 舌尖元音) occur in Standard Chinese (Lee-Kim 2014; Faytak & Lin 2015), and they are broadly attested throughout the Chinese dialects (Zee & Lee 2007; Lee & Zee 2015), including all Wú dialects (Qian 1992). Apical vowels have characteristic phonotactic restrictions: they must occur following a fricative or affricate consonant that shares their place of articulation. Because of this pattern and the fact that they are most often allophones of high front vowel phonemes such as /i/, they are generally presumed to have arisen from high front vowels via total coarticulation with their onsets (Chen 1976; Yu 1999). In Sūzhōu Chinese, the unrounded and rounded apical vowels /ɿ/ and /ʯ/ have the characteristic phonotactics, occurring only after apico-alveolar fricative and affricate onsets (/s/, /ts/, etc.). Unlike in Standard Chinese, on distributional grounds, the Sūzhōu Chinese unrounded apical vowel is phonemic (see Table 3).

The Sūzhōu Chinese vowels are described as having an apico-alveolar constriction (Ling 2009; Wang 2011), similar to the Standard Chinese apical vowel [ɿ] that occurs following apico-alveolar fricative and affricate onsets (/s/, /ts/, etc.).

The fricative vowels (mócāhuà yuányīn 摩擦化元音) in Sūzhōu Chinese exhibit a different, more posterior constriction location compared to the apical vowels. Ling (2007; 2009) identifies this constriction location as lamino-postalveolar, resembling Sūzhōu Chinese's lamino-postalveolar fricative consonants, e.g. /ɕ/. On the basis of Ling's data, I transcribe these two vowels as laminal /ɨ̻/ and /ʉ̻/. In both Sūzhōu Chinese and in other Chinese varieties that have them (Zhu 2004), fricative vowels are phonotactically less restricted than apical vowels, and may occur not only with homorganic fricative and affricate onsets (/ɕ/, /tɕ/, etc.) but also with bilabial and labiodental onsets (/ɨ̻/) and without any onset (both /ɨ̻/ and /ʉ̻/). Fricative vowels such as they occur in Sūzhōu Chinese, then, appear to arise not through assimilation to onset consonants (as is the case with apical vowels); the process of high vowel fricativization that does appear to give rise to them is explored in the next section. All Sūzhōu Chinese fricative and apical vowels phonemically contrast with one another, except perhaps [ʮ], which in distributional terms could be considered an allophone of /ʉ̻/ (Figure 3).

Apical and fricative vowels are attested in the Chinese dialects (Zee & Lee 2007; Zhu 2004) and in various languages beyond (Björsten & Engstrand 1999; Connell 2007; Westerberg 2016), notably Swedish. The acoustic characteristic uniting the various descriptions of these segments is the consistent presence of voiced fricative noise, which appears to form part of the segments' production goals in the case of the fricative vowels. In the case of apical vowels, which obligatorily follow strident fricative or affricate onset consonants, the presence of fricative noise is perhaps unsurprising;[2] for fricative vowels, more interestingly, the affiliation of the fricative noise appears to be to the vowel itself.

Both fricative and apical vowels also exhibit a clear formant structure resembling a high central vowel, "rather than [the] schwa-like quality often associated with syllabic fricatives" (Connell 2007: 15). For both of the Sūzhōu Chinese fricative vowels and the comparable unrounded vowel in dialectal Swedish, F1 is somewhat higher, and F2 slightly lower, than a comparable high front vowel with the same lip rounding (Björsten & Engstrand 1999; Ling 2009; Westerberg 2016; Schötz et al. 2011); apical vowels tend to have a lower F1 than fricative vowels with the same lip rounding (Ling 2009). Both the characteristic fricative noise at

[2]See Lee-Kim (2014) on Standard Chinese apical vowels as an apparent counterexample to this generalization: although they exhibit fricative-like tongue shapes and immediately follow fricative onsets, they do not appear to exhibit fricative noise consistently.

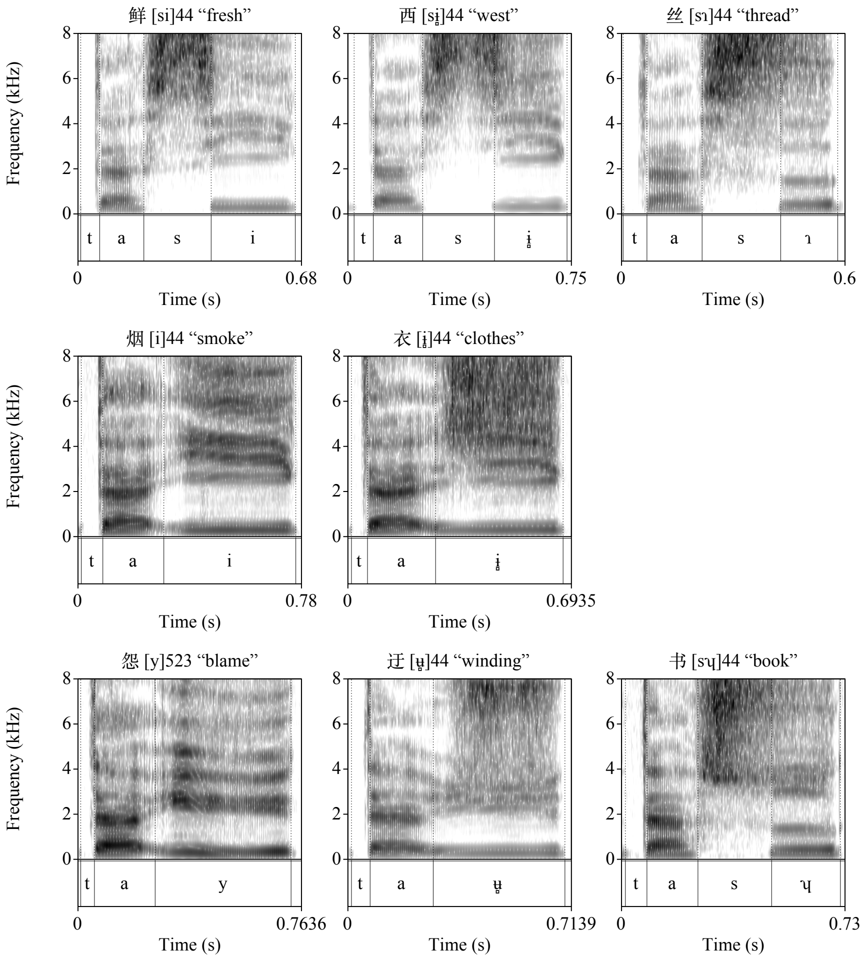

Figure 3: Spectrograms for minimal sets of Sūzhōu Chinese high front vowels /i/, /y/, fricative vowels /i̬/, /ʉ/, and apical vowels /ɿ/, [ʮ]. Examples extracted from a frame sentence with segmental context [ta ___ kɛ].

high frequencies and the typical formant frequencies described here can be seen in the example spectrograms of the Sūzhōu Chinese apical and fricative vowels in Figure 3.

The fricative noise associated with both apical and fricative vowels is typically strident in quality (Rose 1982; Björsten & Engstrand 1999; Connell 2007; Ling 2009), suggesting that the tongue is configured to direct a turbulent jet of air at the alveolar ridge or teeth, but the specific quality and intensity of the resulting frication varies somewhat among speakers. Other plausible sources of fricative noise can be ruled out. The Wú dialects are known for their register systems involving contrastive use of breathiness or other non-modal phonation (Rose 1989; Cao & Maddieson 1992; Chen & Gussenhoven 2015). The fricative noise in apical and fricative vowels does not appear to be a manifestation of a register contrast in Sūzhōu Chinese or related Wú dialects. Fricative and apical vowels are characterized by unbroken modal voice, and the non-laryngeal character of their fricative noise is evident from its spectral shape, visible in Figure 3 above 4 kHz, in a reasonable range for sibilant or shibilant fricatives. The common element across speakers is the production of some type of fricative noise with a supralaryngeal constriction, most often coronal.[3]

2.2 The fricative vowel-high front vowel contrast: an ultrasound study

A relative abundance of data exists showing that the apical vowels are produced with a constriction made at the alveolar ridge by the tongue tip, similar to [s], in both Standard Chinese and Sūzhōu Chinese (Zhou & Wu 1963; Lee-Kim 2014; Faytak & Lin 2015; Ling 2009). To confirm that the fricative vowels are articulated similarly to other fricative consonants such as [ɕ] in Sūzhōu Chinese, data on the Sūzhōu Chinese high front vowel /i/, the fricative vowel /i̴̻/, and the fricative consonant /ɕ/ were collected using ultrasound tongue imaging. Eight participants (four male, four female) were recruited at the University of California, Berkeley and were compensated for their time and effort; all procedures described here were approved by the local institutional review board.

Recording took place in a sound-attenuated booth in the UC Berkeley PhonLab. Participants were asked to read the monosyllabic stimuli shown in Table 1 with a Sūzhōu Chinese reading (as opposed to a Standard Chinese reading). Stimuli containing the target segments were displayed as simplified Chinese characters on a computer screen. Each stimulus item was read embedded in the frame sentence given in 1:

[3]An anonymous reviewer points out that all of the languages mentioned in this chapter are tonal in some sense. We reserve further comment on the connection between tonality and HVF for future research: it cannot be ruled out, for instance, that some third characteristic predisposes languages to the development of both lexical tone contrasts and fricative noise contrasts on vowels.

(1) Frame sentence (Sūzhōu Chinese)

我	说	___	拨	你	听。
ŋəu˩	səʔ˧	___	pəʔ˧	neɪ˧	tʰɪŋ˧
1	say	___	give	2	hear

‘I say ___ to you’

Readings for each stimulus item were prompted in randomized order for eight blocks. This resulted in a maximum of 48 stimuli per participant containing 64 tokens of target segments (since two words contain both /ɕ/ and a vowel: 24 tokens of /ɨ̻/, 24 /i/, and 16 /ɕ/). Speakers 1 and 2 completed only five blocks of the study and so have only 40 tokens of target segments (15 /ɨ̻/, 15 /i/, and 10 /ɕ/). Several tokens were discarded due to recording errors; as a result, Speaker 03 has one less token of /ɕ/ and /ɨ̻/ than would be expected, Speaker 04 is missing one token of /ɨ̻/, Speaker 7 is missing one token of /i/, and Speaker 08 is missing one token of /ɕ/ and two tokens of /ɨ̻/.

Table 1: Stimuli for ultrasound study; from Ye (1988).

Onset	/ɨ̻/	/i/
/Ø/	衣 ɨ̻^{44} ‘clothes’	烟 i^{44} ‘smoke’
/p/	比 pɨ̻˥˩ ‘compare’	边 pi˥ ‘side’
/ɕ/	稀 ɕɨ̻˥ ‘rare’	掀 ɕi˥ ‘flip’

Ultrasound video of the resulting utterances was recorded in midsagittal section at a frame rate of 107 Hz using an Ultrasonix SonixTablet. The device was equipped with a C9-5/10 microconvex transducer held in place by an Articulate Instruments Ltd. stabilization headset (Scobbie et al. 2008). Audio was recorded with an AKG 535 EB microphone and digitized through a Steinberg UR22 USB audio interface. Frames corresponding to the acoustic midpoints of /ɨ̻/, /i/, and /ɕ/ were selected using acoustic landmarks in time-aligned audio, and tongue surface contours were semiautomatically extracted using EdgeTrak (Li et al. 2005). Each speaker's contours were submitted to a smoothing-spline ANOVA (SSANOVA) model to estimate the speaker's typical tongue shape for each segment (Gu 2002; Davidson 2006); a polar coordinate system was used to reduce distortion in the tongue blade and root regions (Mielke 2015). Separately, the position of a portion of the hard palate was estimated for each speaker from the average of five frames showing maximal tongue-palate contact during a swallow task.[4] Since individual anatomical variation cannot easily be factored out of the data, tongue shape comparisons are made within the model outputs of single speakers.

SSANOVA splines are presented for each speaker in Figure 4, which shows that /ɨ̻/ is more similar to /ɕ/ than /i/ across speakers: /ɕ/ and /ɨ̻/ both typically exhibit a retracted tongue root, lowered tongue dorsum, and raised tongue blade in opposition to [i], which exhibits an advanced root, raised dorsum, and lowered blade. Speaker 6 excepted, enough of the tongue blade is visible to directly suggest a similar postalveolar constriction for both /ɕ/ and /ɨ̻/. Most speakers' /ɨ̻/ tongue shapes differ from those used for /ɕ/ primarily in that /ɕ/ exhibits a raised tongue dorsum relative to /ɨ̻/. For speakers 1, 2, and 5, this difference is slight, but for speakers 3, 4, 6, and 7, a greater degree of tongue dorsum raising distinguishes /ɕ/ from /ɨ̻/.

This inter-speaker variation in similarity between /ɕ/ and /ɨ̻/ appears to be mediated by coarticulation of the onset consonant /ɕ/ with the following vowel. Tokens of /ɕ/ which are followed by /i/ have a more domed tongue shape which differs substantially from /ɕ/ followed by /ɨ̻/ as well as /ɨ̻/ itself, a difference which can be attributed to coarticulation with /i/ (Figure 5). The extent of this coarticulation in half of the /ɕ/ tokens mirrors the extent to which a speaker's /ɕ/ resembles their /ɨ̻/ in terms of *overall* tongue position found by the SSANOVA models shown in Figure 4. Speakers 1 and 5 shows the least coarticulation, which is reflected in the close overall similarity of their /ɕ/ and their /ɨ̻/. Other speakers (notably Speakers 3 and 6) have more dramatic coarticulatory differences, and the overall SSANOVA result for /ɕ/ in Figure 4 is a spline intermediate in shape between the two /ɕ/ variants but resembling neither.

Speaker 8 qualitatively differs from the other speakers in producing /ɨ̻/ similarly to /ɕ/ in some respects and to /i/ in others. Speaker 8's /ɨ̻/ has a raised tongue blade closer in character to that of /ɕ/, a behavior exhibited in common with the other seven speakers. However, Speaker 8's /ɨ̻/ is produced with an advanced tongue root and raised tongue dorsum, more akin to /i/. This variant of /ɨ̻/ could be described as dorso-postalveolar in articulation, somewhat akin to an [i] articulated further front, with the tongue dorsum and blade shifted toward

[4] No palate trace is available for Speaker 3 due to their incomplete swallow task.

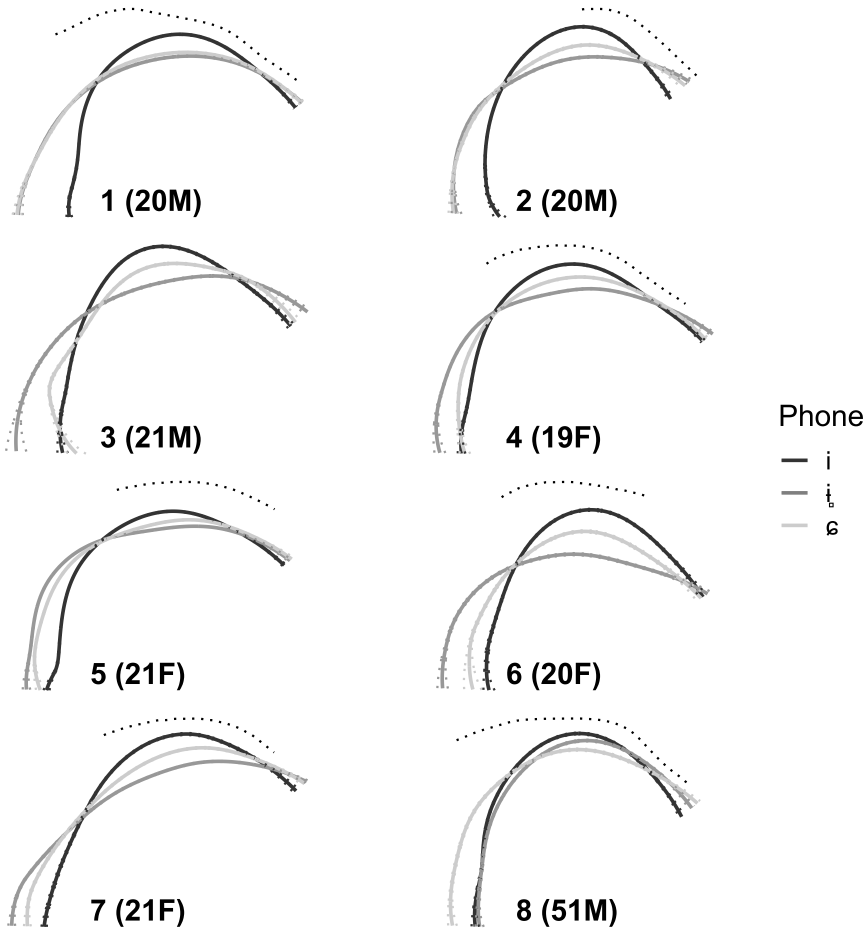

Figure 4: Smoothing-spline ANOVA estimates of tongue contour position with 95% confidence intervals for /ɨ̥/, /i/, and /ɕ/, with palate trace (dotted line) when available. Right is anterior.

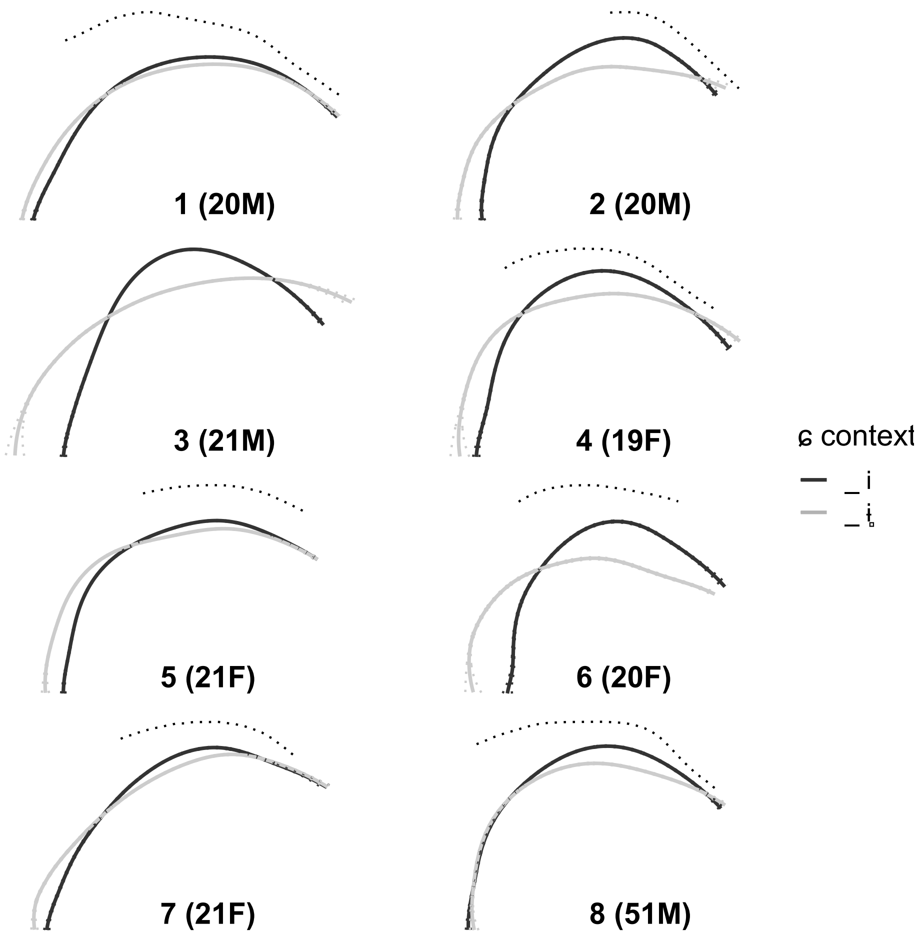

Figure 5: Smoothing-spline ANOVA estimates of tongue contour position for /ɕ/ preceding the two vowels in the data set, with 95% confidence intervals and palate trace (dotted line) when available. Right is anterior.

the postalveolar area. Speaker 8 is closer in age to the population studied in Ling (2009), members of which are described as using one of two articulations for /i̯/: a lamino-postalveolar variant similar to the one described here for Speakers 1–7, and a dorso-postalveolar variant which resembles Speaker 8's /i̯/. This raises the possibility that the observed difference is related to speaker age.

Regardless of speaker idiosyncrasies, and taking coarticulation of /ɕ/ with /i/ into account, the typical articulation of /i̯/ is much more similar to /ɕ/ than to /i/ for all speakers, especially in that a postalveolar constriction location is observed for /i̯/ which is absent in /i/. The location of this constriction is typically quite close to the constriction for /ɕ/, which suggests an articulatory-acoustic goal shared among these segments: the production of strident fricative noise of a specific quality close to that of /ɕ/.

3 Diachrony of high vowel fricativization in Wú Chinese

Having confirmed the nature of the contrast between /i/ and /i̯/ – and by extension, that between /y/ and /y̯/ – we turn to high vowel fricativization (HVF), the sound change that gives rise to the fricative vowels from high front vowels. The focus here is on the Northern Wú dialects, most of which belong to the Tàihú (Lake Tài) subgroup of Wú dialects. Tàihú Wú can in turn be subdivided into the coastal Sūhùjiā 苏沪嘉 group, which contains the relatively well-studied local dialects of Sūzhōu and the Shànghǎi area[5], and the inland Pílíng 毗陵 group, spoken north and east of Lake Tài to the Yangtze River (Qian 1992: 2–3). The Southern Wú dialects are phonologically conservative and with one apparent exception (Jīnhuá 金华 dialect; see Qian (1992)) do not undergo HVF (Cao 2002: 229). As such, they are not discussed here except as an out-group to Northern Wú, for instance in Table 3.

After an overview of HVF in Tàihú Wú, I begin to consider motivations for the sound change. I describe the process as one of transphonologization starting in Section 3.2. Two possible origins for this transphonologization are considered: one in which encroachment of the lower rhymes on the acoustic space of the higher rhymes gradually makes frication a more important cue to the latter, and one in which frication becomes an important cue essentially at random. Surprisingly, the second origin is better supported by the detailed chronology of HVF and related changes to the lower rhymes in Tàihú Wú, a finding which later factors in to the conclusion that HVF does not confer any clear advantage on the

[5] *Sūhùjiā* is an initialism referring to Sūzhōu 苏州, 沪渎 Hùdú (an archaic name for Shànghǎi), and 嘉兴 Jiāxīng.

Tàihú Wú high vowels.

3.1 History and extent of HVF in Northern Wú

Comparative data from Wú Chinese makes it clear that historical high front vowels are the origin of today's fricative vowels in Sūzhōu Chinese and other closely related Wú dialects. HVF has affected most of the Northern Wú varieties within Tàihú Wú and relatively few Wú varieties beyond it to the south, although it is also observed in the less closely related Jiānghuái 江淮 Mandarin dialects spoken to the north and west across the Yangtze, for instance Yánchéng 盐城 Mandarin (Cai 2011) and Héféi 合肥 Mandarin (Hou 2009; Kong et al. 2019).

Wú-internal comparative evidence laid out in Table 2 indicates that the fricative vowels are common reflexes of the Proto-Wú (PWú) vowels **i* and **y*, as reconstructed in Ballard (1969). Comparison of the Tàihú Wú group with Wú dialects further afield makes it clear that PWú **i*, **y* were likely conventional high front vowels, given that an overall majority of reflexes for this reconstructed set are [i] or [y]. In the Tàihú Wú varieties spoken west of Shànghǎi, exemplified here by Dānyáng and Sūzhōu, Qian (1992) transcribes the reflexes of the PWú high front vowels as high front vowels with subscripted *z* or *j*/*ɥ*. The subscripts are intended to indicate subtle differences in the quality of the frication noise produced: the former indicates that the vowel is "accompanied by a [z] sound," while the latter refers to a more general "accompanying frication" (Qian 1992: 12). Qian's transcriptions (i_z, i_j, y_z, etc.) can readily be identified as the fricative vowels [ɨ̻] and [ʉ̻] described in Section 2.1.

HVF as a sound change does not uniformly apply across Northern Wú, judging from the varied reflexes of PWú **i* and **y*. Wú varieties spoken at the southern end of the Northern area do not appear to have undergone HVF for the most part. This group is represented in Table 2 by the Tàipíng variety, one of the southernmost and most phonologically conservative Northern Wú dialects. In addition, the Shànghǎi-area dialects at the core of the Tàihú area do not exhibit fricative vowels at present, and in fact the reflexes of PWú **i* and **y* are sometimes merged with the reflexes of two other PWú rhymes, **jen* and **ɥɤn*, in these varieties. In Table 2, these varieties are represented by the Shànghǎi dialect of the city center.

There is evidence, however, that the Shànghǎi-area dialects *did* undergo HVF, only to subsequently merge the unrounded fricative vowel and unrounded high front vowel and lose frication on the rounded fricative vowel. Merger of reflexes of **i* and **jen* is prominently mentioned in a number of descriptions of urban Shanghainese beginning in the mid-twentieth century, starting with speakers who came of age in the 1980s (Xu & Tang 1962; 1988; Chen 2007). The unmerged

Table 2: Some Tàihú Wú cognate sets that undergo HVF, from Qian (1992) with Proto-Wú reconstructions from Ballard (1969). Vowel qualities in Sūzhōu Chinese are from my own notes.

Proto-Wú		Dānyáng	Sūzhōu	Shànghǎi	Tàipíng
闭 *pi$^{\text{III}}$	‘close’	pɨ̻^{324}	pɨ̻^{412}	pi^{334}	pi^{35}
移 *ɦi$^{\text{I}}$	‘move’	ɦɨ̻^{213}	ɦɨ̻^{223}	ɦi^{113}	ɦi^{312}
变 *pjen$^{\text{III}}$	‘change’	pɪ^{324}	pi^{412}	pi^{334}	piẽ^{35}
片 *p’jen$^{\text{III}}$	‘slice’	pʰɪ^{324}	pʰi^{412}	pʰi^{334}	pʰiẽ^{324}
居 *ky$^{\text{I}}$	‘home’	tɕʉ̻^{22}	tɕʉ̻^{44}	tɕy^{52}	tɕy^{523}
雨 *ʔy$^{\text{II}}$	‘rain’	ʉ̻^{44}	ɦʉ̻^{231}	ɦy^{113}	ɦy^{22}
捐 *kɥɤn$^{\text{I}}$	‘donate’	tɕʏ^{22}	y^{44}	tɕyø^{52}	tɕyœ̃^{523}
远 *ʔɥɤn$^{\text{II}}$	‘far’	ʏ^{44}	ɦy^{231}	ɦyø^{113}	ɦyœ̃^{22}

reflex of **i* is described as fricated whenever a detailed phonetic description is included: Qian (1992: 45) notes that some speakers still read modern Shànghǎi /i/ and /y/ with a fricative quality, and both Zhu (2006: 14) and Chen & Gussenhoven (2015: 329–30) observe a contrast based in part on the presence or absence of frication in the reflexes of PWú **i* and **jen* for some of their older consultants. HVF also seems to have affected PWú **y* in Shànghǎi, based on Qian's comments, but the resulting fricative quality was not, on its own, the primary means of signalling contrast with some other vowel: PWú **ɥɤn* has diphthongal [yø] as a reflex in Shànghǎinese (Qian 1992). Loss of fricative vowels in the city center has gradually radiated outward to suburban areas of Shànghǎi, owing to the city's role as an economic and cultural center starting in the early 20th century (Qian & Shen 1991; Chen 2007).

Thus, nearly all of the Tàihú Wú dialects appear to have undergone HVF at some point; Table 3 provides a more thorough listing of the typical reflexes of PWú **i*, **jen*, **y*, and **ɥɤn* and conveys the extent to which HVF has affected the various Wú subgroups. The available evidence suggests that HVF has in fact only recently occurred in Tàihú Wú. As mentioned above, fricative vowels cannot be reconstructed for proto-Wú (Ballard 1969); they also are not reconstructible for the proto-language of the nearby Jiānghuái Mandarin group (Coblin 2000). Systematic description of the Wú dialects begins in the mid-19th century with the dialects of urban Shànghǎi and Sūzhōu. Starting in these early time periods and up through the mid-20th century, in the Chinese-language dialectological literature, there is essentially no reference to fricated reflexes of PWú **i* or **y* in Tàihú

Table 3: Reflexes of **i*, **jen*, **y*, and **ɥɤn* in various Wú dialects. Proto-Wú (PWú) from Ballard (1969), other Wú from Qian (1992), except Sūzhōu from my own notes. Qian's various transcriptions of fricative vowels are shown here as ɨ̝ or ʉ̝.

		Proto-Wú	**i*	**jen*	**y*	**ɥɤn*
Northern	Pílíng 毗陵	Yíxīng 宜兴	ɨ̝	ɪ	ʉ̝	yẽ
		Jīntán 金坛	ɨ̝	ɪ̃	ʉ̝	yɪ̃ ~ yʊ̃
		Dānyáng 丹阳	ɨ̝	ɪ	ʉ̝	ʏ
		Jìngjiāng 靖江	ɨ̝	ɪ̃	ʉ̝	yɯ̃
		Chángzhōu 常州	ɨ̝	ɪ̃	ʉ̝	iɔ
	Sūhùjiā 苏沪嘉	Sūzhōu 苏州	ɨ̝	i	ʉ̝	y ~ iɵ
		Shànghǎi 上海	ɨ̝ → i	i	ʉ̝ → y	y ~ yø
		Sōngjiāng 松江	ɨ̝ → i	i	ʉ̝ → y	ø ~ yø
		Jiāxīng 嘉兴	i	ie	y	yɤə
		Wúxī 无锡	i	ɪ	y	io
	Other	Shàoxīng 绍兴	i	ɪ̃	ʉ̝	yɵ̃
		Chóngrén 崇仁	ɨ̝	iẽ	ʉ̝	yœ̃
		Tàipíng 太平	i	iẽ	y	yœ̃
Southern		Qúzhōu 衢州	i	iẽ	y	yə
		Yǒngkāng 永康	i	ie	ʏ	yə
		Jīnhuá 金华	ɨ̝ ~ ie	iæ̃	ʉ̝	yæ̃
		Wēnzhōu 温州	ɪi	i	y	y

Wú (Ting 2003; Qian 2003; Chen 2007). It is likely, however, that a fricated quality was present but mostly unremarked upon, except in cases where researchers included fine phonetic detail in their transcriptions: for instance, Chao Yuen-ren's 1928 description of Shanghainese (as cited in Qian 2003) transcribes the reflex of **i* as i_j, indicating a degree of constriction greater than for [i] (see Qian (1992) as discussed above). Even if the arrival of HVF in Tàihú Wú can thus be pushed back to the 1920s, it is likely that fricative vowels have constituted a part of the Northern Wú segmental repertoire for only a few generations of speakers.

3.2 HVF as transphonologization

The motivations for HVF have yet to be discussed here, a task we now approach. We may treat HVF as a type of intra-categorical change, TRANSPHONOLOGIZAtion, in which one means of acoustically signaling a phonological category is used in place of another (Hyman 1976; 2013; Ohala 1993b; Kirby 2011; 2013). Two important aspects of the phenomenon are addressed in more detail here. In this subsection, we elaborate on the precursor fricative noise most likely to give rise to HVF. In the following subsection, we consider how this noise may be exaggerated and eventually exchanged for more typically vowel-like cues, and the phonetic biases which may have led to this exchange.

The most plausible phonetic precursor for HVF is the aperiodic energy sporadically and unintentionally produced during production of high vowels such as [i] and [y]. As a high vowel becomes increasingly high and front, airflow during the production of the vowel is increasingly biased towards being turbulent. On first principles, the narrower the tongue-palate aperture, the more likely a given rate of air flow through that apterure is to spontaneously give rise to turbulence (Catford 1977; Shadle 1990). Modally voiced vowels require a high level of airflow, which itself also makes spontaneous turbulence more likely to spontaneously arise in a subset of instances of [i] or [y] production. The turbulent airflow that incidentally results may then be phonologized as a fricative noise source intrinsic to the vowel, likely due to listeners' misattribution of the fricative noise source to a constriction deliberately produced in association with the vowel (Ohala 1993a).[6] However, transphonologization does not proceed without some phonetic bias pushing it along (Kirby 2013; Garrett & Johnson 2013; Kirby & Sonderegger 2015), and so we must also ask what phonetic bias or biases led to a gradual increase in importance for fricative noise as a cue to reflexes of Proto-Wú *i and *y.

3.3 Motivating fricative noise as a cue

At first glance, HVF appears to have its basis in contrast maintenance: specifically, of the contrasts between these rhymes and the reflexes of **jen* and **ɥɤn*, respectively. Probabilistic enhancement (Kirby 2013) of fricative noise could occur if the reliability of formants as cues to the relevant contrasts were reduced, in this case due to crowding of vowels in the acoustic space near [i] and [y]. As seen in Table 3, the reflexes of PWú **jen* and **ɥɤn* have been denasalized, monophthongized, and raised in various combinations and to various extents in the Wú dialects (Qian 1992: 15), moving the reflexes of **jen* and **ɥɤn* closer to the

[6] HVF typically results in constrictions which produce strident frication. We speculate that this could be due to an intermediate stage of enhancement which takes place during HVF: as the importance of fricative noise as a cue to category grows, speakers preferentially enhance frication with stridency (Kingston & Diehl 1994; Stevens & Keyser 2010).

reflexes of **i* and **y* in acoustic space. In Sūzhōu Chinese, for instance, the reflex of PWú **jen* has lost its nasal coda and internal dynamicity and is produced as high, monophthongal, and oral [i].

The pair of contrasts at issue, between PWú **i* and **jen* on the one hand and **y* and **ɥɤn* on the other, have high functional load in Sūzhōu Chinese and related Wú dialects.[7] High functional load has been shown to inhibit contrast loss in diverse languages (Wedel et al. 2013), and perhaps in some cases serves as a driver of contrast maintenance. To maintain a contrast, listeners must attend to reliable cues. We might assume, then, that as the reflexes of **jen* and **ɥɤn* gradually neared the reflexes of **i* and **y* in formant space, listeners made greater use of the fricative noise more frequent in **i* and **y* to reliably distingish each pair, eventually leading to HVF and the use of fricative vowel reflexes.

The interaction described above would essentially be a push chain shift, in which the reflexes of **jen* and **ɥɤn* encroach on those of **i* and **y*, causing displacement of the latter (Ettlinger 2007; Faytak 2014). Puzzlingly, however, HVF appears to lead a pull chain in Tàihú Wú, occurring first for its own unclear reasons rather than as a result of encroachment of another vowel on its acoustic space.

3.4 HVF does not occur due to encroachment

Detailed inspection of the chronology of HVF and associated sound changes is possible for two Tàihú Wú varieties, Sūzhōu Chinese and Shanghainese. HVF in Sūzhōu Chinese, for instance, likely precedes raising of monophthongal reflexes of **jen* and **ɥɤn* into the acoustic space occupied by reflexes of **i* and **y*. Through the first half of the twentieth century, **jen* and **ɥɤn* in Sūzhōu Chinese develop from approximately [ie] and [yø] Lu (1935, cited in Ting 2003) to [iɪ] and [iɵ], respectively (Ye 1988; Qian 1992). Monophthongal reflexes of **jen* and **ɥɤn*, i.e. [ɪ] and [ʏ], only enter the descriptive record after the mid-1980's (Wang 1987; Ling 2008; 2009), although [ʏ] is still diphthongal [iø] for some speakers (Ling 2008). Taking into account the stated preference of the above sources to work with speakers over the age of 40, some speakers examined in these sources, who were born as late as the early 1940's, appear to maintain diphthongization of the lower series, and speakers born after this point appear to maintain a height difference, although the youngest speakers today produce [i] and [y] for **jen* and **ɥɤn*.

[7] While there is no source of lexical statistics available for Tàihú Wú to quantify functional load for these contrasts, minimal pairs are easy to find. For instance, the mid-twentieth century merger of **i* and **jen* in Shanghainese created numerous homophones (Qian 2003; Zhu 2006).

HVF in Sūzhōu Chinese appears to predate this raising and monophthongization of the lower rhymes by decades, with frication already a noticeable aspect of production of the reflex of **i* in Chao (1928, cited in Ling 2009). Later descriptions confirm the presence of frication for both **i* and **y* for speakers born roughly from 1930 to 1960 (Wang 1987; Qian 1992; Ling 2009).

More detailed historical data are available for Shanghainese, much of which is collected in Qian (2003). An even larger acoustic gap between **i* and **jen* in Shanghainese is readily evident at the time that HVF began affecting **i*. Nasalization of **jen* and **ɥɤn* is absent in the descriptive record as early as the first decades of the 20th century, but the rhymes were still diphthongized at this time, similar to Sūzhōu Chinese (Qian 2003: 22-23). Shortly thereafter, vowel fricativization is first explicitly described for the reflex of **i*; at this time, the lower rhymes are still described as diphthongized, oral [iɛ] according to Chao (1928, cited in Qian 2003). While it is logically possible that frication on the reflex of **i* existed earlier but was not described, an earlier onset of HVF would mean that **jen* was *even more* acoustically distinct from **i* at the time of HVF. In Shanghainese, the development of a fricative vowel reflex for **i* thus seems to precede any close encroachment of gradually raising **jen*.

Outside of Tàihú Wú, when HVF affects the refexes of PWú **i* and **y*, the acoustic difference between these and the reflexes of **jen* and **ɥɤn* tends to be even larger. In the Chóngrén dialect (Northern Wú, outside Tàihú) and Jīnhuá dialect (Southern Wú), both the **jen* and **ɥɤn* rhymes are nasalized and diphthongized with a very low second part, yet both dialects have fricative vowels as reflexes of PWú **i* and **y*. The overall appearance is thus one of HVF diffusing from north to south, and of a gradual, entirely optional filling of the vacuum left behind in the high front area of the vowel space by HVF, but crucially subsequent to HVF and not causing it via push chain.

To sum up, in each of the Wú cases reviewed here, there is evidence for a large acoustic gap between the high, monophthongal reflexes of **i*, **y* and the lower, diphthongal, or nasalized reflexes of **jen*, **ɥɤn* at present or at some point in recent history, which may signal that HVF of the higher rhymes occurs before monophthongization and raising of the lower rhymes.[8] In the context of Tàihú

[8] An anonymous reviewer points out that the chronologies described here could involve simultaneous gradual developments in both the higher and lower rhymes, rather than occurring in a discrete sequence as described here. Such a chronology would not disqualify the broader point made in this section, however: my aim has not been to emphasize that a pull chain must have taken place, but rather that a push chain decidedly has not taken place. Whether the "pull" was discrete and sudden or continuous and gradual in nature is beside the point, since the point is that HVF does not seem to be systematically related to developments of the lower rhymes.

Wú, then, HVF does not appear to be a strategy for contrast maintenance. Rather, it seems to have occurred essentially at random and spread throughout a small area, more akin to random genetic drift which has been amplified for unclear reasons. The apparently spontaneous and unmotivated nature of HVF in Tàihú Wú is significant for further discussion in the next section.

4 Maladaptivity of high vowel fricativization

The data presented up to this point suggest that HVF is *non*-adaptive for speakers of Sūzhōu Chinese and other Northern Wú varieties, at least in terms of the mechanics of speech communication. The basic acoustic and articulatory properties of the fricative vowels that result from the sound change have also been described for Sūzhōu Chinese. In the section below, I provide evidence suggesting that HVF in Northern Wú is not only non-adaptive, but relatively *maladaptive*, causing a relative reduction in fitness relative to a known adaptive peak. I begin this section by providing basic evidence that HVF removes languages undergoing it from such an adaptive peak in speech communication terms: high front vowels like **i* and **y* are highly optimal for speech communication (Section 4.1), and the results of HVF, fricative vowels, are substantially less so (Section 4.2).

I then approach the question of maladaptation from a phylogenetic angle in Section 4.3: whether or not fricative vowels are a maladaptive characteristic can be gauged by their long-term success in the phylogeny relative to other comparable speech sounds (high front vowels, apical vowels, rising diphthongs such as [əi̯], and so on). Reliably signaling contrast is a major aspect of fitness and success for phonemes, per models in, e.g., Wedel (2006) and Wedel et al. (2013), so the question is whether contrasts between fricative vowels and other vowels remain stable or are lost to merger. A number of other Northern Wú or Jiānghuái Mandarin dialects have merged fricative vowels to either high front vowels or apical vowels, suggesting that fricative vowels are not well-adapted for the types of contrasts that they end up participating in.

4.1 High front vowels are an adaptive peak

High front vowels, particularly unrounded [i], are known to be produced using a configuration of articulators that is highly optimized for the physical constraints of the human vocal tract and the perceptual dimensions used to contrast vowel qualities. High front unrounded [i] is extremely stable in terms of its articulation-acoustics mapping, with so-called quantal effects resulting in consistent acoustic outputs for a relatively wide range of articulatory inputs (Stevens 1989; Stevens & Keyser 2010). Furthermore, the formant frequencies that characterize the quantal zone for [i] are especially salient and recoverable due to the focalization of F3 and F4, in which the formant frequencies converge on a common frequency band and perceptually reinforce each other (Schwartz et al. 1997: 258–9). High front vowels such as [i] are known to gain added stability in production from SATURATION, by which a variety of motoric inputs result in relatively invariant articulatory output. Specifically, various levels of genioglossus muscle activation result in a relatively invariant amount of tongue front bunching (Fujimura & Kakita 1979).

Front rounded [y], and labial-palatal vowels in general, are not a global optimum of stability in the way that [i] is (Stevens 1989; De Jong & Obeng 2000). However, for larger vowel systems such as those present in Tàihú Wú, [y] is a *local* adaptive peak and a frequently recurring vowel quality, in part due to its own perceptual focalization, in this case of F2 and F3 (Schwartz et al. 1997: 259). As [y] has a lingual articulation quite similar to, though not identical to, [i] (Wood 1986), we may also expect saturation to add to the segment's articulatory stability to some extent. Much as for [i], then, it is probable that [y] will be relatively fit compared to a number offayta speech sounds which it might develop into.

4.2 Fricative vowels are relatively difficult to produce

If high front vowels such as [i] and [y] are adaptive peaks, then fricative vowels are relatively maladapted compared to these peaks. The fricative vowels [ɨ̻] and [ʉ̻] are similar to syllabic voiced fricatives, apparently with the production of strident frication as a goal for production on par with their particular formant frequency targets. This specification introduces a number of added complications in their production compared to [i] and [y]; while comparisons cannot properly be made in terms of motor-articulatory mappings due to a lack of research on fricative vowels, a number of observations strongly suggest that fricative vowels are less stable in articulation-acoustics mappings. On the whole, transformation of [i] into [ɨ̻] or [y] into [ʉ̻] seems to trade an easily achieved target in formant frequencies for a relatively fragile target, based in part on voiced frication, which uses different articulatory controls with less robustness to noise and fewer degrees of freedom.

The two aerodynamic goals of producing a voiced obstruent, phonation and turbulent airflow upstream of the phonating larynx, are antagonistic. The production of voicing interferes with the production of turbulent air flow owing to the need for a double drop in air pressure, one across the vocal folds and another across the frication-producing constriction (Catford 1977; Ohala 1983). Achieving strident frication specifically, which appears to be characteristic of fricative vowels, requires a high degree of articulatory precision, and articulation strongly influences salient details of the acoustic output (Iskarous et al. 2011), in contrast to the quantal zones that characterize [i] and [y]. These factors place limits on the precise production of fricative noise targets in voiced segments such as fricative vowels, and is known to make related contrasts less reliable (Solé 2010).

In my experience, fricative vowels sporadically involve the production of less fricative noise than might be expected. If fricative noise is not achieved in [ɨ̻] or [ʉ̻] due to a failure to reach the appropriate aerodynamic conditions, then the resulting vowels will differ only slightly from [i] and [y] in their formant frequencies, a precarious position for maintaining contrast. A need to prioritize voicing over frication likely further destabilizes articulatory-acoustic mappings. Phonologically "voiced" fricative consonants are in fact often devoiced across most of their duration (Haggard 1978; Stevens et al. 1992), which enables more consistent production of fricative noise. Fricative vowels, on the other hand, are fully voiced over their entire duration (see Figure 3) and bear lexical tone in Tàihú Wú, making them even more antagonistic to the consistent production of frication than apparently comparable voiced fricatives elsewhere.

4.3 Fricative vowels are relatively predisposed to merger

Contrasts involving fricative vowels appear to be less resilient than contrasts that involve the outputs of other sound changes affecting high front vowels. For instance, chain shifts involving diphthongization of high front vowels are amply attested in the world's languages (Labov 1994), in part because they tend to leave clear traces in the form of diphthongs that remain contrastive with monophthongs. HVF, on the other hand, cannot be reconstructed nearly as frequently. This may simply be because HVF is rarer, but I argue for an additional contributing factor: contrasts that have passed through HVF are intrinsically fragile due to the aerodynamic factors described in the previous section, as well as the fact that the "competitor" vowels are [i] and [y]. In Tàihú Wú and Jiānghuái Mandarin alone, one can find at least two major mergers affecting the lexical set that has undergone HVF.

Following some instances of HVF, aerodynamic failure cannot immediately threaten merger, since a language that has undergone HVF may have no phonetic monophthongal [i] or [y] to compete with now-fricativized **i* and **y*. In Tàihú Wú, for instance, the entire Pílíng group lacks monophthongal [i] or [y] (see Section 3.1, Figure 3). A gap for [i] is also documented in Yancheng Mandarin, a Jiānghuái Mandarin dialect (Cai 2011: 53), and in Swedish (Westerberg

2016: 70–71). However, given the tendency for languages to fill gaps in acoustic space through "pull chain" shifts (Labov 1994), and given that the acoustic gap in this case corresponds to a local optimum of vowel production, other vowel phonemes will tend to utilize the empty acoustic space that would otherwise be occupied by [i], [y], making the fragile conditions for fricative vowel production especially critical. Nearly all of the Sūhùjiā Wú dialects and some Jiānghuái Mandarin dialects have found themselves in the latter situation: a shaky contrast between fricative vowels and high front vowels that is cued mainly by fricative noise, which is unreliably produced.

Occasional failure to generate audible fricative noise could encourage a contrast between fricative vowels and high front vowels to be lost after a few generations of language transmission. For instance, as discussed above in Section 3.1, Shànghǎi and many of the Sūhùjiā dialects spoken near it merge the fricative vowels /i̯/, /ʉ̯/ with two high front vowel rhymes /i/, /y/ that develop as reflexes of **jen* and **ɥɤn*, respectively. There is a fair amount of evidence in the descriptive record for a contrast between high front vowels and fricative vowels that is later merged, particularly for the urban Shànghǎi dialect, shown in Table 4 (left). Both Zhu (2006) and Chen & Gussenhoven (2015) describe fricative /i̯/ as occurring for some older speakers, and Qian (1992: 45) mentions that a segment of his speaker population (for which he does not describe the age) produces fricative vowels for the expected rhymes, but that another portion does not.

Beyond merger with high front vowels, which have a constriction location posterior to the typical fricative vowel, merger with the more anterior apical vowels is also observed (see Section 2.1). Apical vowels are well-established across the Chinese languages (Zee & Lee 2007) given that they were innovated in Middle Chinese, the common ancestor of many modern varieties (Chen 1976; Yu 1999). For instance, in Héféi Mandarin, a Jiānghuái Mandarin dialect, HVF is known to have affected reconstructible **i* and **y*, but the fricativized reflexes of these vowels have merged with the apical vowels (Wu 1995). In the case of unrounded **i*, the resulting reflex is merged with the pre-existing unrounded apical vowel phoneme /ɿ/ (Table 4, right); in the case of **y*, a newly innovated rounded apical vowel /ʮ/ is the result (Wu 1995; Hou 2009). Although fricative vowels stably contrast with both high front vowels and apical vowels for most Sūzhōu Chinese speakers (see Table 2), some among the youngest Sūzhōu Chinese speakers are also reported to collapse the distinctions between the fricative and apical vowel sets (Li 1998; Wang 2011).

Merger with apical vowels might represent development to a local, rather than absolute, adaptive peak: unlike the merger with high front vowels in the Sūhùjiā

Table 4: Development of representative lexical items affected by HVF in Héféi Mandarin (Wu 1995) and Shanghainese (Qian 1992). PWú reconstructions from Ballard (1969).

	Shanghainese	
HVF:	比 'compare' *pi^{III} > *pɨ̻ > pi^{334}	居 'residence' *ky^{I} > *tɕʉ̻ > $tɕy^{52}$
	移 'move' *$ɦi^{I}$ > *ɦɨ̻ > $ɦi^{113}$	雨 'rain' *$ʔy^{II}$ > *ɦʉ̻ > $ɦy^{113}$
Merged into:	变 'change' *$pjen^{III}$ > pi^{334}	*n/a* (*ɥɤn> yø; contrast)
	Héféi 合肥 Mandarin	
HVF:	比 'compare' *pi > *pɨ̻ > $pɿ^{24}$	居 'residence' *tɕy > *tɕʉ̻ > $tsɥ^{31}$
	西 'west' *ɕi > *ɕɨ̻ > $sɿ^{31}$	雨 'rain' *jy > *jʉ̻ > $zɥ^{24}$
Merged into:	思 'think' *sɿ > $sɿ^{31}$	*n/a* ([ɥ] was innovated)

group in Tàihú Wú, merger with apical vowels preserves the important contrast between reflexes of **i*, **jen* and **y*, **ɥɤn*. Apical vowels are also typically much more acoustically distinct from high front vowels than fricative vowels are: given their very anterior constrictions, they have an even lower F2 than is typical for fricative vowels (Ling 2009), resulting in a large, easily perceptible acoustic difference from high front vowels that may contribute to their persistence as innovative variants.

5 Discussion

The research program which I have begun to describe here requires us to locate a maladaptive language change, a "pejoration" in the words of Vennemann (1993). High vowel fricativization as described here for Northern Wú Chinese is a good candidate for such a change. Fricative vowels, the outputs of high vowel fricativization (HVF), can in this specific case be taken as deviations from the adaptive peak represented by high front vowels, and are relatively unreliable compared to high front vowels in production owing to their production of fricative noise as a cue to category. Fricative vowels are, then, poor competitors for acoustic space, and tend to be outcompeted by the especially stable high front vowels that tend to develop in the nearby acoustic space cleared by HVF. They also compete poorly with apical vowels, which are common throughout the Chinese dialects and present throughout Northern Wú and neighboring dialects, occasionally resulting in merger into that category.

Before concluding, I consider a handful of more speculative points. First, social factors have largely been left out of the discussion here, but they may be taken to define an additional "fitness space" upon which HVF might confer some advantage, separate from the clear disadvantages it introduces in the physical circumstances of speech production. As such, I consider possible social motivations for HVF in Section 5.1, and how social advantage might relate to overall advantage in language change as a whole. Second, in Section 5.2, I discuss where we might expect to find more maladaptive changes, based on a few characteristics of the HVF case. These two points together represent a first step at generalizing the type of maladaptative change described here, and beginning to predict where more of them might be found in the world's languages.

5.1 The role of social advantage in maladaptive change

Given the apparent north-to-south diffusion of HVF mentioned in Section 3.2, we can speculate at the social dimensions of HVF as a sound change. It is possible that HVF in Northern Wú actually originated in Jiānghuái Mandarin, a distantly related dialect group spoken across the Yangtze River to the north and west. A detailed description of HVF in Jiānghuái Mandarin is beyond the scope of this chapter, and there is some serious speculation involved in suggesting that HVF in the area originated there: the historical record for Jiānghuái Mandarin is far less developed than it is for Northern Wú, and from the evidence available, there is no obvious reason to reconstruct HVF to an earlier date in Jiānghuái Mandarin Coblin (2000).

Regardless, the above evidence suggests that if HVF did spread due to some advantageousness conferred by the innovation, it was likely socially motivated, albeit for sociolinguistic dimensions that are not entirely clear at present. Diffusion of innovative variants created by HVF from Jiānghuái Mandarin into Wú would be unsurprising, given patterns of linguistic diffusion long known to have affected the Wú dialects: Northern Wú has long been subject to influence from the Mandarin dialects percolating southward across the Yangtze (Norman 1988;

Ramsey 1989). HVF also seems to skip over small population centers, with the notable exception of the Pílíng group (which is nonetheless located very close to the border with Jiānghuái Mandarin). This suggests a spread of HVF from north to south through major population centers, particularly the densely populated, economically important Sūhùjiā area; HVF is in this sense reminiscent of other, better-known sound changes such as the development of "guttural" rhotics from alveolar trills in the population centers of northern continental Europe (Trudgill 1974).

It is possible that most, if not all, maladaptive changes yet to be discovered are only maladaptive in the domain of communicative efficiency, but will prove to confer some social advantage upon their speakers. This may signal that we may again have reached the impasse of whether a change actuated across an entire community can ever be truly maladaptive for the entire linguistic "organism" if change that negatively impacts the mechanics of speech production and comprehension is generally advantageous socially, or vice-versa. The need to consider potentially antagonistic adaptive outcomes in these multiple adaptive spaces – the physical act of communication on one hand, and its received social value on the other – may present an important non-isomorphism between the study of adaptation in language change and in biological evolution. In the latter case, a good case can be made against analysis of adaptation solely in terms of its discrete effects on single functional units (i.e., appendages, organs) (Gould & Lewontin 1979); in language change, approaching social and non-social advantage separately may be unavoidable.

5.2 Identifying maladaptive changes elsewhere

The findings here for Wú Chinese may also be supported by finding other maladaptive changes in the recent historical record of other languages. HVF itself can be observed in several other language families which are genetically and areally well removed from Wú Chinese, providing a means of assessing the claims made here. A fricative vowel (the *Viby-i* or *Goteborges-i*) that has developed recently from **iː* has featured prominently in descriptions of dialectal Swedish for more than a hundred years (Gjerdman 1916; Karlgren 1926; Björsten & Engstrand 1999; Schötz et al. 2011) and is growing in use in standard Swedish (Riad 2013; Westerberg 2016). Fricative vowels have also been noted as reflexes of reconstructible high front vowels in the Ring subfamily of Grassfields Bantu in northwestern Cameroon and at least two regions of Mandarin Chinese dialects that are geographically discontinuous with Wú (Faytak 2014). In fact, HVF is likely underreported in the world's languages, given the unexpected nature of the contrast between fricative vowels and high front vowels.

One might consider a few additional factors at the outset of work aiming to identify maladaptive language changes. First, context is important: a given sound change may not be maladaptive when it affects certain inventories, depending on the other segments present that might "outcompete" a less robust variant. For instance, a major contributing factor to HVF being considered maladaptive here is the fact that the change affects high front vowels; this "niche", once emptied, repopulates quite quickly through intracategorical change of some other vowel category. Given a sufficiently crowded inventory of monophthongs, true of both Wú Chinese and Swedish, it is highly probable that high front vowels will eventually redevelop and outcompete fricative vowels; in a less crowded vowel system, this may not prove to be the case. Thus, maladaptive sound changes may prove to be more common when they produce minor variants on commonly attested, robust segments, which will tend to appear again and re-incorporate the unsustainable variants. These less robust variants should be highly improbable, but still possible (Blevins 2006).

This brings us to a second suggestion: arguing for highly improbable developments that may quickly disappear requires improbably good evidence, and so the data for illustrating maladaptive changes must have a good temporal resolution. That is, data on the segments affected by the sound change will probably have been collected and recollected a number of times in a fairly short time period by a number of different researchers. This would allow us to determine an order of developments directly, rather than infer it, which is essentially required to effectively argue for a non-adaptive (let alone maladaptive) basis for a change in biology (Gould 1997; Crespi 2000). This is especially important given that evidence for a maladaptive linguistic variant might quickly disappear: in the case of HVF, without documentation of fricative vowels in Shànghǎi-area dialects in the mid-20th century, a historical linguist would reasonably assume that the reflexes of **i* and **jen* simply merged into modern /i/ without ***i* first undergoing HVF.

5.3 Conclusion

Vennemann (1993) asks how the study of language change can "recognize a pejoration" as a way of invalidating the idea of change as optimization. I have taken steps toward doing just that, but rather than recognizing "pejoration," I have couched my discussion in maladaptivity in context of innovative linguistic variants. Acknowledging that maladaptive change is occasionally found in the world's languages may allow for a more neutral study of language change that is not hobbled by the "blind adaptationism" criticized in (Gould & Lewontin 1979).

None of this is to say that language is not fundamentally an adaptive system, but rather that not all synchronic linguistic features and inventory characteristics can be treated as optimized outcomes of natural selection, as some linguistic researchers have also suggested (Lindblom et al. 1995). Regardless of one's theoretical orientation toward evolutionary programs of linguistic change (or even one's interest in the research program of this volume), I hope that this chapter will also be useful as a detailed reckoning of an unusual and under-reported sound change.

Abbreviations

Acknowledgements

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Chapter 3

Postoralized and devoiced nasals in Panãra (Jê): ND > NT

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This paper discusses a sound change from ND > NT in Panãra. Postnasal devoicing in Panãra is categorical, and articulatory data suggests that vocal fold vibration is actively suppressed when the velum is maximally open. Panãra differs structurally from other languages for which a change from ND > NT has been observed, as the NC segments in Panãra are monosegmental and arise from a synchronic process of postoralization and devoicing of nasal stops /N/. I argue that this case of ND > NT is motivated by the need to increase the perceptual salience of the oral release of the stop in order to enhance the phonemic contrast between oral and nasal vowels.

1 Introduction

1.1 Language change as language improvement

According to Vennemann (1993), changes in language are guided by local improvements in some aspect of a grammar. This is not to say that, over time, languages become simpler as a whole: As a by-product of a local improvement, some other aspect of the language's grammar may become more complex. As such, no given linguistic feature is good or bad in itself: Things may only be considered good or bad relative to a given parameter of evaluation.

Vennemann's classic example of local language improvement relates to the interaction between syllable and metrical well-formedness. On the one hand, the optimal syllable consists of a single perceptually-salient onset consonant and a sonorous vowel (e.g., [pa]); on the other hand, the ideal phonological word consists of a disyllabic foot, where one syllable is more prominent than the other. A word such as [ˈka.pa] is thus phonologically optimal in that it is composed of

Myriam Lapierre. 2020. Postoralized and devoiced nasals in Pan$_{t}ext_{c}omposite_{p}atch : ra(J_{t}ext_{c}omposite_{p}atch :) : ND > NT$. In Dankmar Enke, Larry Hyman, Johanna Nichols, Guido Seiler & Thilo Weber (eds.), *Language Change for the Worse*, 53–87. Berlin: Language Science Press. DOI: ??

two independently well-formed syllables, but it is at the same time sub-optimal, in that it is composed of two more or less equally prominent syllables. Due to these constraints on metrical well-formedness, a word such as [ˈka.pa] may progressively evolve to reduce the prominence of its unstressed syllable, as in (1).

(1) ˈka.pa > ˈka.ba > ˈka.βa > ˈka.wa > ˈka.wə> kaw > ko

Over time, the onset of the unstressed syllable [pa] may gradually lenite, such that [p] becomes [w]. Similarly, the vowel may progressively reduce, such that it is eventually elided entirely. The end result of this progressive lenition is a change from a single dissyllabic word [ˈka.pa], where both syllables are independently well-formed, to [ko], a monosyllable.

Ohala (1993) argued for a different view of sound change, whereby sound changes are non-teleological. Speakers do not intend to change the pronunciation of a word or a phone. Rather, they intend to *preserve* the pronunciation norm, and changes are triggered when listeners make mistakes in their interpretation of a sound. According to this view, sound changes arise from misperceptions, which are phonetically grounded.

Both views of sound change agree that sound changes are phonetically natural; that is, grounded in universal principles of articulation and/or perception common to all humans. Hayes (1999), Hyman (2001), and Beguš (2019) argue that all sound changes are phonetically natural, and that a phonologically unnatural system can only result from a series of independent, phonetically natural changes. While the view that sound changes must be phonetically natural is widely accepted in the fields of phonetics, phonology, and historical linguistics, this view has been challenged by some authors, e.g. Blust (2013).

Throughout this paper, I follow Beguš (2019) in adopting the following definitions: (i) a *natural process* is motivated by a *universal phonetic tendency*, namely phonetic pressures of articulatory or perceptual mechanisms that passively operate in speech production and result in typologically common phonological processes; (ii) an *unnatural* or *marked process* operates against a universal phonetic tendency. The next subsection discusses the phenomenon of postnasal voicing, which has figured prominently in the debate on whether or not sound changes must be phonetically grounded.

1.2 Postnasal voicing

The phenomenon of postnasal (de)voicing is of particular interest in the debate on whether or not sound changes must be phonetically natural, as NTs are cross-linguistically rare. Out of a sample of 451 languages in the UPSID database Maddieson (1984), only eight languages possess NT segments in their phonological inventory (Brao, Gelao, Hadza, Hmong, Konyagi, Sama, Tiwi, and Yanyuwa). Of these eight languages, one exhibits NT^h sequences, where the oral release is aspirated rather than plain voiceless (Hadza), and one exhibits a single phonemic NT segment (Brao). This leaves only six languages out of 451 which exhibit a series of phonemic NT segments, representing only 1.33% of the languages in UPSID.

In addition, a number of cross-linguistic surveys claim that languages employ a variety of phonological processes to avoid such sequences (Herbert 1986; Rosenthal 1989; Steriade 1993; Pater 1999; Hyman 2001). The most common phonological process that serves to resolve a ban on NT segments is postnasal voicing (2). One of many languages that exhibits postnasal voicing is Luhya, a Bantu language of Western Kenya, where a sequence of /N/ followed by /p, t, ts, c, k/ is realized as [mb, nd, nz, ɲj, ŋg] (Herbert 1986: 236). Another common process that can resolve a ban on NT segments is T deletion (3). A famous example of this process comes from Indonesian (Table 1; Halle & Clements 1983; Pater 1999).

(2) C → [+voice] / N __

(3) T → ∅ / N __

Table 1: Oral stop deletion in Indonesian

Root-initial /p, t, k/	/meN-pilih/	[məmilih]	‘to choose, to vote’
	/meN-tulis/	[mənulis]	‘to write’
	/meN-kasih/	[məŋasih]	‘to give’
Root-initial /b, d, g/	/meN-bəli/	[məmbəli]	‘to buy’
	/meN-dapat/	[məndapat]	‘to get, to receive’
	/meN-ganti/	[məŋganti]	‘to change’

As seen in Table 1, when the prefix /meN-/ is attached to a root beginning with a voiced stop, the stop is retained. When the same prefix is attached to a root beginning with a voiceless stop, the stop is deleted. This phenomenon, known as nasal substitution, allows ND sequences to surface at a prefix-root boundary, but not NT sequences. Another cross-linguistically common repair for NT segments is N deletion (4), as in Kelanatan Malay and Swahili (Pater 2001).

(4) N → ∅ / __ T

The large number of languages that exhibit a ban on NT and favour ND supports the markedness hierarchy in (5), where NT is more marked than ND.

(5) a. ND >> NT b. *NT >> *ND

This markedness hierarchy was formalized by several authors who proposed a universal bias against postnasal devoicing, namely the Optimality Theoretic constraint *NT (Hayes & Stivers 1995; Hayes 1999; Pater 1996; 1999; Hyman 2001). Gouskova et al. (2011) observe that this asymmetry is due to aerodynamic principles that inhibit voicing during the production of stops. These aerodynamic principles are discussed in the following subsection.

1.2.1 The aerodynamic voicing constraint

The articulation of sounds is constrained by certain aerodynamic principles. During the production of stops, voicing cannot be maintained for a prolonged period of time while the flow of air is completely obstructed in the oral cavity. This principle is known as the aerodynamic voicing constraint (Ohala 1993; 2011). For example, during the production of the voiced alveolar stop [d], the speaker produces a closure of the vocal tract at two different points of articulation, the alveolar ridge and the velum. The oral cavity is thus completely sealed off, and air particles cannot escape. When the air pressure in the supraglottal cavity is inferior to the air pressure in the subglottal cavity, vocal fold vibration occurs naturally; however, vocal fold vibration can only be maintained until the air pressure in the supraglottal cavity equalizes with the subglottal cavity. Once this point of equilibrium is reached, vocal fold vibration is inhibited (unless some articulatory adjustment is made, e.g., prenasalization, cavity expansion). The closure phase of an oral stop must be relatively short for voicing to be maintained throughout the its entire duration: The longer the stop, the more likely that air pressure in the two cavities will equalize and vocal fold vibration will be inhibited.

In contrast, during the production of the nasal alveolar stop [n], the speaker obstructs the vocal tract at only one point of articulation, the alveolar ridge. The velum remains lowered during the entire duration of the stop, such that the air particles in the oral cavity escape through the nasal cavity and the air pressure between the supra- and subglottal cavities never equalizes. For this reason, vocal fold vibration can be maintained during the entire production of a nasal stop.

During the production of the prenasalized stop [nd], the initial articulatory configuration is as described above for [n]: The oral tract is completely obstructed at the alveolar ridge, but the velum is lowered. In order to produce an oral release, the speaker must raise their velum. Once the velum is fully raised, the air pressure in the oral cavity has still not equalized with the subglottal cavity. In addition, a full closure of the velum expands the size of the oral cavity, further facilitating vocal fold vibration (Hayes & Stivers 1995). For these reasons, the natural articulatory state is such that vocal fold vibration is maintained, and the oral release of the prenasalized stop is voiced. While it is certainly possible to produce a voiceless oral stop after a nasal consonant, this requires a specific articulatory adjustment. Specifically, the muscles of the vocal folds must be adducted for the release to be voiceless, as vocal fold inertia results in a voiced oral release.

The longer the period of time during which the vocal tract is obstructed, the more likely a state of equilibrium between the supra- and subglottal cavities will be reached (Solé et al. 2010; Solé 2012). Thus, the longer the oral portion of the prenasalized stop is maintained, the more likely it is that the oral release of the stop will be devoiced and that the speaker will produce a prenasalized voiceless stop [NT], rather than a prenasalized voiced stop [ND]. This is consistent with the observation that voiceless stops have a longer closure duration than voiced stops (Massaro & Cohen 1983). In her typological overview of NC segments, Stanton (2017) finds that ND segments tend to have a very brief period of orality, while the oral portion of NT segments is much longer (Maddieson & Ladefoged 1993; Ladefoged & Maddieson 1996; Riehl 2008; Cohn & Riehl 2012), as in Table 2.

Table 2: Proportional duration of orality and nasality in ND and NT

<table>
<tr><td colspan="2">N</td><td>D</td></tr>
<tr><td>N</td><td colspan="2">T</td></tr>
</table>

1.2.2 Cases of postnasal devoicing

Despite vast typological and phonetic evidence supporting the idea that postnasal devoicing is an unnatural phonetic process, cases of postnasal devoicing have been reported for a number of (mostly Bantu) languages. Postnasal devoicing has been documented for Shekgalagari (Solé et al. 2010), Tswana (Hyman 2001; Coetzee et al. 2007; Coetzee & Pretorius 2010; Gouskova et al. 2011; Boyer & Zsiga 2013), and Sebirwa (Boyer & Zsiga 2013), three closely related languages.

Coetzee et al. (2007) and Coetzee & Pretorius (2010) investigate postnasal devoicing in 12 native speakers of Tswana. Their results indicate that 4/12 speakers of Tswana show clear and consistent postnasal devoicing, and that an additional

3/12 speakers show infrequent postnasal devoicing. Speakers produce postnasal devoicing at the same rate in real and nonce words, suggesting that postnasal devoicing is a productive phonological process for at least some speakers of Tswana. For those speakers, the contrast between /b/ and /p/ is completely neutralized after nasal consonants. Gouskova et al. (2011) also recorded six speakers of Tswana and found extensive variation in the laryngeal realization of voiced and voiceless stops. The authors argue that, while there is definitely neutralization of voiced and voiceless stops after nasal consonants in Tswana, the alternation is not one of devoicing, but rather one of ejectivity. Zsiga (2018) confirms this proposal and argues that Tswana does not actually exhibit a [+/-voice] contrast in its phonemic inventory; rather the opposition between stops is a [fortis/lenis] distinction, evidenced by the fact that voiceless stops are often ejective in utterance-initial position. The author argues that the two kinds of stops do not actually exhibit a difference in voicing after nasals; rather, fortis stops have a longer closure duration than do lenis stops. For these reasons, Zsiga argues that the alternation in question is better described as postnasal *fortition* than as postnasal devoicing.

Furthermore, Boyer & Zsiga (2013) argue that Sebirwa, an endangered minority language of Botswana, borrowed the pattern of postnasal devoicing from Tswana as a result of heavy contact between the two languages. The alternation in laryngeal features that is observed in oral stops after nasal consonants is a true voicing alternation, rather than a case of postnasal fortition, as in Tswana. The authors thus argue that postnasal devoicing in Sebirwa is not the result of a historical innovation, but rather a borrowed phonological pattern from Tswana, and is thus not an instance of a natural diachronic change from ND > NT. Furthermore, Sebirwa speakers are able to learn the postnasal devoicing alternation despite the fact that postnasal devoicing is an unnatural phonological process, and some speakers extend the pattern to nonce-words.

Beguš (2019) conducts a thorough typological survey of languages that exhibit postnasal devoicing. The results of his survey provide evidence of a number of additional languages for which postnasal devoicing has been described, namely Yaghnobi (Iranian; Xromov 1972), Konyagi (Niger-Congo; Merrill 2016), South Italian (Kümmel 2007), as well as Buginese and Murik (Austronesian; Blust 2005; 2013). Based on this typological work, the author argues that cases of postnasal devoicing never occur as a single sound change, but rather, are telescoped through the series of sound changes presented in (6).

(6) a. D > Z / [-nas] __ *lenition*
b. D > T *devoicing*
c. (Z > D) *fortition*

First, voiced stops are spirantized, except after nasals (6a). Second, a process of unconditioned devoicing of stops occurs (6b)[1]. Third, voiced fricatives are optionally occluded (6c), which blurs the first two sound changes. This creates the false impression that a single sound change has occurred, namely that voiced stops are devoiced only after nasal consonants (D > T / N __). Beguš argues that all seemingly unnatural sound changes arise from a series of two or three independent, phonetically grounded changes, which he formalizes as the *Blurring Process*[2], and never from a single phonetically unnatural sound change. In the first sound change, a set of segments enters in complementary distribution (A > B / X). The second sound change is context-free and operates on the unchanged subset of those segments (A > C). Finally, a third change may optionally occur and blur the original complementary distribution environment (B > A), creating the false impression of a single phonetically unnatural sound change (A > C / X).

1.3 Proposal

In this paper, I argue that Panãra (ISO code: kre) presents a case of postnasal devoicing resulting from a direct sound change from ND > NT. This synchronic process is categorical: Postnasal devoicing is completely phonologized and productive for all speakers. I explore the possibility that this change from ND > NT is phonetically natural, as motivated by the need to increase the perceptual salience of the oral release of the stop in order to enhance the contrast between oral and nasal vowels.

Panãra differs structurally from other languages for which a change from ND > NT has been reported. Importantly, unlike in other languages with postnasal devoicing, the NCs in Panãra are not the result of a concatenation of two phonemes /ND/, but rather the result of synchronic denasalization and devoicing of a nasal stop /N/. In other words, [NT] segments are allophones of fully nasal

[1]As a result of the rule (6b), voiced stops are only found after nasal consonants. Consequently, this change could be characterized as a case of postnasal devoicing; however, Beguš argues that this is not a rule targeting postnasal devoicing, but one that devoices *all* stops. This context-free devoicing analysis was also proposed for Tswana by Hyman (2001).

[2]See Harris (2005) for similar discussions on the interactions of separate primary language changes, which result in unnatural or “crazy” rules.

stops /N/. This process of postoralization of nasal consonants before oral vowels, commonly termed *shielding*, is a widespread phenomenon in the Amazon (/N/ → [NC][3] / __ V; see Stanton 2017); however, Panãra is special, even among Amazonian languages, in that the oral release of the stop is voiceless. The details of this phonological process are described in the following section.

2 Evidence of NT in Panãra

2.1 Background on Panãra

Panãra is a member of the Northern Branch of the Jê language family. It is spoken by approximately 680 people in the Eastern Amazon, in the Brazilian states of Pará and Mato Grosso. The phonemic inventory of Panãra is presented in Tables 3[4] and 4. Panãra exhibits a full series of voiceless and nasal stops, but no voiced stops. In addition, the language exhibits a highly productive contrast between oral and nasal vowels. For a full review of Panãra phonology, see Lapierre (2019).

Table 3: Consonant phonemes of Panãra

	Bilabial	Alveolar	Palatal	Velar
Singleton obstruent	p	t	s	k
Geminate obstruent	pː	tː	sː	kː
Singleton nasal	m	n	ɲ	ŋ
Geminate nasal	mː	nː		
Approximant	w	ɾ	j	

Table 4: Vowel phonemes of Panãra

Short oral		
i	ɯ	u
e	ɤ	o
ɛ	a	ɔ

Long oral		
iː	ɯː	uː
eː	ɤː	oː
ɛː	aː	ɔː

Short nasal		
ĩ	ɯ̃	ũ
ẽ	ã	õ

Long nasal		
ĩː		
ẽː	ãː	õː

[3] I do not consider cases of shielding as instances of consonant epenthesis: The oral stop is the result of a temporal realignment of the velum lowering gesture, not the insertion of an articulatory gesture. Crucially, the resulting NCs still behaves as unary segments.
[4] Note that /s, sː/ are not truly articulated at the palate, but they form a natural class with /ɲ, j/.

In addition to the fully nasalized consonants in Table 3, Panãra also exhibits a series of [NT] segments: [mp, nt, ns, ŋk]. These are in complementary distribution with fully nasalized stops: Where [N]s occur before phonemically nasal vowels (7a, 8a-d), and [NT]s appear before phonemically oral vowels and approximants (7b, 8e-h). Panãra exhibits a synchronic process of postoralization and devoicing of nasal consonants. The next subsection provides acoustic data supporting the claim that the oral portion of [NT]s is indeed voiceless.

(7) a. /m, n, ɲ, ŋ/ → [m, n, ɲ, ŋ[5]] / σ[__ Ṽ
b. /m, n, ɲ, ŋ/ → [mp, nt, ns, ŋk] / σ[__ {V, w, ɾ, j}[6]

(8)	a. [mɯ̃ĩŋ]	'come (IMP)'	e. [ĩmpɯ]	'man'
	b. [nãpjɤ]	'mother'	f. [ĩnta]	'rain'
	c. [ɲãsɯ]	'deer'	g. [nãnso]	'mouse'
	d. [ŋãː]	'yes'	h. [ĩŋkɤ]	'political house'

2.2 Data collection

The data reported here are from three[7] male native speakers of Panãra, who were 23, 23, and 37 years old and all resided in the Panãra Indigenous Land at the time of recording. Though participants are functional speakers of Brazilian Portuguese, all Panãra speakers are clearly dominant in their native language. The materials for the experiment included 50 target words, which were either mono- or disyllabic. Target syllables included the following phonotactic sequences: NṼ, NCV, NCVː, CV, CVː, CṼ, CṼː. A carrier phrase with the meaning 'I say the word [X]' was selected, where [X] represents the target word: '*Inkjẽ hẽ ka sũ [X]*'.

All recordings were produced in the village of Nãnsêpôtiti using an IMG StageLine ECM-500L/SK microphone and an EGG D-800 (produced by Laryngograph Ltd.) as a recording device, with a sampling rate of 22.05 kHz. Along with acoustic recordings, oral and nasal airflow measurements were collected. Stimuli were presented visually on a computer screen: Words within their carrier phases were presented in Panãra orthography alongside a picture depicting the target word. As most speakers of Panãra do not read in a fluid manner representative of natural speech, the author guided the participants through the task by producing the

[5]The fully nasalized allophone of the velar nasal is very rare in the Panãra lexicon, with a single attested word (8d). It appears the fully nasalized velar has merged with the palatal nasal [ɲ].

[6]Panãra is the only Jê language to exhibit postoralization of nasal consonants before approximants, even when the nucleus of the syllable is a nasal vowel.

[7]Data was collected from a total of 18 native speakers of Panãra between the ages of 19 and 44 (*n* female=9); however, I report only on the subset of data analyzed thus far.

entire carrier phrase for each token, and participants were asked to simply repeat the sentence. This method was chosen to reduce the complexity of the task, and it allowed participants to feel more at ease by understanding that the goal of the experiment was not to evaluate their reading proficiency. Participants received 175 grams of Czech beads as compensation.[8] Each target word was presented a total of five times in semi-randomized blocks, which yielded a total of 250 words per speaker. The data presented here include a total of 212 NC tokens. Phones were first segmented using the Penn Forced Aligner (P2FA) and the output of the automatic aligner was then corrected manually. Voicing values were extracted using a PointProcess object in Praat, and the percentage of the duration of each phone that was voiced was then calculated for each target phone.

2.3 Results

The goal of the acoustic analysis was to determine the proportion of voicing in the oral portion of [NT]s in Panãra. Table 5 below summarizes the results.

Table 5: Proportion of voicing duration. $\underline{\mathrm{N}}\mathrm{T}$ stands for the nasal portion of [NT]s and $\mathrm{N}\underline{\mathrm{T}}$ for the oral portion of [NT]s.

	V	N	T	$\underline{\mathrm{N}}\mathrm{T}$	$\mathrm{N}\underline{\mathrm{T}}$
Number of tokens	1130	240	297	212	212
Mean voicing proportion	96.58%	98.56%	8.54%	91.59%	5.25%
Standard deviation	7.11%	8.51%	7.74%	11.1%	5.89%
Min. voicing proportion	45.15%	3.01%	0%	48.32%	0%
Max. voicing proportion	100%	100%	41.72%	100%	26.11%
Mean duration	148 ms	141 ms	212 ms	140 ms	134 ms
Standard deviation	77 ms	59 ms	61 ms	33 ms	38 ms
Min. duration	30 ms	35 ms	60 ms	30 ms	60 ms
Max. duration	51 ms	392 ms	369 ms	269 ms	259 ms

As seen in Table 5, vowels, nasal stops, and the nasal portion of [NT]s are categorically voiced, with an average proportional duration of voicing of 96.58%, 98.56% and 91.59% respectively. In comparison, oral stops and the oral portion

[8]The economic system in use in the Panãra Indigenous Land is mostly dependent on trade, and monetary transactions are virtually absent in the villages. Czech beads are among the most valued goods, as they are used to create ornaments worn during celebrations and festivities.

of [NT]s are all categorically voiceless, with an average proportional duration of voicing of 8.54% and 5.25% respectively. Following Westbury & Keating (1986), Hayes (1999), and Coetzee et al. (2007), I classify a stop as voiced if 50% or more of its duration is characterized by vocal fold vibration. According to this criterion, not a single oral stop token in the Panãra data can be classified as voiced.

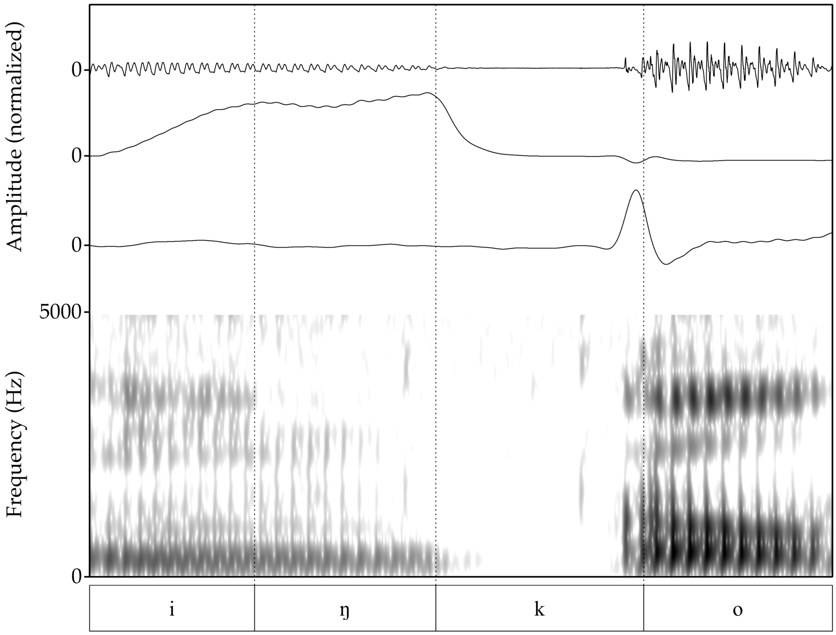

Figure 1: Waveform, nasal airflow, oral airflow, and spectrogram (from top to bottom) from the production of the word /?o/ [ĩ?ko] 'water'. Waveform and airflow measures are all normalized from 1 to -1.

Figure 1 below presents the waveform, nasal airflow, oral airflow, and spectrogram for the production of the word /ŋo/ [ĩŋko][9] 'water' by a male speaker of Panãra (age=23). As can be observed, vocal fold vibration ceases at the moment that peak nasal airflow is achieved; in other words, vocal fold vibration is suppressed at the moment when the velum is maximally open. As discussed above in Section 1.2.1, the natural state of the glottis during an oral stop that occurs after a nasal consonant is for vocal fold vibration to occur; however, it appears that vocal fold vibration is actively suppressed during the oral portion of NCs in

[9]The word-initial [ĩ] in [ĩŋko] is an epenthetic vowel that surfaces before root-initial geminates and [NT]s in Panãra to satisfy a word-minimality requirement of two syllables. For a full account of this phonological pattern, see Lapierre (2019).

Panãra. From this, I conclude that Panãra exhibits a clear and categorical process of synchronic postnasal devoicing.

3 Evidence of ND > NT in Panãra

In this section, I consider two recent proposals for the internal classification of Jê and present comparative data from nasal consonants across the family. I argue that the realization of nasal stops between two phonemically oral vowels in Proto-Jê, as well as in Proto-Northern-Jê, was [mb], with a voiced oral release. Finally, I derive the present-day form of the realization of nasal stops between oral vowels for both family trees. I conclude that a direct sound change from ND > NT must indeed have occurred from Proto-Northern-Jê to Panãra.

3.1 The internal classification of Jê languages

The internal classification of Jê languages is a topic of current debate in the Jê literature. Two recent proposals for the internal organization of the Jê family are presented below in Figures 2 and 3.

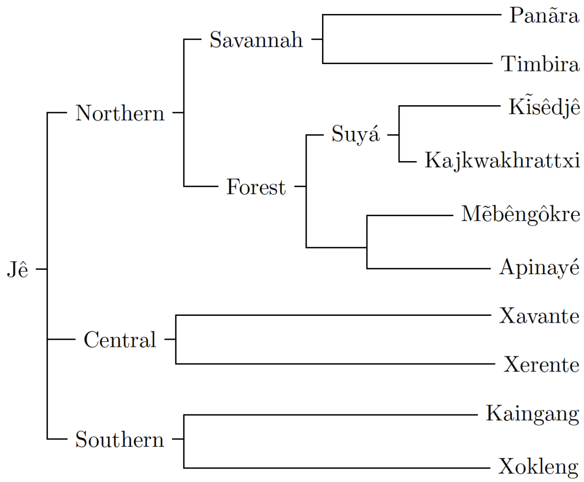

Figure 2: First proposal for the subgrouping of Jê Lapierre et al. (2016)

The two proposals crucially differ with respect to the position of Panãra and Timbira within the Northern-Jê subgroup. According to the first proposal (Figure 2; Lapierre et al. 2016), Panãra and Timbira are sister languages which form a clade separate from the other four Northern Jê languages. According to the

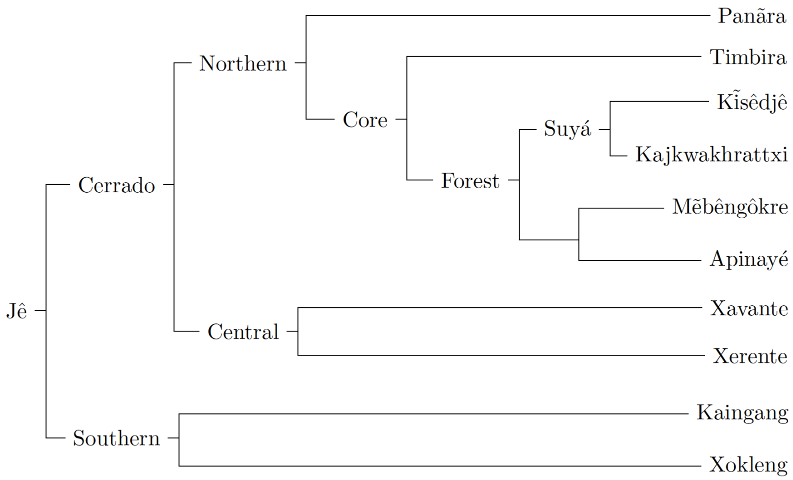

Figure 3: Second proposal for the subgrouping of Jê Nikulin (2016; 2017)

second proposal (Figure 3; Nikulin 2016; 2017), Panãra was the first language to branch off within Northern-Jê, followed by Timbira.

Evidence for the classification of Panãra and Timbira as a clade comes from a number of shared innovations between the two languages that cannot be traced back to Proto-Northern-Jê. First, Panãra and Timbira are the only two Jê languages to exhibit a series of contrastive long vowels, as well as a series of contrastive geminate consonants. Both languages underwent a merger, whereby /ã, ʌ̃/ > /ʌ̃/, as well as loss of the fully nasalized allophone of the velar nasal. Furthermore, both languages underwent postnasal devoicing, and subsequent denasalization of the resulting [NT] in word-initial position, i.e. ND > NT > T / # __ (see Section 4.4. for a discussion of this denasalization process). Finally, they share the change from Proto-Northern-Jẽ /tʃ/ > /s/, followed by /s/ > /h/ in Timbira .

Evidence for the classification of Panãra as a sister to Core Jê comes from Nikulin's claim that the number of innovations in Panãra not shared with Core Jê is greater than the number of common features between Panãra and Timbira. He thus proposes that Panãra was the first Northern Jê language to split. Panãra is the only language where word-final echo vowels became [i], and where word-initial /ka/ simplified to /a/. Panãra also underwent changes, whereby [ŋgɾw] > [ŋkw], and /ɾ/ > /j/ / __ V[+*back*]. Finally, Nikulin proposes that word-initial /ku-/ > /i-/; however, the correct series of sound changes is actually /C_1C_2/ > /C_2ː/ > /iC_2ː/. He further proposes that Timibira is the only language where Proto-Northern-Jê /tʃ/ > /h/; however, this change almost certainly happened with an intermediate step /tʃ/ > /s/ > /h/, given that /s/ > /h/ is one of the most common sound changes crosslinguistically, and that Panãra has /s/ where Timibira has /h/. Apinayé and Timibira underwent metathesis, whereby /ɾw/ > /wɾ/, and Apinayé, Mẽbêngôkre and Timbira share the change /tj/ > /tʃ/.

3.2 Comparative data from other Jê languages

In order to determine whether a sound change from ND > NT has occurred in Jê, I consider the realization of nasal consonants occurring between two phonemically oral vowels (/N/ / V __ V). The relevant synchronic forms are provided in Table 6 for all ten Jê languages. For the sake of simplicity, the data is presented using the bilabial nasal stop /m/ as a representative example for the full series of nasal consonants, as this general pattern holds for other places of articulation[10].

Table 6: Realization of /m/ between two oral vowels in Jê languages

Pan.	**Tim.**	**Meb.**	**Api.**	**Kĩs.**	**Kaj.**	**Xav.**	**Xer.**	**Kai.**	**Xok.**
[mp]	[mp]	[m]	[mb]	[mb]	[w̃ʷ]	[b]	[b]	[bmb]	[mb]

The most frequent form observed in the data from Table 2 is [mb], which occurs in 4/10 of the Jê languages. [mb] is in fact observed in 5/10 of the languages when one considers the Kaingang data in more detail. The data in (9) presents the synchronic distribution of nasal stops in Kaingang (Wiesemann 1972).

(9) a. /m/ → [m] / {Ṽ, #} __ {Ṽ, #}
b. /m/ → [mb] / {Ṽ, #} __ V
c. /m/ → [bm] / V __ {Ṽ, #}
d. /m/ → [bmb] / V __ V

Kaingang exhibits both a process of postoralization of nasal stops before oral vowels (9b), as well as a process of preoralization of nasal stops after oral vowels (9c). When a nasal stop occurs between two oral vowels, both postoralization and preoralization take place, resulting in a circumoralized nasal stop (9d). Consequently, Kaingang does indeed exhibit an allophone [mb], as is the case for Apinayé, Kĩsêdjê, Kajkwakhrattxi, and Xokleng. This pattern is consistent with

[10] There are some caveats to this generalization. First, Central Jê contrasts only two places of articulation for nasal consonants /m, n/, compared to a four-way contrast for the other languages in the family /m, n, ɲ, ŋ/. Second, the postoralized allophones of the palatal nasal /ɲ/ exhibit a lot of variation across the family: Panãra [ns]; Timbira Apãniekrá [ɲtʃ], Kĩsêdjê [ɲj, nt], Kajkwakhrattxi [nt], Mẽbêngôkre [ɲ], Apinayé [ɲdʒ], Kaingang [ɟɲɟ], and Xokleng [ndʒ].

the implicational hierarchy proposed by Stanton (2017), whereby if a language exhibits circumoralized nasal stops, it also exhibits postoralized nasal stops (10).

(10) [mb] >> [bmb]

Kajkwakhrattxi exhibits an interesting case of shielding, as the postoralized segment is an approximant [w̃ʷ], rather than a stop [mb]. This pattern arises because Kajkwakhrattxi contrasts oral and nasal bilabial approximants /w, w̃/ (Beauchamp 2019) as a result of a historical lenition process that affected all bilabial stops, namely [m, mb, p] > [w̃, w̃ʷ, hw]. As observed during my own fieldwork on Kajkwakhrattxi, the postoralization of the nasal bilabial approximant is quite perceptually salient. Note that the pattern observed at other places of articulation is different: Nasal velars before oral vowels are always realized as [ŋg], and nasal alveolars before oral vowels exhibit variation between [nd ~ n].

The Mẽbêngôkre pattern is the most divergent from the other Jê languages, as nasal consonants are realized as fully nasal [m] before oral vowels. Crucially, Mẽbêngôkre is the only language that does not exhibit some form of shielding[11].

Two allophones of /m/ occurring before oral vowels remain to be explained, namely the fully oralized [b] of Xavante and Xerente, and the postoralized and devoiced [mp] of Panãra and Timbira. Both of these allophones can be rather straightforwardly accounted for as variants of the shielding process. Specifically, the case of Xavante and Xerente[12] is one of complete, rather than partial, oral-

[11]Some authors (Stout & Thomson 1974; Salanova & Reis Silva 2011) report preoralization of nasal consonants after oral vowels in coda position, such that /m/ → [bm] / V __. However, in my own fieldwork with speakers of the Xikrín dialect of Mẽbêngôkre, I did not observe this process. I also conducted elicitation with speakers of the Kayapó dialect of Mẽbêngôkre, and I did not observe this process in their speech either.

[12]As a very thoughtful reviewer notes, Proto-Jê *p and *m underwent a series of sound changes in Central Jê, obscuring the correspondences between [p, m] in Central vs. Northern and Southern Jê. Crucially, *p underwent nasalization before nasal vowels, and *mb underwent complete oralization before oral vowels, and in some cases, devoicing (Davis 1966). As such, Central Jê [m] corresponds to both [p, m] in Northern and Southern Jê, and Central Jê [p] corresponds to both [p, m] in Northern and Southern Jê. These sound changes are summarized in (i).

(i) a. *m > m / __ Ṽ
 b. *mb > b, p / __ V
 c. *p > m / __ {]σ, Ṽ}
 d. *p > p / __ V

Despite these sound changes, the data that I consider here, namely the realization of /m/ between two oral vowels, only corresponds to Proto-Jê *mb. Crucially, the words resulting from (ia, ic) are excluded, since the relevant stops occur before nasal vowels. The words resulting from (id) are also excluded because they do not correspond to an underlying nasal stop in modern Central Jê. Finally, the change in (ib) resulted in *mb being realized as [b] in some ization of nasal consonants (11); and the case of Panãra and Timbira[13] is one of devoicing of the oral release of the nasal stop (12).

(11) /m/ → [b] / __ V

(12) /m/ → [mp] / __ V

Returning now to the question of the most common phonetic realization of nasal consonants before oral vowels in Jê languages, I propose that this form is [mb], with postoralization and a voiced oral release. Crucially, postoralization of nasal consonants before oral vowels is observed in 7/10 of the Jê languages, and some form of oralization of nasal consonants before oral vowels is observed in 9/10 of the Jê languages. For this reason, I reconstruct *mb as the Proto-Jê form corresponding to the set of phones in Table 6. All of the other reflexes of *mb, namely [w̃ʷ], [bmb], [mp], [b] and [m], can be straightforwardly explained by one of a number of natural sound changes from *mb. These sound changes are presented below in (13). Note that Nikulin (2016; 2017); Davis (1966) also reconstruct *mb for Proto-Jê, indicating some agreement regarding this analysis among Jê researchers. In the following subsection, I provide evidence from an earlier variety of Panãra supporting a sound change from ND > NT.

words and as [p] in others. As such, the changes in (i) do not invalidate the data considered here. While it is true that there are certain cases of Proto-Jê *mb that are being excluded from the present analysis (namely those realized as [p] in modern Central Jê), the cases that are being considered, namely the [b] reflex of Proto-Jê *mb, are the only cases of /m/ occurring between two phonemically oral vowels in modern Central Jê.

At this time, I am unable to provide an explanation of the conditioning environment of the two reflexes of *mb in Central Jê, [b, p]. Nikulin (2017) proposes that Xavante [b] results from a process of stop voicing before high vowels; however, I have not been able to find any evidence of a difference in the realization of voiceless stops before high and non-high vowels in Central Jê. In Nikulin's own data, there are a number of cases of Proto-Jê *p and *t that are not realized with voicing before high vowels, as well as instances of [b, d] occurring before non-high vowels (p. 160). In Quintino (2000) and Pickering (2010), there are abundant examples of voiced stops before non-high vowels, as well as of voiceless stops before high vowels.

[13] There are a number of cases where Proto-Jê *mb corresponds to [p] in Timbira. This suggests that Timbira has undergone a diachronic process of denasalization (*mb > mp > p) affecting most instances of [mp], except those in stem-initial position when preceded by a vowel-final morpheme. The items in which Proto-Jê *mb corresponds to Timibira [p] are excluded from this analysis, as they cannot synchronically be analyzed as underlying nasals /m/ in the grammar of Timbira. Rather, these are now underlying voiceless stops /p/. Furthermore, there are some rare cases where /m/ is realized without postoralization in Timbira (e.g. [jama] 'chin'), suggesting that postoralization of the type in (12) is no longer productive in Timbira grammar.

(13)	a. mb > bmb	Preoralization	*(Kaingang)*
	b. mb > mp	Devoicing of oral release	*(Panãra, Timbira)*
	c. mb > b	Complete oralization	*(Xavante, Xerente)*
	d. mb > m	Loss of postoralization	*(Mẽbêngôkre)*
	e. mb > w̃ʷ	Lenition	*(Kajkwakhrattxi)*

3.3 Evidence from Southern Cayapó

Additional evidence that a sound change from ND > NT occurred in Panãra comes from historical documents on Southern Cayapó. The Southern Cayapó were proposed by Heelas (1979) to be the ancestors of the currently living Panãra. This proposal was supported by Schwartzman (1988); Rodrigues & Dourado (1993); Giraldin (1997; 2000); and Dourado (2004). Vasconcelos (2013) provides a detailed comparison of Southern Cayapó data to Apinayé, Apãniekrá, Kajkwakhrattxi, and Panãra data, and concludes that the language spoken today by the Panãra is indeed the same language that was spoken by the Southern Cayapó.

Vasconcelos reviews all 7 historical documents available for Southern Cayapó. As he points out (p. 134), all but one Ehrenreich (1894) of the documents present evidence of voiced stops in onset of unstressed syllables. This suggests that Southern Cayapó likely exhibited variable stop voicing in this phonological environment, e.g. Southern Cayapó <impute ~ impude> [ĩm.ˈpu.te ~ ĩm.ˈpu.de] and Panãra [ĩm.ˈpuː.ti] 'neck'. Furthermore, although the vast majority of transcriptions in these documents suggest that the oral release of postoralized nasals was generally voiceless, three documents provide evidence of some instances of [ND]s. Vila Boa's 1782 baptism registry[14] contains a list of proper names that present postoralized nasals, both voiced [mb] (n=5[15]) and voiceless [mp] (n=18[16]), suggesting that these two sounds were likely in variation at the time that the document was written. Lemos da Silva (1882) presents one lexical item suggesting the presence of a voiced [mb][17]. Barbosa (1918) presents a number of <mb, nd> transcriptions[18].

The data from these historical documents thus suggest that Southern Cayapó exhibited some variation between voiced and voiceless postoralized nasal stops.

[14] This historical data was accessed through Vasconcelos (2013).

[15] <Angrayocha, Pembaque, Ungaptuai, Combono, Cambriopixom>

[16] <Queampia, Coimpa, Uncrixiu, Xuanampiae, Carampea (x2), Incapuim, Quipanto, Enconâ, Tuuntu, Tanqueré, Emponi, Xampeu, Canampuaxi, Xampea, Cananquete, Tuinta, Canampui>

[17] <copembe> 'acabou,' (Vasconcelos' proposed IPA transcription [kõpẽmbe])

[18] <ambrendá> 'dois,' <iundé> 'atravessar,' <iundê> 'compadre,' <tapyundé> 'arrependerse,' <iundêkúa> 'comadre.'

Since this variation is no longer observed in Panãra, the data presented here support the claim that a sound change from ND > NT did indeed occur in an earlier variety of the language. Furthermore, transcriptions of plain voiced stops D occur more frequently in these historical documents than do transcriptions of ND, suggesting that postnasal devoicing (ND > NT) probably happened before plain stop devoicing (D > T), and that an analysis positing across-the-board devoicing of stops (*D) as a single sound change is likely incorrect (see Section 4.1).

3.4 Evidence from Macro-Jê languages

Further evidence that a sound change from ND > NT did occur in Panãra comes from comparative data from Macro-Jê languages. A list of the following 12 Macro-Jê languages was compiled by referring to the SAPhon database (Michael et al. 2015): Bésɨro, Bororo, Guató, Djeoromitxí, Arikapú, Karajá, Krenak, Ofayé, Purí, Maxakalí, Rikbaktsa, and Yaathe. Of this set of languages, five exhibit shielding. Specifically, Arikapú Ribeiro & van der Voort (2010), Krenák Pessoa (2012), and Maxakalí de Oliveira Campos (2009) exhibit [mb] before oral vowels and [m] before nasal vowels. Furthermore, Djeoromitxí Ribeiro & van der Voort (2010) and Karajá Ribeiro (2012) exhibit [b] before oral vowels and [m] before nasal vowels. Note that none of the Macro-Jê language exhibits shielding of the type observed in Panãra, with a voiceless oral portion. There is thus no clear evidence suggesting that *mp should be reconstructed for Proto-Macro-Jê, but there is some support for the reconstruction of *mb as the realization of nasal stops occurring before oral vowels in Proto-Macro-Jê. Furthermore, if Proto-Macro-Jê did have voiceless postoralized nasals, we would perhaps expect to find more languages of the family to retain [NT]. However, this is not the case.

3.5 Deriving the sound changes

In this subsection, I derive the synchronic reflexes of Proto-Jê *mb for each of the ten extant Jê languages according to the two subgrouping proposals in Figures 2 and 3. I begin this discussion by mapping out the possible sound changes that can occur between the synchronic reflexes of *mb in each one of the ten Jê languages, namely [mb, m, w̃ʷ, bmb, b, mp, p]] (Figure 4).

The arrows in Figure 4 present what I consider to be possible sound changes between the seven sounds. Specifically, a sound change is considered possible if (1) it is attested, and/or (2) it involves a change in a single phonetic feature. If a sound change is unattested, or if it involves a change in more than one feature at a time (i.e., if it is saltatory (Hayes & White 2016)), then I consider that

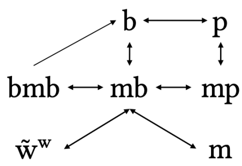

Figure 4: Possible sound changes between [mb, m, w̃^{w}, bmb, b, mp, p]

sound change impossible. The changes presented in (13-15) involve changes in two phonetic features at once, and are thus considered impossible as a single sound change. While some of the changes in (13-17) may have occurred, these are assumed to have been telescoped through a sequence of two (or more) changes. (16) is unattested.

(14)	a. m > mp[19]	Postoralization and devoicing of oral release
	b. mp > m	Voicing of oral release and postnasalization
(15)	a. m > bmb	Preoralization and postoralization
	b. bmb > m[20]	Prenasalization and postoralization
(16)	a. b > mp	Prenasalization and devoicing
	b. mp > b[21]	Oralization and voicing
(17)	a. m > w̃^{w}	Postoralization and lenition
	b. w̃^{w} > m[22]	Postnasalization and fortition
(18)	b > bmb[23]	Medio-nasalization

Assuming the internal classification proposed by Lapierre et al. (2016), it is necessary to posit five independent sound changes in order to derive the present day realization of /m/ between two oral vowels in the ten extant Jê languages. Specifically, the following sound changes must have occurred: (1) mb > bmb in Kaingang; (2) mb > b in Central Jê; (3) mb > mp in Savannah Jê; (4) mb > w̃^{w} in Kajkwakhrattxi; and (5) mb > m in Mẽbêngôkre. Other potential pathways are

[19] Apart from Panãra and Timbira, all other attested cases of postoralization of a nasal consonant involve a voiced oral release, e.g., [mb].

[20] This change is unattested. All languages that exhibit circum-oralized [bmb] also exhibit [mb] (10). It is thus assumed that the presence of [bmb] must be preceded by [mb], i.e. mb > bmb.

[21] While there are many attested cases of changes from mp > b, I assume that this happens through telescoping of an intermediate stage, i.e., mp > mb > b.

[22] I assume here that any change between [m] and [w̃^{w}] must be telescoped through [w̃]. Note that a change from m > w̃ is in fact attested in Kajkwakhrattxi.

[23] Cases of prenasalization (b > mb) and postnasalization (b > bm) are common in the literature (Wetzels & Nevins 2018); however, cases of medio-nasalization (b > bmb) are unattested.

possible to arrive from *mb to the present-day forms in the ten Jê languages, but these would require a greater number of posited sound changes. Because all of these other conceivable sequences of events are less parsimonious than the one presented here, I do not discuss them.

I now consider two possible ways in which it is possible to derive the present day realization of /m/ between two oral vowels in the ten modern Jê languages, assuming the subgrouping proposed by Nikulin (2016; 2017). The first set of changes involves six independent sound changes, including two instances of mb > mp, and the second set of sound changes involves seven independent innovations, including two cases of mb > mp > mb back-mutation. The first set of possible sound changes that can derive the present day forms of Proto-Jê *mb includes: (1) mb > bmb in Kaingang; (2) mb > b in Central Jê; (3) mb > mp in Panãra; (4) an additional independent change from mb > mp in Timbira; (5) mb > $\tilde{w}^{w}$ in Kajkwakhrattxi; and (6) mb > m in Mẽbêngôkre. Given that homoplasy is known to occur (Chang et al. 2015), having to posit two independent instances of post-nasal devoicing within Northern Jê may not be so controversial. However, the change from mb > mp is, at best, typologically rare (see Section 1), and it seems suboptimal to have to posit two independent changes from mb > mp.

The second set of possible sound changes that can derive the present day forms of Proto-Jê *mb includes: (1) mb > bmb in Kaingang; (2) mb > b in Central Jê; (3) mb > mp in North-Western Jê; (4) two cases of back-mutation from mp > mb in Core Jê; (5) mb > $\tilde{w}^{w}$ in Kajkwakhrattxi; and (6) mb > m in Mẽbêngôkre. While this set of sound changes has the advantage of positing a single instance of mb > mp, it is less parsimonious than the other set of changes presented above, as it includes an additional sound change, and it further includes two cases of back-mutation from mb > mp > mb.

It is unclear which of the two sets of sound changes proposed for Nikulin's subgrouping would be more likely to have occurred. Nevertheless, both of the proposed pathways for Nikulin's subgrouping of Jê are suboptimal compared to the sequence of events that must be posited when assuming Lapierre et al.'s subgrouping, as the series of four sound changes proposed for Lapierre et al.'s subgrouping is the most parsimonious way to derive the present-day realization of /m/ in the ten modern Jê languages. Of course, in order to determine which of the two Jê subgroupings is most likely, we must consider a much larger set of evidence than simply the changes of state of Proto-Jê *mb, but the evidence presented here does support Lapierre et al.'s subgrouping. Regardless of which phylogenetic proposal is correct, the crucial point here is simply that a sound change from ND > NT must have occurred *at least once* in the history of the Jê languages, and that this must have occurred as a single sound change.

4 Discussion

4.1 One or more sound changes?

In Section 3, I argued that a change from ND > NT must have occurred in Panãra and Timbira. The proposal that this occurred as a single sound change, rather than as a series of telescoped sound changes, in the Jê language appears, at first glance, to challenge Beguš (2019) proposal for the Blurring Process (6); however, I show here that this is not in fact the case.

Additional evidence that ND > NT in Panãra and Timbira occurred as a single sound change comes from the absence of a series of voiced stops in Proto-Jê (Davis 1966)[24]. According to the Blurring Process, a series of voiced stops first had to undergo spirantization for postnasal devoicing to occur. However, none of the Jê languages exhibits a full series of fricatives, and voiced fricatives are absent altogether (with the exception of /ð/ in Xokleng, and /z/ in Central Jê, sometimes realized as [dz] by older Xavante speakers). If the change from ND > NT had been telescoped through the sound changes D > Z > D, we would expect to find in those languages that exhibit postnasal devoicing either a series of voiced fricatives, or a series of voiced stops. However, with the exception of voiced stops in Mẽbêngôkre, neither a series of voiced stops or fricatives is observed in any Jê

[24] Nikulin (2016; 2017) posits a series of voiced stops (*b, *ɟ, *ɡ) for Proto-Northern-Jê. The author claims that voiced stops underwent devoicing in all of the Northern-Jê languages except Mẽbêngôkre, the only Northern-Jê language to exhibit voiced stops. This proposal, however, is implausible. As Wetzels & Nevins (2018) clearly note, languages with a three-way stop contrast /m, b, p/ do not exhibit shielding. If a language had a three-way stop contrast, shielding would not result in contrast *enhancement*, but rather in reduction of the /m, b/ contrast. Since, to the best of my knowledge, no such language is attested, the proposal that Proto-Northern-Jê exhibited a series of voiced stops as well as shielding is improbable. I follow Davis (1966) in assuming that the voiced stops in Mẽbêngôkre are an innovation. While the details of the motivation for this innovation are not clear, all voiced stops in the language seem to be predictable. First, /ʤ/ is the reflex of Proto-Northern-Jê *tʃ ([s] in Panãra and Kĩsêdjê, [t] in Kajkwakhrattxi, [tʃ] in Apinayé, and [h] in Timbira), since /ʤ/ is the most common of the voiced stops in Mẽbêngôkre and /tʃ/ is very marginal (p.c. Salanova 2016). Furthermore, /d, ɡ/ are very marginal and seem to only occur in function words. /b/ is more common than /d, ɡ/ but also seems to occur more frequently in function words and in the onset of unstressed syllables. As such, I propose that /b, d, ɡ/ arose as the result of stop voicing in the onset of unstressed syllables, but more methodical comparisons are in order to support this hypothesis. Furthermore, note that Mẽbêngôkre is the only Jê language to exhibit a series of voiced stops, and also the only Jê language that does not exhibit shielding. These two facts seem crucially related (as noted by Wetzels & Nevins), such that the innovation of the voiced stops likely resulted in the loss of shielding.

language. Thus, neither the diachronic nor the synchronic data from Jê presents any evidence of a change from D > Z, or from Z > D, and I conclude that the change from ND > NT did indeed occur as a single sound change.

That said, the data from Jê do not present a clear counterexample to the Blurring Process. Beguš defines postnasal devoicing as a process that applies to voiced stops only after nasals (i.e., D → T / N __). Crucially, because voiced stops do not occur elsewhere in the grammar of Panãra or Timbira, the sound change from ND > NT could perhaps be analyzed as a case of unconditioned devoicing (i.e., D > T) banning all voiced stops. This across-the-board ban on voiced stops can be formalized in Optimality Theory as an undominated *D constraint, and would thus not be expected to arise from a series of changes. That said, the historical documents from Southern Cayapó suggest that postnasal devoicing may have occurred before the devoicing process for plain stops, as noted in Section 3.3. Further investigation into this is needed to determine whether stop devoicing occurred as a single sound change (D > T) or as two independent changes (ND > NT followed by D > T). Regardless of the correct occurrence of events, this case of postnasal devoicing is especially noteworthy for a number of reasons.

First, this sound change is an instance of a direct change from ND > NT and thus contributes to the body of literature on postnasal devoicing, a change characterized as an unnatural by many authors. Second, previously described cases of postnasal devoicing involve a sequence of two phonemes /ND/, where /D/ is realized as [T]. The case described here differs in a crucial way: In Panãra and Timbira, [NT]s are monosegmental, as they are allophones of the phoneme /N/. Finally, to the best of my knowledge, the synchronic pattern whereby nasal consonants are simultaneously postoralized *and* devoiced (/N/ → [NT] / __ V) has not yet been discussed. If not unattested, these cases are, at best, very rare.

4.2 Is ND > NT a phonetically-grounded sound change?

A sound change may be phonetically-grounded according to either articulatory or perceptual principles. I begin this discussion by considering the articulatory motivation for a change from ND > NT. As discussed in Section 1.2.1, aerodynamic principles cause oral stops occurring after nasal consonants to be realized with vocal fold vibration, unless special articulatory effort is made to prevent voicing. However, Beguš (2019) (p. 104), notes that '[d]espite nasal leakage and volume expansion, [...] speakers still need to accommodate for voicing [...] in order to counter the anti-voicing effect of closure—even in postnasal position.' Devoicing of an oral stop thus has an articulatory motivation, even after nasals.

The data from Panãra, however, does not support an articulatory motivation for the change from ND > NT. Crucially, the nasal airflow measurements presented in Figure 1 show that vocal fold vibration ceases at the precise moment when peak nasal airflow is achieved during the production of [NT]. This means that voicelessness of the oral portion of [NT] is not achieved by simply lengthening the oral closure; otherwise, we would expect voicing to persist into the closure of the oral stop and cease at the moment when the air pressure in the oral cavity equalize with the subglottal cavity. Instead, the airflow data suggests that vocal fold vibration is actively suppressed at the moment when the velum is maximally open, supporting a non-articulatory motivation for the sound change.

An alternative explanation of this sound change is grounded in perceptual principles. Whether a change from ND > NT can be explained by perceptual salience is somewhat controversial, as no experimental evidence has addressed this question directly. Some authors, such as Hyman (2001); and Beguš (2019) argue against a perceptual motivation for postnasal devoicing, but others, such as Kirchner (2000); and Stanton (2017) argue in favour of such an explanation. In her typological review of NC segments, Stanton discusses the perceptual cues to the /N, ND/ contrast, namely intrinsic cues (i.e., cues found during the production of the consonant itself), and extrinsic cues (i.e., coarticulatory cues found on neighboring segments). Intrinsic cues to the /N, ND/ contrast are the presence of an oral closure and release during the production of ND, and its absence during the production of N. Extrinsic cues to this contrast are the presence of an oral vowel following ND, and the presence of a nasal vowel following N. Stanton further argues that NT has a more perceptually salient release burst than ND, and that ND has a more perceptually salient release burst than N, as in (19). This proposal is supported by data from a perception experiment on [NT] segments in Panãra, which suggests that the voiceless oral release is indeed very perceptually salient to native speakers of the language Lapierre & Lin (2019).

(19) NT >> ND >> N

There are two possible ways to increase the perceptual distance between N and ND: Increasing the duration of the oral closure, or devoicing the release burst. These two strategies, however, are not independent (see Section 1.2.1). Specifically, the longer the closure of the oral portion, the more likely the burst will be voiceless; conversely, producing a voiceless oral release is likely to result in lengthening of the oral closure, as predicted by the aerodynamic voicing constraint (Ohala 1983; 2011). If these assumptions are true, the two possible pathways for a sound change from ND > NT, as motivated by a need to increase the perceptual distance between N and ND, are (1) lengthening the oral closure of the stop, subsequently leading to a devoicing of the oral release, or (2) devoicing of the oral release, subsequently leading to a lengthening of the oral closure.

The airflow data in Figure 1 supports the perceptual account of the ND > NT sound change in Panãra. Specifically, vocal fold vibration is actively suppressed at the moment of maximal velic opening, supporting the idea that vocal fold vibration is inhibited to increase the perceptual salience of the oral burst. In addition, the acoustic duration measurements in Table 5 suggest that the oral closure of Panãra [NT]s are indeed very long. However, given that vocal fold vibration is actively suppressed, it does not appear that the lengthening of the oral closure arose as a way of inhibiting voicing. Instead, lengthening of the oral closure may be another form of perceptual enhancement of the oral portion of [NT].

Whether or not sound changes can be motivated by a need for contrast enhancement is controversial. Blevins (2004: 205) argues that pressures for contrast enhancement can trigger hyperarticulation, thus avoiding common instances of phonetic mergers (see also Flemming 2002; 2008a,b on the role of contrast in grammar). This claim is well supported by experimental results by Baese-Berk & Goldrick (2009), which showed that words with minimal pair neighbours (e.g., 'pox' and 'box') were consistently produced with longer VOTs than words without (e.g., 'posh' and *'bosh'). This form of lexically conditioned variation suggests that speakers do indeed enhance the phonetic cues to phonemic contrast when these cues serve to distinguish words in the lexicon.

The case of ND > NT can be viewed as a case of dissimilatory hyperarticulation, since ND > N (as occurred in Mẽbêngôkre) results in a partial merger of the contrast between oral and nasal vowels. In contrast, the change from ND > NT results in enhancement of the contrast between oral and nasal vowels. Blevins claims that sound changes that are motivated by contrast enhancement may only arise when there exists free variation between two existing forms. In the case of ND > NT described here for Panãra, we expect free variation between [ND] and [NT] to have occurred at an earlier stage of the language. That such variation existed in Southern Cayapó is supported by the historical data presented in Section 3.3. As such, the proposal that the change from ND > NT in Panãra and Timbira was perceptually motivated by a need to enhance the contrast between oral and nasal vowels is supported.

4.3 Two necessary preconditions for a change from ND > NT

As discussed in Section 1.2, only 1.33% of the languages in UPSID possess NT segments in their phonological inventory. If a change from ND > NT is phonetically-grounded as argued in Section 4.2, then why are instances of this change so typologically rare? The change from ND > NT in Panãra and Timbira appears to be correlated with two characteristics of the languages' phonological systems: (1) the two-way contrast between in /N, T/; and (2) the contrast between oral and nasal vowels /V, Ṽ/. If these two characteristics of the phonemic inventory of a language are prerequisites to the occurrence of a direct sound change from ND > NT, this could explain why this change, as observed in Panãra, occurs so infrequently. Crucially, it has been claimed that shielding may only occur in languages that (1) do not exhibit a three-way contrast in stops /N, D, T/ (Wetzels & Nevins 2018), and (2) exhibit a contrast in oral and nasal vowels (Hyman 1975; Herbert 1986; Stanton 2017). I first consider Wetzels & Nevins' claim.

Of the ten Jê languages, none exhibits both postoralization ([ND] or [NT]) and phonemic voiced stops (/D/). Within the family, none of the languages that exhibit postoralization ([ND] or [NT]) have voiced stops (/D/) (i.e., Panãra, Timbira, Apinayé, Kĩsêdjê, Kajkwakhrattxi, Kaingang, and Xokleng), and Mẽbêngôkre, the only language with voiced stops /D/, does exhibit shielding. This is well predicted by Wetzels & Nevins' analysis of the cross-linguistic distribution of postoralized nasal stops, according to which shielding may only occur in languages that do not exhibit a contrastive series of voiced stops.

These typological observations, however, make no prediction as to whether the postoralized allophones should be realized with a voiced or voiceless oral release (i.e., as [ND] or [NT]). Crucially, within Jê, only Panãra and Timbira exhibit voiceless postoralized nasals [NT], while Apinayé, Kĩsêdjê, Kajkwakhrattxi, Kaingang, and Xokleng all exhibit voiced postoralized nasals [ND]. There seems to be no correlation between the observation that a language does not exhibit phonemic voiced stops and that it exhibits postoralized and devoiced nasals [NT]. Given these facts, it seems unsatisfactory to justify the diachronic change from ND > NT as an instance of across-the-board stop devoicing (*D), as this analysis does not provide an explanation for why such a change *did* occur.

I now turn to the second claim regarding the presence of postoralized nasal consonants, namely that the synchronic process whereby /N/ → [ND, NT] / __ V may only occur in languages that license a contrast between oral and nasal vowels (Hyman 1975; Herbert 1986; Stanton 2017). In a language that does not exhibit shielding, nasal consonants are realized as fully nasal before phonemically oral vowels, which results in some coarticulatory nasalization of the following vowel (/ma/ → [m$^{\tilde{a}}$a]). Given that an intrinsic cue to the contrast between oral and nasal vowels is the presence of nasality in nasal vowels and its absence in oral vowels (Beddor & Onsuwan 2003), the absence of shielding reduces the cues to the contrast between oral and nasal vowels. Alternatively, the presence of shielding prevents coarticulatory nasality from a nasal consonant onto a following vowel, as discussed by Hyman (1975: 256):

> 'The partial denasalization of /m/ to [mb] serves to check the spreading of nasality from the nasal consonant onto the following oral vowel. As a result, the intrinsic nasalizing effect of [m] is counteracted. [...] Denasalization takes place when the maintaining of a perceptual contrast imposes an articulatory complexity.'

Thus, assuming an underlying /NV/ sequence, the presence of an oral closure and burst in the nasal stop provides an extrinsic cue to the orality of the vowel. Furthermore, the absence of such an oral closure and burst in an underlying /NṼ/ sequence provides an extrinsic cue to the presence of a nasal vowel.

Given the observations outlined above, the presence of a contrast between oral and nasal vowels seems crucial to the occurrence of the change from ND > NT in Panãra and Timbira. If shielding serves to enhance the contrast between oral and nasal vowels, and voiceless release bursts are more perceptually salient than voiced release bursts (see 19), then the motivation for the change from ND > NT in Panãra and Timbira could be further enhancement of the /V, Ṽ/ contrast. If this view is correct, then a change from ND > NT in onset position of a syllable[25] is predicted to only occur as a single sound change, and under the following conditions: (1) the language exhibits a contrast between oral and nasal vowels, (2) [ND] sequences occur as allophones of /N/ before phonemically oral vowels, and (3) the language does not exhibit a three-way /N, D, T/ contrast in stops.

4.4 Do unnatural sound changes exist?

While a contrast ehancement motivation for the change from ND > NT is plausible, there is also evidence that [NT]s are marked in both Panãra and Timbira, as both languages exhibit variation between [NT] and [T] in word-initial position. This variable denasalization process provides evidence of the markedness (or perhaps the articulatory complexity) of [NT]s. This avoidance of [NT]s can be formalized as a *NT constraint active in the grammar of the two languages. The sound change acting against [NT] is predicted by Beguš, who claims that once a phonetically unnatural sound change has taken place, the grammar will start to exert pressure against this sound or sequence of sounds.

Following the sound change of postnasal devoicing in Panãra and Timbira (21a), the grammars of both languages have begun to lose the nasal portion of

[25] See stanton2017 for cases of synchronic postnasal devoicing in word-final position.

[NT] in word-initial position if there is no immediately preceding vowel (21b). This may be interpreted as a way to 'undo' the first change in order to avoid the marked NT segments. The change in (21a) is fully phonologized and categorical, while the change in (21b) is ongoing. In Panãra, word-initial [NT] denasalization does not occur categorically (see Lapierre 2019 for a detailed discussion of this process). In Timbira, word-initial NTs are always realized as [T] if they do not occur immediately after a vowel (de Castro Alves 2007). Furthermore, word-internal [NT]s are no longer observed in Timbira. As such, while the process is not fully phonologized in either of the two languages, the change from NT > T can be seen as farther along the diachronic trajectory in Timbira than in Panãra.

(20) a. ND > NT — *fully phonologized*
b. NT > T / $_{\mathrm{W}}$[__ — *ongoing change*

Given the evidence that [NT]s are marked in both Panãra and Timbira, it is difficult to conclude that [NT]s are really optimal, even in these two languages. While the change from ND > NT may have been *phonologically* grounded in a perceptual motivation to enhance the contrast between oral and nasal vowels, it appears that this motivation is insufficient for fully maintaining the pattern. In comparison to the devoiced instances of shielding that occur in Panãra and Timbira (NT), the other Northern Jê languages that exhibit voiced shielding do not exhibit instability of this pattern. [ND]s do not alternate with [D] or [T] in any position in Kajkwakhrattxi, Kĩsêdjê, or Apinayé. This provides further evidence that [NT]s are more marked that [ND]s. Furthermore, shielding is a widespread phenomenon in Amazonia; however, even in a geographic area where shielding is such a common phonological pattern, postoralized nasal consonants are never observed with a voiceless release, with the exception of Panãra and Timbira.

While there may be a motivation for the sound change from ND > NT in Panãra and Timbira, this pattern appears unstable. Insofar as this instance of postnasal devoicing has a phonological explanation, this motivation may not be as natural as the mirror change, NT > ND, which is cross-linguistically very common. If ND > NT were as natural as NT > ND, we would expect to find these changes equally as often. However, [NT] is typologically underrepresented compared to [ND]. For this reason, I conclude that naturalness should be seen as a gradient phenomenon and that, while the change from ND > NT may have a perceptual motivation in the case reported for Panãra, it is *less natural* than the change from NT > ND. While all sound changes may have a phonetic motivation in some corner of their grammar, not all sound changes are created equal.

5 Conclusion

This paper explored a sound change from ND > NT in Panãra. I argued that this case of postnasal devoicing is an instance of a natural sound change, grounded in a perceptual motivation to enhance the contrast between oral and nasal vowels. Crucially, the change from ND > NT in Panãra differs from other reported cases of postnasal devoicing, in that it involves a single phoneme /N/, which is synchronically postoralized *and* devoiced. In contrast, other cases of postnasal devoicing involve a sequence of two phonemes, /ND/, where D > T. I further argue that this change is dependent on three preconditions of a phonological system: (1) the language must exhibit a contrast between oral and nasal vowels, (2) [ND]s occur as allophones of /N/ before phonemically oral vowels, and (3) the language must not exhibit a three-way /N, D, T/ contrast in stops.

Abbreviations

C = voiced or voiceless oral consonant; N = nasal consonant; V = oral vowel; Ṽ = nasal vowel; T = voiceless, unsapirated stop or affricate; D = voiced stop or affricate; S = voiceless fricative; Z = voiced fricative.

Acknowledgements

I first thank the Panãra community for allowing me to study their language, particularly those who participated in my experiment. I thank the audiences of the Workshop on Language Change for the Worse and of the Second Symposium on American Languages, as well as Larry Hyman, Andrew Garrett, Lev Michael, Gašper Beguš, Susan Lin, Nicholas Rolle, Kelsey Neely, and Bernat Bardagil-Mas for valuable comments and stimulating discussions at various stages of this work. My sincere gratitude goes to two anonymous reviewers for detailed and helpful comments on this paper. I thank Jessica Wang, Marina Hansson, Priyasundari Natarajan, Chris Mitchell, and Bryce Smith for their hard work in processing the phonetic data presented here. All remaining errors are my own. This research was supported by the Social Sciences and Humanities Research Council of Canada, as well as two Robert Oswalt Endangered Language Grants.

Appendix: Phonemic inventories of the Jê languages

Panãra (Lapierre 2019):
/p, t, s, k, pː, tː, sː, kː, m, n, ɲ, ŋ, mː, nː, w, ɾ, j, i, e, ɛ, ɯ, ɤ, a, u, o, ɔ, iː, eː, ɛː, ɯː, ɤː, aː, uː, oː, ɔː, ĩ, ẽ, ɯ̃, ã, ũ, õ, ĩː, ẽː, ãː, õː/

Timbira Apãniekrá (de Castro Alves 1999; 2004):
/p, t, tʃ, k, m, n, ɲ, ŋ, w, ɾ, j, h, i, e, ɛ, ɨ, ə, ɜ, a, u, o, ɔ, ĩ, ɛ̃, ɨ̃, ã, ũ, ɔ̃/

Kĩsêdjê (Nonato 2014):
/p, t, tʃ, k, tʰ, kʰ, m, n, ɲ, ŋ, w, ɾ, s, h, i, e, ɛ, ɨ, ə, ɜ, a, u, o, ɔ, ĩ, ẽ, ɨ̃, ə̃, ã, ũ, õ/

Kajkwakhrattxi (da Silva Camargo 2010; Beauchamp 2019):
/t, tɕ, ʈʰ, k, kʰ, hʷ, w, w̃, ɽ, ɽ̃, n, ɲ, ŋ, i, e, ɛ, ɨ, ə, ʌ, a, u, o, ɔ, ĩ, ẽ, ɨ̃, ɐ̃, ũ, õ/

Mẽbêngôkre (Salanova 2001; Salanova & Reis Silva 2011):
/p, t, tʃ, k, ʔ, b, d, ʤ, g, m, n, ɲ, ŋ, w, ɾ, j, i, e, ɛ, ɯ, ɤ, ʌ, a, u, o, ɔ, ĩ, ẽ, ɯ̃, ʌ̃, ã, ũ, õ/

Apinayé (De Oliveira 2005; Albuquerque 2007):
/p, t, tʃ, k, ʔ, m, n, ɲ, ŋ, f, s, w, ɾ, j, i, e, ɛ, ɨ, ə, ʌ, a, u, o, ɔ, ĩ, ẽ, ɨ̃, ə̃, ũ, õ/

Xavante (Quintino 2000; Estevam 2011):
/p, t, ʔ, m, n, s, z, h, w, ɾ, j, i, e, ɛ, ɨ, ə, a, u, o, ɔ, ĩ, ẽ, ɐ̃, õ/

Xerente (de Souza 2008):
/p, t, k, m, n, s, z, h, w, ɾ, j, i, e, ɛ, ɨ, ə, a, u, o, ɔ, ĩ, ẽ, ə̃, õ/

Kaingang (Wiesemann 1972):
/p, t, k, ʔ, m, n, ɲ, ŋ, ɸ, ʃ, w, h, ɾ, i, e, ɛ, ɨ, ə, a, u, o, ɔ, ĩ, æ̃, ɨ̃, ə̃, ã, õ/

Xokleng (Gakran 2005; 2018):
/p, t, tʃ, k, kʷ, ʔ, m, n, ɲ, ŋ, ð, h, w, l, j, i, e, ɛ, ɨ, ə, a, u, o, ɔ, ĩ, ɛ̃, ɨ̃, ã, ũ, õ/

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Chapter 4

Loss of number in the English 2nd person pronoun: A change for the worse, but due to a change for the better?

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The article approaches recognized changes in the paradigm of the 2nd person personal pronoun as changes "for the worse" or "for the better". The loss of the 2nd person singular pronoun *thou/thee* by the eighteenth century left standard English with *you* as the only address pronoun, with no distinction in number any more. We argue that the emergence of new forms such as *you guys, y' all, youse, yinz*, which reestablish the number distinction, indicates that this was a "change for the worse" for speakers. Can this change, however, also be viewed as a by-product of a change for the better on another level? We discuss two possible changes for the better involved in the loss of number from the 2nd person: a) before *thou/thee* was lost from standard English, a two-term address pronoun system had developed, which offered speakers a means of pragmatic differentiation. b) the loss of the 2sg verbal ending {-*st*}, which disappears together with *thou*, can be considered as a change for the better in the verbal inflectional system.

1 Loss of number in the 2nd person pronoun as a change for the worse

Almost all modern European languages have a number distinction in the personal pronouns of the 2nd person, e.g. French (*tu/vous*) or Czech (*ty/vy*). Moreover, the use of these address pronouns often corresponds to the T/V system of politeness

Christine Elsweiler & Judith Huber. 2020. Loss of number in the English 2nd person pronoun: A change for the worse, but due to a change for the better? In Dankmar Enke, Larry Hyman, Johanna Nichols, Guido Seiler & Thilo Weber (eds.), *Language Change for the Worse*, 89–112. Berlin: Language Science Press. DOI: ??

in address pronouns described by Brown & Gilman (1960), with the V pronoun as the formal pronoun and the T form as the informal variant (Jucker & Taavitsainen 2013: 74). Present-day standard English, however, only has the address pronoun *you*, originally the V form, which is used regardless of the number of addressees, the communicative situation, and the relation between the interlocutors.

Historically, English had a number contrast in the 2nd-person personal pronouns with a distinction between *thou* (subject form) and *thee* (object form) in the singular and *ye* (subject form) and *you* (object form) in the plural (Lass 1999: 148). This distinction can still be found dialectally (e.g. in Scots and in Northern English dialects). In the standard, however, the singular pronouns *thou/thee* were lost by the eighteenth century, and the original object form *you* was generalized to replace earlier subject *ye*.

From a structural point of view, the paradigm of the Present-day English personal pronouns is therefore asymmetrical, with the 2nd person being the only one with neither case nor number contrast.[1] The loss of the case opposition appears entirely unproblematic for speakers.[2] The loss of the number opposition, however, clearly constitutes a "change for the worse" for many speakers, as witnessed by the emergence of several new 2nd person plural pronouns that re-establish the number distinction and thus remedy the change: *youse* and *yiz*, evidenced in Scots, Irish English and American English, as well as *y' all* in the southern US or *you guys* more generally in the US (Lass 1999: 154–155; Hickey 2003) (§2).

What caused this "change for the worse"? The simple number contrast that the language still had in the Old English period (*thou/thee* singular -- *ye/you* plural) was complicated in Middle English with the adaptation of the plural pronouns for the formal address of a single interlocutor, leaving *thou* and *thee* for informal address (e.g. Lass 1999: 148–149). Between the thirteenth and the eighteenth century, English therefore had a two-term address pronoun system which opened up the possibility of subtle socio-pragmatic distinctions for speakers – a pragmatic "change for the better", as we will argue in this contribution (§4).

[1] The only other pronoun which has identical subject and object forms in Present-day English is the 3rd singular neuter *it*.

[2] Some of the varieties that retain the 2nd person singular pronoun neutralize the case distinction in the singular, too: In Western Midlands and Southwestern British dialects as well as in the language of the Quakers, the original object form *thee* is generalized to subject function (Hernández 2011: FN 18). That case is a dispensable category in Modern English, a language in which syntactic function is mostly determined by word order, is also visible more generally in the phenomenon of "pronoun exchange" (e.g. ***her** told me; I give it to **he***) that is frequently found in English dialects (Hernández 2011: 124).

This possibility was lost along with the disappearance of the singular pronouns *thou/thee* from Standard English in the eighteenth century.

The disappearance of *thou/thee*, however, did not only cause a "change for the worse" in the pronoun paradigm (the loss of number contrast), it also brought about a structural "change for the better" in the verbal paradigm, which became simpler due to the loss of the 2nd person singular inflectional ending {-*st*}. Traditionally, the loss of {-*st*} is described as a mere side effect of the loss of *thou* (e.g. Lass 1999: 162). Against this, we will discuss the idea put forward by Aalberse & Stoop (2015) that the simplification of the verbal paradigm may actually have been one of the causes of the loss of *thou*, rather than its consequence.

The outline of the paper is as follows: §2 will sketch how different varieties of English have reacted to the change for the worse in the 2nd person pronoun paradigm by developing repair forms to unambiguously mark plural address. §3 will provide an overview of the diachronic dimension of the changes in the address pronoun system, from a paradigm with a simple number contrast in Old English, via a two-term system in Middle and Early Modern English to a reduced one-term system from the eighteenth century onwards. The pragmatic change for the better that came along with the introduction of the two-term system will be addressed in §4, with a detailed outline of the socio-pragmatic distinctions interactants could express, as evident from both literary and non-literary texts. Finally, in §5, we will explore the possibility of a structural change for the better in the verbal paradigm involved in the loss of *thou*. First, we will present the evidence given by Aalberse & Stoop (2015) for Dutch and then draw on quantitative data from earlier studies of the Early Modern English address pronouns to check whether their hypothesis may also hold for English. A conclusion is provided in §6.

2 Therapeutic changes in spoken varieties of English

Speakers apparently want to be able to distinguish number in the 2nd person. This is evident in the various new 2nd person plural pronouns that have emerged in many spoken varieties of English and which "rectify the deficiency and fill the gap in the pronoun paradigm" (Hickey 2003: 345). The use of "special forms or phrases for the 2nd person plural pronoun" is extremely widespread in varieties of English: Kortmann & Szmrecsanyi (2004: 1154), for instance, find it in 34 of 46 worldwide varieties. The more recent World Atlas of Varieties of English (Kortmann & Lunkenheimer 2013) has the feature attested in 69 of the 76 varieties investigated, in 38 of which it is pervasive or obligatory. The present section gives a brief overview of the most common new 2nd person plural forms; more detailed documentation can be found in Wright (1997) and Hickey (2003).

You guys, *y'all*, and *you'uns* are all found in spoken US-American Englishes. *You'uns*, a contracted form of *you ones* (also spelled *you'ns* or *yinz*, and first attested in 1810, cf. OED s.v. *you-uns*, pron.), is more or less restricted to the Pittsburgh and southern Appalachian dialects (Wolfram & Schilling 2016: 81). Characteristic of southern US varieties is *y'all*, a fused form of *you all* or *ye all* (first attested 1824, cf. OED s.v. you-all; Montgomery 1992). *You guys* is least regionally marked. This form is sometimes blamed as sexist, since, containing the word *guys*, it may be interpreted as excluding women (e.g. Saul 2016; Maynor 2000: 417). However, at least in the TV series *Friends*, Heyd (2010) has not detected any gender bias, neither in the users of *you guys* (men and women use it roughly equally often) nor in its denotation: The referent of *you guys* is most often a mixed male-female group of people. Yet the wish to use gender-neutral alternatives to *you guys* might perhaps be involved in the spread of *y'all*, which, as shown by Tillery et al. (2000), is diffusing from the South to other regions of the US.

Irish English varieties continued *ye*, the original subject plural, as plural form (with new possessives *yeer* and *yeres*) next to the singular *you*. In the early 19th century, when large numbers of adult Irish speakers acquired English, the plurals *yez* and *youse* were innovated. *Yez* is doubly marked for plural ({*ye*} '2nd person plural' + {-s} 'plural') (Hickey 2003: 351), and first attested in 1802 (OED s.v. *yez*, pron.); in *youse*, first attested in 1835 (OED s.v. *yous*, pron.) the plural morpheme {-s} is attached to the singular pronoun *you*. The presence of *youse* in urban centres in England, Scotland, the United States, New Zealand, and Australia is most probably due to Irish immigration. Milroy & Milroy's comments on their field recordings in Belfast demonstrate that *youse* is the obligatory 2nd person plural pronoun there, and not a mere alternative to *you*: "There were many cases both in the fieldwork and in daily life where miscomprehension was evident. Often, when a group of people was addressed as *you* (SE [Standard English] plural), individuals would look round to see which single member of the group was being addressed" (2012: 20–21).

In the creation of new plural pronoun forms, different strategies can be distinguished:

- a new pronoun is created by adding the regular plural morpheme to what is perceived to be the singular pronoun: this yields *youse* ({*you*}+{s}) in Irish English, or *jɔːli* in the pidgins Pitcairnese and Norfolk, where the plural suffix is {-*li*} (Hickey 2003: 333).

- a phrase like *you guys*, *you all*, or *you ones* starts to become grammaticalized as plural pronoun, with typical effects of grammaticalization such as phonetic reduction (*yall*, *yinz*) and semantic bleaching. For instance, we can address (1a) to two female colleagues, but describing this situation with (1b) would probably not work because here *two guys* would be interpreted as referring to men (on gender in the reference of *guy* in different grammatical contexts, see McLennan 2004). Another example of semantic bleaching is (2a–b), where *yall* is preceded by *all (of)*, indicating that the idea of totality originally present in the phrase *you all* is backgrounded.

(1) a. ***You guys*** *[female referents] want to join us for lunch?*
    b. *?We asked two* ***guys*** *[female referents] whether they wanted to join us for lunch.*

(2) a. *Nice to see* ***all of yall*** *here today. [administrator addressing a group of faculty]*
    (from Tillery et al. 2000: 291)
    b. *Listen* ***all y'all*** *it's a sabotage*
    (Beastie Boys, "Sabotage", 1994)

- New pronouns are borrowed, as in Caribbean Englishes, where new plural forms such as *unu* (Jamaican) and *wuna* (Barbados) are taken from Ibo and other Niger-Congo languages (Hickey 2003: 360).

Hickey (2003: 359) and Wright (1997: 181–182) both point out the time lag between the loss of *thou* and the emergence of the new plural forms. By c. 1700, *thou* had become highly marked, but the earliest attestations of *y' all*, *youse* etc. only date from between 1802 and 1835, according to the revised OED. This, of course, may be due to the fact that the spoken varieties were not frequently recorded in writing, so that the pronouns may have been established several decades earlier than their first attestations.

In any case, the numerous different new forms that speakers of English worldwide have come up with fill the gap that the loss of *thou* has left in the English pronominal system. Therefore, they appear to be "therapeutic changes", and the loss of number in the 2nd person can thus legitimately be characterized as a change for the worse. In the following section, we sketch the developments that led to this change for the worse.

3 Adaptation of plural pronouns for singular use in English

Many European languages originally only had one pronoun of singular address (Mazzon 2010: 354). In the course of their history, they acquired a formal address pronoun, either grammaticalizing a respectful title, such as Spanish *Usted*, derived from *vuestra merced* 'your grace', or using a 2nd- or 3rd-person plural pronoun for single addressees, e.g. French *vous* or German *Sie* (Jucker & Taavitsainen 2003: 4). The use of plural pronouns for single address is generally thought to have spread from Latin and French to other European languages, but its origin is not quite clear (see Jucker & Taavitsainen 2003: 4–5). It may have to do with a strategy of negative politeness where using the plural is a means to avoid explicitly singling out the addressee (widely attested also in languages not influenced by Latin and French practice, see Brown & Levinson 1987: 198–199). It may also be generally rooted in a metaphor of 'more' (plural) is 'power'. Brown & Gilman (1960: 255) attribute it specifically to the practice of addressing the two Roman emperors in Rome and Constantinople by *vos* in the fourth century. Despite having two different seats of power, the Roman imperial office was unified and therefore an address to one of the two emperors was understood as an address to both. Over time, the use of plural pronouns was extended to the address of other power figures and ultimately to all social superiors. This custom spread from Latin to other Romance languages and served as a model for high language registers in the medieval European societies where Latin was known (Jucker & Taavitsainen 2003: 4–5; Jucker & Taavitsainen 2013: 74; Mazzon 2010: 354). On the basis of this historical usage pattern reflecting asymmetrical social standing, Brown & Gilman develop the concept of non-reciprocal power semantics.

Brown & Gilman introduce the symbols T, derived from Latin *tu*, to refer to the informal address pronoun, and V, from Latin *vos*, to denote the distant, formal pronoun. Regarding their use, Brown & Gilman consider two dimensions: a vertical and a horizontal one. In the vertical dimension, there is an asymmetry between the speaker and the addressee due to social status. People of lower social status receive the T pronoun but have to pay respect to superiors by using the V form. The horizontal dimension, referred to as solidarity semantics, applies to a symmetrical relationship between the interlocutors, who, based on the degree of familiarity between them, will address each other reciprocally either with the T or with the V form (1960: 254–261).

English was one of the European languages that have extended the use of the 2nd-person plural pronouns to include formal singular address. In its earliest period, it only had one pronoun for the address of one interlocutor (see Table 1).

Table 1: Old English address pronouns

	singular	plural
nominative	þū	gē
genitive	þīn	ēower
dative/accusative	þē	ēow

Table 1 illustrates that Old English had a perfectly symmetrical paradigm with a simple number contrast: *þū* and the case-marked forms were employed for singular, *gē* and related forms for plural address (Lass 1999: 148). As Hogg points out, a sociolinguistic differentiation between the singular and plural pronouns did not yet exist (1992: 144). There were, however, other linguistic means to express respect towards a superior in Old English. Kohnen (2008: 152–154) shows that *hlaford* 'lord' was an address term used in asymmetrical power relationships between addressor and addressee as e.g. in (3).

(3) Ch 1428 (Harm 113) B15.4.10 [0015 (18)], cited from Kohnen (2008: 153)
Nu wille <ic> ***þæ*** *kyþan* ***hlaford*** *Ælfsige biscop hu þeos cwydrædene fyrmæst wæs <gestaþelod> […].*
'Now I want to let thee know, Lord Bishop Ælfsige, how this spoken agreement was originally fixed […].'

The example given in (3) illustrates that the singular object pronoun *þæ* combines with the address term *hlaford*, allowing a monk to respectfully address a bishop.

The adoption of the plural pronouns *ye* and *you* (henceforth referred to as Y and *thou* and related forms as T) in Middle English for formal singular address is attributed to the influence of French courtly practice, itself ultimately based on the Latin tradition (Lass 1999: 148). The earliest extant example in the OED dates from the thirteenth century (cf. (4)).

(4) English Lyrics 13th Century, ca. 1250; cited by OED, s.v. you II 5.a
Þus is vriten in þe gospelle, min suete vrend, asse ic ou telle.
'Thus it is written in the gospel, my sweet friend, as I tell you.'

While it is clear, that in (4) *ou* is used for the singular address of the narrator's *suete vrend*, the co-text of the poem does not provide any indication about the relationship between addressor and addressee. From the thirteenth century onwards, the paradigm given in Table 1 can thus be functionally expanded for Middle English to include formal singular address for you in addition to plural use (see Table 2).

Table 2: Middle English address pronouns

	singular informal	plural/singular formal
subject	thou	ye
possessive	thin	your
object	thee	you

Burnley (1983: 17–22; 2003: 28–29), distinguishing between a courtly and a non-courtly style for Chaucer's use of address pronouns, shows that in late Middle English Y spread in upper-class and courtly contexts, thereafter gradually permeating downwards (see also Leith 1997: 106). In the non-courtly style, T was the only address pronoun. In the courtly style, the variables familiarity, age and social status influenced the choice between T and Y. Whereas this may be seen as evidence that Middle English had acquired a T/V system in the sense of Brown & Gilman's non-reciprocal power semantics, this would be too simplistic a depiction of the factors governing the choice of address pronoun. The use of singular Y gradually gained currency during the Middle English period and quickly gathered pace during Early Modern English to turn into the unmarked address pronoun in Standard English (Lass 1999: 150), thus progressively reducing the use of T. Nevertheless, as long as the two singular address pronouns co-existed, the choice between them allowed for subtle pragmatic distinctions, which will be discussed in §4. By the eighteenth century, T had disappeared from standard usage, leaving only one pronominal form in the asymmetrical paradigm of 2nd-person personal pronouns. According to traditional accounts, in eighteenth-century English, the use of T has come to be linked to the speech of rural areas, lower classes and radical religious communities such as the Quakers (Wales 1996: 76) so that, due to this stigmatisation, it is avoided by speakers of Standard English.

4 A two-term address pronoun system: a pragmatic change for the better

As was delineated in §3, Brown & Gilman (1960) describe the choice of T and Y in Middle English as being governed by social status in a strictly hierarchical medieval society, thus likening it to the use of address pronouns in other contemporary European languages. Uses that do not fit this pattern are explained away as deviations from the socially determined default (Brown & Gilman 1960: 274–276; see Jucker 2000: 155). In more recent studies, however, it has been argued that the introduction of the singular Y form and the restriction and shift in the functional range of T gave speakers a new pragmatic tool to encode e.g. intimacy, distance and emotions by modulating and adapting their use of address forms according to situational context (Jucker 2000: 158). Pronoun retractability, i.e. the possibility for an addressor to employ either T or Y for singular address of the same interlocutor, is unusual for modern languages, but was common in Middle and Early Modern English with numerous examples showing that "politeness (…) was more negotiable" (Jucker 2000: 158). In this section, selected pertinent examples from literary and non-literary texts will be given to illustrate that the expansion of the pragmatic toolkit in the domain of singular address forms between the thirteenth and the eighteenth century can be seen as a change for the better, albeit short-lived.

4.1 Literary texts

Middle English and Early Modern English literary texts, in particular Chaucer's and Shakespeare's works, offer insightful examples of the expressive possibilities the two-term address pronoun system afforded authors. One situational context in literary texts, especially in Shakespearean drama, that may trigger the use of T is the suspension of a character's social status due to "social absence" (Mazzon 2000: 138; 2010: 138), e.g. in asides and in scenes where a physically absent character is addressed, including dead, sleeping or mad interlocutors. Only in direct interaction with a character does facework apply, so that a physically absent character's face does not have to be preserved, which allows T.

The possibility to signal politeness and face wants through T and Y switching transpires in exchanges between characters in both Chaucer's and Shakespeare's works. While the interaction between the pilgrims in the frame narrative of the *Canterbury Tales* shows that there are some characters who always receive the same address pronoun –the Knight, who is highest in social rank, is consistently addressed by the Host with Y, whereas some of the commoners such as the Miller or the Reeve always receive T (Jucker & Taavitsainen 2013: 79–80) –there are other characters who do not receive a stable pronoun. One such case is the Parson, who, as a parish priest, occupies a rather low rank within the clergy. In his first address in the Prologue to the Parson's Tale, the Host seems to jokingly play down the Parson's rank within his estate by using T when enquiring about his exact status:

(5) Prologue to the Parson's Tale X, 22, cited by Jucker & Taavitsainen 2013: 81
__Artow__ a vicary? Or __arte__ a person?
Telle us a fable anon, for cokkes bones!
'Art thou a vicar or art thou a parish priest? Tell us a fable, by God's bones.'

The Host invites the Parson to tell a fable, to which the latter objects, stressing that he will tell an edifying story, "a myrie tale in prose". The Parson's reaction thus shows his face wants, which the Host respects by switching to singular Y (see (6)).

(6) Prologue to the Parson's Tale X, 68–70, cited by Jucker & Taavitsainen 2013: 81
'__Sire preest__,' quod he, 'now faire __yow__ bifalle!
Telleth,' quod he, '__your__ meditacioun.'
But hasteth yow; the sonne wole adoun;
' "Sire priest," he said, "good fortune may now come to you! Tell us your meditation," he said. But make haste; the sun is about to go down;'

Also in Shakespearean drama, the interactions between characters similarly manifest pronoun switches. It has been claimed that they formed part of an established shared code, which an Elizabethan audience would have recognised and exploited as a means of interpretation (Mazzon 1995: 25–26). The switching between T and Y thus reflects changing degrees of e.g. intimacy and distance in the relationship of the characters (Mazzon 2003: 240)). In *King Lear*, for instance, Lear expresses his anger at Cordelia's disappointing demonstration of daughterly love by T, then distances himself from her by switching to Y and eventually uses T again as a sign of solidarity between them during their imprisonment (Mazzon 2003: 230).

Address pronouns are not employed in isolation, though, but frequently co-occur e.g. with nominal address terms to expressively mark emotional attitudes towards interlocutors. In Chaucer, abusive terms of address, e.g. *false traitour*, as well as terms of endearment, are frequently used with T forms (Mazzon 2000: 150). For Shakespeare, Busse (2003) demonstrates a similar correlation of pronominal and nominal address terms. Terms of endearment such as *heart* or *joy* preponderantly co-occur with T, with terms of abuse such as *rogue* being next on the scale of preferred combinations with T forms. Titles of courtesy, e.g. *Your Honour*, are situated at the other end of the scale, showing predominant preference of Y over T (2003: 214).

4.2 Non-literary texts

In addition to the analysis of the use of address pronouns in literary works, non-literary texts, representing authentic rather than fictional pronoun usage, have moved into the focus of historical sociolinguistics and historical pragmatics in recent years. The present section provides a concise overview of the pragmatic contrasts in address pronoun use in depositions, trial texts and letters.

The pragmatics of T and Y use in depositions, i.e. written records of the spoken testimony of e.g. witnesses or defendants, in the 1560s was investigated by Hope (1994).[3] He distinguishes between usages on the socially pragmatic level, which indicate the social status of the interactants, and on the micro-pragmatic level, encoding strong emotions such as anger or contempt through pronoun shifting. For the analysis of T and Y use in conversations Hope further draws a distinction between "addresses", where only one interactant uses address pronouns, and "exchanges", i.e. interactions in which both interactants use address forms (Hope 1994: 147). Hope' s study reveals that micro-pragmatic shifting is restricted to exchanges, typically with a shift from *you* to *thou*, signalling e.g. anger, rather than the other way around: "Presumably conversations tend to begin with socially pragmatic usages, and move on into non-socially pragmatic usages once a context has been established." (Hope 1994: 147).

Walker' s studies (2003; 2007) of pronominal usage in trial texts written down between 1560 and 1760 show that T forms are employed in interactions to indicate the speaker' s social superiority, to express negative emotions such as contempt, but also what she qualifies as "more positive feelings" such as "a fatherly, patient condescension" (2007: 91–92). In fact, she finds that out of these different functions of T, it is the expression of emotions which most persistently motivates the use of T in trials as well as in the other text types she examined (Walker 2003: 338–339).

[3] For the text type deposition see §5.

Letters are another text type in which switches of singular address pronouns encode pragmatic meaning. Although letters do not reflect dialogues, they do nevertheless represent a form of interaction between an addressor and an addressee and are thus an example of involved production, typically containing a high number of 2nd-person pronouns (Biber 1995: 142; 288–289). Whereas e.g. the Paston letters of the fifteenth century, which were generally written in a formal style, show a uniform use of singular Y with few exceptions, mostly in representations of spoken language (Bergs 2005: 129–130), private letters of the seventeenth century provide insightful evidence of the pragmatic distinctions T and Y may transport. Lass (1999: 151–152), drawing on letters by Lady Katherine Paston and Henry Oxinden, delineates how shifts between the two pronouns demarcate changes in topic and tone. The T forms often set an intimate and personal tone, transporting heightened emotion. Singular Y, by contrast, tends to mark the return to matters of general concern, introducing a more matter-of-fact tone. Based on these distributional tendencies, Lass argues that by the seventeenth century the contrast between T and Y had turned into a deictic one between a proximal (speaker-oriented) and a distal (distant from the speaker) pronoun (1999: 153). The evidence from private letters further shows that this deictic contrast could be exploited by addressors to heighten the pragmatic force of commissive and expressive speech acts, which convey the speaker's emotional involvement. Thomas Knyvett, a lawyer from Norfolk writing to his wife, did, for instance, exclusively use T forms in commissive speech acts such as (7):

(7) Thomas Knyvett, 1623
I rest ***thy*** *most faithfull loving husband*

T also tends to collocate with words expressing commitment such as *obligation* or the adjective *bound*. Y, by contrast, is preferred in representative speech acts, e.g. when reporting some news as illustrated by (8):

(8) Thomas Knyvett, 1623
The onely happy newes that I can send you of your kindred is that your cousine Bourh is lately come over with great honor.

Such uses in private letters lending greater strength to speech acts concur with the shaded modulations of T and Y along the distance –intimacy and power – solidarity scales found e.g. in Chaucerian and Shakespearean texts (see Mazzon 2003: 240; 2009: 43 and §4.1 above).

To sum up, from the thirteenth century up to the late seventeenth century, English had a dual system with two singular pronouns of address. Unlike with stable T/V systems in modern languages like German or French, in Middle and Early Modern English the availability of the two singular address pronouns allowed for nuanced pragmatic differentiations according to situational context, in particular, but not exclusively, in direct interactions between interlocutors. As has been demonstrated with evidence from both literary and non-literary texts, switches from Y to T and back, often within the same exchange, were an adept linguistic means to negotiate politeness and to signal subtle nuances in the relationship of interactants, e.g. differing degrees of intimacy and distance or relative situational power and solidarity. This extension of the pragmatic toolkit was a clear change for the better since these possibilities had not existed within the one-term address system. It has to be borne in mind, though, that the pragmatic exploitation of the T/Y distinction was an option rather than the norm. In the course of the Early Modern period, Y more and more developed into the default address pronoun with a gradually decreasing number of speakers making use of the pragmatic contrast between T and Y. By the eighteenth century, pronominal address in Standard English had turned into a one-term system again. A possible structural reason for the eventual loss of T will be discussed in the next section.

5 Loss of *-st*: a structural change for the better?

According to the standard account sketched in §3, the T pronoun was lost because it had become associated with the speech of rural areas, lower classes, and radical religious communities; particularly in London (e.g. Finkenstaedt 1963: 224) speakers avoided it and used *you* instead. In this traditional view, therefore, the loss of *thou* can be characterized as a sociopragmatic change from above.

Recently however, this account has been called into question by Aalberse & Stoop (2015), who claim that aside from these sociopragmatic reasons, the loss of T is additionally driven by deflexion, i.e. by a change from below. Aalberse & Stoop develop this hypothesis for both Dutch and English, but only test it for Dutch. In this section, we present the main line of their argument and briefly check it against data from earlier studies on English. Before, though, a brief overview of the contemporary developments in verbal inflection will be provided so that the loss of *-st* in the 2nd person can be viewed in its larger context.

Verbal inflection in general has undergone major changes from the rich inflectional paradigm of Old English to the rather slim Early Modern set of endings shown in Tables 3 and 4. The overall tendency is towards reduction, but with a range of competing endings of different dialectal origin.

For the plural of the present indicative, for instance, in fifteenth century London, three competing endings are in use: the *-th* typical of Southern dialects of Middle English (and inherited from Old English), the *-n* typical of Midlands dialects (generalized into the present indicative from the subjunctive and the preterite), and the Northern *−s*, particularly with non-pronominal subjects. Beside these three variants, the endingless verb is becoming more and more frequent in the plural. According to Lass (1992: 97), in Caxton' s Prologues and Epilogues (from the 1470s), more than 70 per cent of all plural verbs have no ending any longer, and around 1500 in London English, the only verb forms which regularly have an ending in the present indicative are the 2nd and 3rd person singular, as shown in Table 3 (based on Lass 1999: 161).

For the 3rd person singular in the present indicative, two variant endings are in use in London English over an extended period of time: *-th* is the inherited ending from Old English, *-s* is an innovation of Northern dialects, spreading to London with immigrants from the North. Based on the *Corpus of Early English Correspondence* (CEEC), a corpus of private and official letters, Nevalainen & Raumolin-Brunberg (2017: 68) find that after a first increase of *-s* in the late fifteenth century, it drops again, to start a second rise a century later and quickly becomes the majority ending after 1620. This takeover of *-s* is a change from below: In the beginning, it is led by women, by the lower ranks, and is more frequent in private writings than in formal ones (2017: 123, 144).

In the preterite, inflection for plural is lost at around 1500, and the only ending left is the 2nd person singular *−st* (Lass 1999: 165). Originally, only weak verbs featured this ending in the preterite (e.g. *thou lovedst*) but in the Middle English period, it spread to strong verbs by analogy (Lass 1992: 138, e.g. *thou tookst* instead of earlier *thou took*).

To sum up, in the Early Modern period, the verbal inflectional paradigm in London English had undergone and was still undergoing considerable reduction. The resulting, much simplified inflectional paradigm, as shown in Table 3, is drastically reduced further by the loss of the 2nd person singular *-st* that goes along with the loss of T (see Table 4).

As can be seen in Table 4, avoiding *thou* not only disposes of the number opposition in the 2nd person (*-st* vs. zero), but also of a person opposition in the singular (zero vs. *−st* in 1st and 2nd person); in other words, the only ending left in the present indicative is the 3rd person singular. The simplification of the verbal inflection brought about by the loss of *thou* is even more radical in the preterite, where there is no person/number ending left whatsoever (*I/(s)he/we/you/they loved/took* vs. *thou lovedst/tookst*).

Dutch too lost its original T-pronoun (in the early seventeenth century, cf.

Table 3: Regular verbal inflection (present and preterite indicative) in London English c.1500 (Lass 1999: 161)

	Present indicative		Preterite indicative	
	Sg	Pl	Sg	Pl
1	–	–	-d	-d
2	-st	–	-dst	-d
3	-th/-s	–	-d	-d

Table 4: Simplified regular verbal inflection (present and preterite indicative) in London English c.1500

	Present indicative		Preterite indicative	
	Sg	Pl	Sg	Pl
1	–	–	-d	-d
2	–		-d	
3	-th/-s	–	-d	-d

Howe 1996: 222), but, unlike English, restored the number opposition with a new plural pronoun (*jullie*) also in the standard language. In Dutch, the simplification of the verbal paradigm following the loss of T is similar to the one in English, as shown in Table 5 and Table 6. Here, it is the opposition between the 2nd and 3rd person singular that is smoothed out.

Table 5: Verbal inflection (present indicative) in Middle Dutch (Aalberse & Stoop 2015: 195)

	Sg	Pl
1	-e	-en
2	-s	-t
3	-t	-en

The language contact situation in early modern London and Dutch cities with their phenomenal population growth, Aalberse & Stoop argue, created "a need for a more economical inflectional paradigm" (2015: 193). Massive migration to the cities involves numerous adult second dialect and second language learners,

Table 6: Simplified verbal inflection (present indicative) in Middle Dutch (Aalberse & Stoop 2015: 195)

	Sg	Pl
1	-e	-en
2	-t	-t
3	-t	-en

for whom the acquisition of inflectional endings is known to be difficult (cf. e.g. Blom et al. 2006). As the target language Early Modern English (and similarly Middle Dutch) allows to choose between T and Y for single addressees, learners may be likely to prefer Y (with no ending on the verb) and eschew the difficult –*st* ending required by T.[4]

Aalberse & Stoop (2015) test this hypothesis for Dutch. They argue that if the avoidance of the inflectional ending plays a role in the loss of T, then the loss of T should be more rapid in the subject form, which triggers an inflectional ending on the verb, compared to the object, possessive, or vocative form, which do not. Their analysis of 2nd person pronouns in a corpus of thirteenth and sixteenth century Dutch texts shows that this is indeed the case: T recedes more rapidly in subjects than in non-subjects, as can be seen in Table 7, where the share of the subject forms in the singular decreases from 60% to 24% from the thirteenth to the sixteenth century (2015: 198).

Table 7: Subjects and non-subjects of 2nd person singular and plural pronouns in a corpus of 13th and 16th c. Dutch prose (adapted from Aalberse & Stoop 2015: 197).

		Subject	Non-Subject
13th c. prose	Sg (*Du*)	292 (60%)	197 (40%)
	Pl (*Gi*)	114 (34%)	223 (66%)
16th c. prose	Sg (*Du*)	19 (24%)	60 (76%)
	Pl (*Gi*)	3029 (43%)	4021 (57%)

[4]The scenario is therefore quite similar to the ongoing replacement of the 1st person plural *nous V-ons* in spoken French by *on V-t*, in which the verb form is pronounced identically to all persons in the singular and the 3rd person plural (cf. King et al. 2011). The replacement of spoken Brazilian Portuguese *nos* by *a gente* is another case in point.

In the following, we take a look at data from earlier linguistic studies on 2nd person pronouns in English to see whether they might support this hypothesis in English too. A more thorough examination of this scenario on the basis of selected data from the *Corpus of Early English Correspondence* (CEEC) will be found in Huber & Elsweiler (in prep.).

Surprisingly few of the numerous studies on address pronouns in Middle and Early Modern English actually distinguish case forms (or rather syntactic function, given that the object form *you* increasingly takes over subject function in Early Modern English) in the presentation of their data; most subsume *thou, thee, thine* as T and *ye, you, your* as Y, and can therefore not be used for the present purpose. So we are left with only two studies which differentiate the forms, Mulholland (1967) and Walker (2007). Mulholland (1967) investigates address pronouns with singular reference in Shakespeare's *Much ado about nothing* and *King Lear*. There is no diachronic dimension to these data, but the lower share of subjects in T (57%) than in Y (64%) shown in Table 8 would somewhat fit to Aalberse & Stoop's hypothesis according to which T should recede faster in subjects.

Table 8: Address pronouns in *Much Ado* and *King Lear* (Mulholland 1967)

	Subject	Non-Subject
T	276 (57%)	211 (43%)
Y	481 (64%)	267 (36%)

A diachronic dimension is available in the data from Walker's monograph on address pronouns in Early Modern English dialogues (2007). She studies pronoun usage from the sixteenth to the eighteenth century in three different text types: drama comedy, trial proceedings, and depositions, all from the *Corpus of English Dialogues 1560–1760*. Walker's drama corpus comprises a total of 15 comedies from different playwrights, including e.g. Shakespeare's *The Merry Wiues of Windsor*, Jonson's *Bartholomew Fayre* and Farquhar's *The Beaux Stratagem*. Each author is only represented once with one play. The numbers of pronouns in the comedies per subperiod are shown in Table 9 and Figure 1. Trial proceedings record the direct speech of the trial participants in dialogue form, as taken down by court scribes. The numbers of pronouns per subperiod in these texts are shown in Table 10 and Figure 2. Depositions are "records of the spoken testimony of a witness (or defendant or plaintiff) usually taken down by a scribe before the case is heard in court" and "recorded as a 3rd person narrative" (Kytö & Walker

2006: 20–21). Because of this, they contain considerably less direct speech than the other two genres, and hence do not feature as many address pronouns. Also, those speeches that are reported in the depositions are often defamations, accusations, and the like, which are likely to involve the "strong emotions" with which T is associated (see §4.2). More importantly though, the witness depositions in the corpus mostly do not originate from London, but from places in other dialect areas, such as Durham or Chester (cf. Kytö & Walker 2006; Walker 2007: 98–102), in which the contact situation is different, and in some of whose dialects *thou* survives until today. This is why they are not informative for the present purpose, and why we will focus on Walker's results from the other two text types.

Table 9: T and Y in subjects and non-subjects in English drama comedy, 16th–18th c. (Walker 2007: 320)

		1560–1599	1640–1679	1720–1760
T	subject	140 (48%)	52 (37%)	26 (52%)
	non-subject	152 (52%)	87 (63%)	24 (48%)
	total	292	139	50
Y	subject	453 (50%)	583 (47%)	511 (49%)
	non-subject	452 (50%)	666 (53%)	536 (51%)
	total	905	1249	1047

In the comedies investigated by Walker (2007), overall, all forms of T decrease from 1560 to 1760, with the share of subjects and non-subjects (these include objects as well as possessive pronouns and determiners) being roughly equal in the first and the third subperiod (Table 9 and Figure 1). However, the reduction in T subjects is slightly stronger than in T non-subjects between the first two subperiods. Viewed in isolation, this could lend support to Aalberse & Stoop's (2015) claim. Yet the fact that in the same subperiod also in the Y forms, subjects are less numerous than non-subjects, again casts doubt on this interpretation. The overall lower share of subjects in address pronouns in this subperiod might have a different reason.

In the results from the trial proceedings (Table 10 and Figure 2), the initial decline of T is steeper in the subjects than in the non-subjects too, and in the third subperiod, subjects even become less numerous than non-subjects. (However, the overall numbers of T are fairly low (between 17 and 0) after the first subperiod.) Different from what we saw in the data from drama comedy, the share of subjects

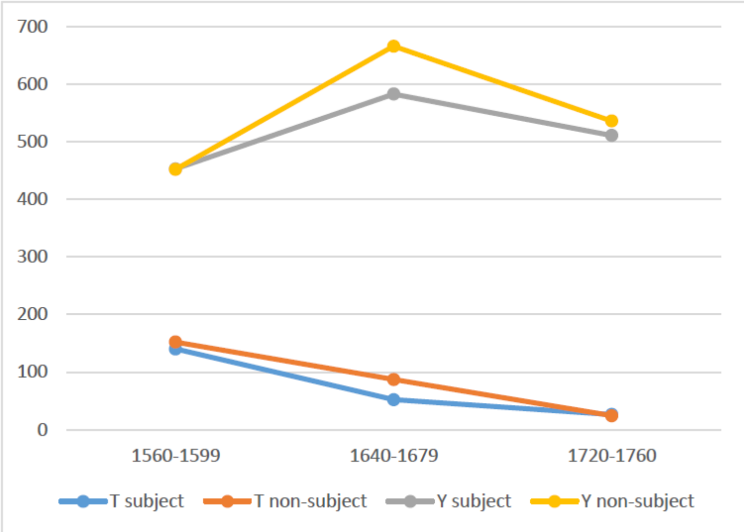

Figure 1: T and Y subjects and non-subjects in drama comedy (based on Walker 2007: 320).

and non-subjects in the Y forms does not mirror the development in T: Y subjects remain more frequent than the other forms throughout. So the results could be cautiously taken to be in accordance with Aalberse & Stoop's hypothesis that speakers tend to avoid subject T more than other T forms.

To conclude, the data found in the literature definitely do not yield a clear picture, but to some extent might support the scenario sketched by Aalberse & Stoop (2015). Huber & Elsweiler (in prep.) will examine it more closely by

Table 10: T and Y in subjects and non-subjects in English trial proceedings, 16th–18th c. (Walker 2007: 321)

		1560–1599	1600–1639	1640–1679	1680–1719	1720–1760
T	subject	80 (65%)	10 (59%)	6 (38%)	6 (50%)	0
	non-subject	43 (35%)	7 (41%)	10 (63%)	6 (50%)	0
	total	123	17	16	12	0
Y	subject	233 (55%)	106 (55%)	326 (72%)	435 (68%)	201 (64%)
	non-subject	189 (45%)	88 (45%)	125 (28%)	204 (32%)	112 (36%)
	total	422	194	451	639	313

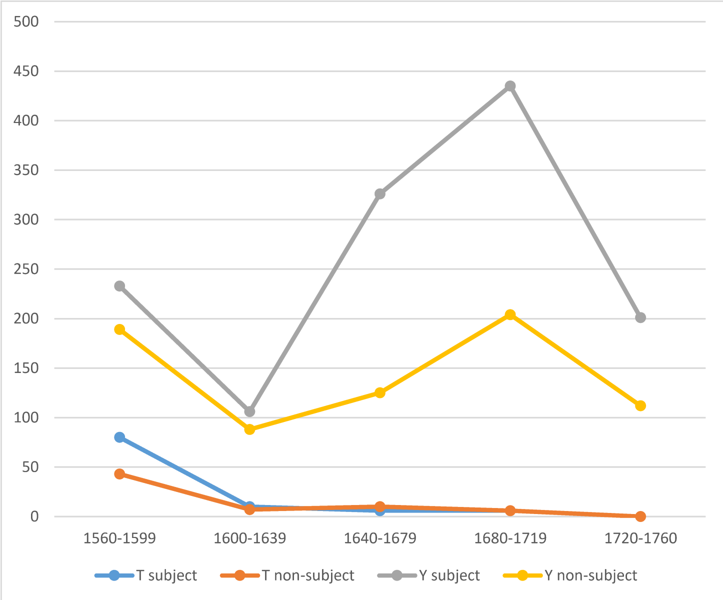

Figure 2: T and Y in subjects and non-subjects in trial proceedings (based on Walker 2007: 321).

studying pronoun use in Early Modern English letters as well as looking into the details of the contact situation in contemporary London.

6 Conclusion

This paper has focused on the loss of the number contrast in the standard English 2nd person pronouns. This loss is undeniably a "change for the worse" for speakers, as attested to by the various repair strategies in different varieties of English that we discuss in §2. Yet, can the loss of number as a change for the worse be attributed to some "change for the better" in another area? We suggest that two changes for the better may have been involved here.

With the introduction and spread of the polite plural in Middle English, as outlined in §3, speakers could choose between two different sets of pronouns for singular address. This can be characterized as a sociopragmatic change for the better, since it constituted an addition to the pragmatic toolkit, a new means of sociopragmatic distinction. As we discuss in §4, some speakers exploited the T/Y opposition for nuanced pragmatic differentiations. T was increasingly avoided though, and by the eighteenth century, Y had become the generally accepted unmarked standard form. Speakers avoided T because of its increasing stigmatization –a change from above in the Labovian sense.

Yet the avoidance of T, we argue with Aalberse & Stoop (2015) in §5, may have been additionally driven by a change from below: the avoidance of the inflectional ending {-*st*} that comes along with T. Getting rid of {-*st*} results in a much simplified verbal paradigm, which clearly represents a structural "change for the better", particularly in the linguistic situation of early modern London, with many second language and second dialect learners. In the literature on English, this has hitherto not been taken into consideration; on the contrary, the "fate of the 2s inflection" is usually depicted as being doomed to die with the pronoun *thou* (e.g. Lass 1999: 162). We suggest that this might have been more of a bilateral story: rather than a mere casualty, {-*st*} may have been one of the responsible factors in the loss of T. The trajectories of T-loss in subjects and non-subjects in texts from the early modern period that we presented in §5 can cautiously be taken as initial support for the idea that deflection may be one of the driving forces in the loss of T in English, but clearly more research is needed.

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Chapter 5

Clitic doubling in Albanian dialects from the perspective of functional transparency

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The relevant literature reports differences in the use of clitic doubling in Albanian dialects. Quantitative corpus studies show that all dialects spoken outside of the Republic of Albania show much a more frequent use of clitic doubling. The data of this corpus prove that the less restrictive use of clitic doubling is not accompanied by increasing transparency of its usage. In contrast to Standard Albanian, where the usage of clitic doubling is not optional and can almost without exception be explained by topicality and focus marking, in the peripheral Albanian dialects outside of the Republic of Albania numerous exceptions from the general tendency can be detected. In order to explain these exceptions, a wide variety of factors must be taken into account and, in certain contexts, point to the optional use of clitic doubling. From a descriptive point of view, these exceptions suggest an increasing degree of functional opaqueness.

1 Introduction

Most studies on differential object marking and clitic doubling, including this one, follow a simple key question: What are the properties of objects that trigger clitic doubling? In order to approach this question from a broader perspective, it is useful to outline general aspects of typologically grounded theories on agreement and transitivity. Typological studies question the purely syntactic notion of transitivity which posits the existence of an object as a sufficient indicator of transitivity. This dichotomous view (intransitive vs. transitive) can be supplemented by a semantic approach to transitivity, which states that clauses exhibit

Veton Matoshi. 2020. Clitic doubling in Albanian dialects from the perspective of functional transparency. In Dankmar Enke, Larry Hyman, Johanna Nichols, Guido Seiler & Thilo Weber (eds.), *Language Change for the Worse*, 113–144. Berlin: Language Science Press. DOI: ??

a certain degree of transitivity depending on the pragmatic and semantic properties of the agent and the patient. The degree of transitivity can be measured on the basis of certain properties of the core arguments and the semantics of the verb. Figure 1 summarizes the basic idea of prototypical transitivity according to Hopper & Thompson (1980).

	Factors	Degree of transitivity High	Low
A.	Participants	2 or more participants, A and O	1 participant
B.	Kinesis	action	non-action
C.	Aspect	telic	atelic
D.	Punctuality	punctual	non-punctual
E.	Volitionality	volitional	non-volitional
F.	Affirmation	affirmative	negative
G.	Mode	realis	irrealis
H.	Agency	A high in potency	A low in potency
I.	Affectedness of O	O totally affected	O not affected
J.	Individuation of O	O highly individuated	O non-individuated

Figure 1: Parameters of transitivity according to Hopper & Thompson (1980: 252)

Prototypical transitive clauses exhibit an object which shows a high degree of individuation and affectedness due to the action executed by the agent which is prototypically a deliberately acting agent. For instance, definite and highly referential objects (criterion J) are analysed as being a more typical component of transitive clauses than indefinite and less referential objects. Hopper & Thompson (1980: 259) go so far as to posit –more like an "extreme statement" –that "an indefinite O [object] is not really an O at all, but is a subordinate part of a compound of which the verb stem is the head (i.e., it is incorporated into the verb)".

Instances of "special" object marking can be considered, in a broad sense, as morphosyntactic realisations of a higher or lower degree of transitivity, among them:

- clitic doubling = high transitivity
- differential object marking = high transitivity
- object omission (anti-causative, incorporation) = low transitivity

Another way of viewing transitivity is the notion of distinctness of participants or the "maximally distinguished argument hypothesis" (Næss 2007) which states, in simple terms, that the two main participants (subject and object) must be semantically maximally distinguishable from each other. Lenz (1920: 52) was one of the first to assume a distinguishing function of differential object marking. He assumed that in Spanish the direct object bears the preposition *a* only if it is logically possible to perceive it as the subject of the clause.

The introduction so far has shown that clitic doubling can be viewed in the wider context of argument alignment and, what is more important, as a realisation of differential object marking (Kallulli 2016). Bossong (1991: 151) regarded the emergence of differential object marking as a form of "grammemic replacement" of eroded case systems with the important difference that the case system, such as the Latin case system, are "a petrified grammatical category whereas the more recent DOM [differential object marking] systems are living ones". As a consequence, the former "are used mechanically and without exception" and are "meaningless", whereas the usage of differential object marking is not pervasive and is dependent on different factors, mostly regarding the defining properties of the object and the action denoted by the verb.

One major factor which can be associated with the emergence of a new case or agreement system is topicality. Givón (1976: 152) introduces a universal hierarchy of topicality that ranks the core arguments regarding their likelihood to be topics as follows: agent > dative > accusative. This hierarchy serves as a starting point for Givón's theory on the emergence of object (and subject) agreement which basically states that an overuse of topic-shift construction will eventually lead to the grammaticalization of object agreement, including clitic doubling in this context, cf. Figure 2:

topic shift ("marked")	afterthought-topic construction ("semi-marked")	neutral ("demarked")
The man, I saw him.	*I saw him, the man.*	*I saw-him, the man.*

Figure 2: Grammaticalization of object agreement via topic-shift constructions according to Givón (1976: 157).

Very often topic and focus are viewed as being in a complementary distribution (see for example Buchholz & Fiedler (1987: 538), Kallulli (2000: 218) for Albanian), which is reminiscent of what is usually called topic and comment. It should not go unmentioned that major caveats have been expressed concerning such a definition of topic and focus (see for example Leafgren (2002: 30)). The absence of a widely accepted definition of the terms *topic* and *focus* and their importance for clitic doubling in Albanian require a general definition of the terms as they are used in this article. The term *topic* is used according to the notion of *aboutness*-topic, thus the "topic of a sentence is the thing which the proposition expressed by the sentence is about" (Lambrecht 1994: 118). Focus, on the other hand, "refers to significant emphasis on a particular element within the context of the information conveyed in a particular clause" (Leafgren 2002: 23–24). It becomes clear that these definitions call into question the view of a complementary distribution of topic and focus. They do not, however, refute the view that in the majority of cases topic and focus do not overlap, as it is usually the part of a clause which conveys the new information that also bears a significant emphasis and consequently stands out. This gradual tendency can be depicted using a modified version of the topic acceptability scale of Lambrecht (1994: 165) in Figure 3.

active	most acceptable topic	least acceptable focus
accessible		
unused	↓	↑
brand-new anchored		
brand-new unanchored	least acceptable topic	most acceptable focus

Figure 3: Topic acceptability scale according to Lambrecht (1994: 165) (grey part is a modification by the author).

The theoretical framework outlined above allows the general statement that objects which incorporate the typical properties of a subject, such as [+animate/human, +definite, +specific, +given, +topic, -focus] are prone to some sort of differential marking. This is, simply put, the basic idea behind the theory of grammaticalization of differential object marking along the referentiality hierarchy, cf. Figure 4.

The theory implies that at the end of the grammaticalization process all objects, irrespective of their pragmatic-semantic quality, will undergo clitic doubling or, as Bossong (1991: 152) puts it, "such a differential system may ultimately become non-differential again".[1]

[1] At least in theory. Grammaticalization processes are not always driven to the end so that existing differential object marking systems can remain stable and functionally transparent over

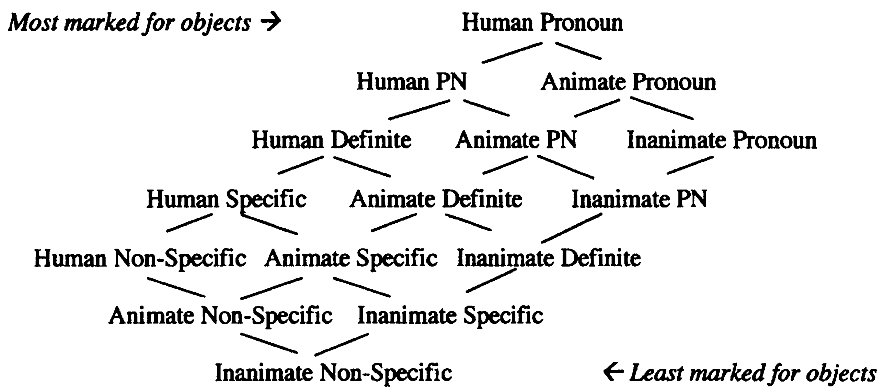

Figure 4: Grammaticalization of differential object marking along the referentiality hierarchy (Aissen 2003: 459).

An intuitive conclusion would be to associate an increasing grammaticalization of differential object marking with a loss of restrictive usage rules, more freedom of use and consequently, in the broadest sense, a language change for the better. Note, however, that Figure 4 viewed in isolation, suggests well-defined intermediate stages, which does not do justice to the fact that grammaticalization is a continuous process with several transitional stages which, in turn, may allow a certain extent of optionality. Optional differential object marking is evidenced for many languages, such as Sinhalese, Romanian, and Yiddish (Aissen 2003). Such cases cannot be explained on the basis of well-defined factors or rules and can be considered, at least from a descriptive point view, as functionally less motivated and therefore opaque. The leading question will be: Does a higher degree of grammaticalization and, therefore, a less restricted usage of clitic doubling consequently lead to a higher degree of functional transparency or does an increased frequency of usage lead to the disappearance of a stable system and therefore result in a higher degree of optionality and functional opaqueness in certain contexts? This question will be pursued on the basis of a quantitative and qualitative corpus analysis on clitic doubling in Albanian dialects.

a very long period of time without developing into fully-fledged case marking systems.

2 Clitic doubling in Albanian

2.1 Syntax of clitic doubling in Albanian

Albanian, as a member of the so-called *Balkan sprachbund*, shares some structural similarities with surrounding languages which cannot be attributed to genealogical relationships, but rather to intensive language contact. It is important to note that these similarities go beyond lexical borrowings or phonological approximations and extend to the level of morphosyntax (Friedman 2006), one case being clitic doubling. In the case of Albanian and other Balkan languages, clitic doubling constitutes an additional marking of the direct or indirect object with depronominal clitics; cf. example 1, where the clitic *e* is coreferential to *djalin* 'the boy'. Note: In the translations the accusative clitic in the 3rd person is always indicated by a CL and its absence with an ∅.

(1) Northwest Gheg (Montenegro; 42.43041, 19.25936)[2][3]

Plaka	*e*	*ndali*	*djalin*	*me*	*têtjë*
old_woman.NOM.DEF	CL.ACC.3SG	STOP.AOR.3SG	boy.ACC.DEF	INF	stay.PTCP

me	*tê*
with	her

'The old woman CL stopped the boy so that he would stay with her.'

In contrast to other Balkan languages, the inventory of pronominal clitics in Albanian is rather simple since they show no gender distinction and dative and accusative clitics in the 1st and 2nd person coincide in their form, cf. Table 1.

[2] Most language examples have glosses. If an example exceeds a certain length, only the translation is given. The information given for each example are: Albanian dialect, country, geographical coordinates (longitude and latitude). If not otherwise stated, all examples are taken from a dialect corpus which was compiled for this study that is described in Section 3.1. Section 3.1 gives an overview of modern Albanian dialects.

[3] The following abbreviations are used: 1: first person; 2: second person; 3: third person; ABL: ablative; ACC: accusative; AOR: aorist; ART: linking article; CL: clitic; DAT: dative; DEF: definite; GER: gerund; IMP: imperative; INF: infinitive; IPF: imperfect; NEG: negation, negative; NOM: nominative; PASS: passive; PL: plural; PROG: progressive; PRS: present; PTCP: participle; SG: singular; SUPIN: supin.

Table 1: Paradigm of pronominal clitics in Standard Albanian. Some dialects may show slightly different paradigms.

	Dative	Accusative
1SG	*më*	
1PL	*na*	
2SG	*të*	
2PL	*ju*	
3SG	*i*	*e*
3PL	*u*	*i*

Clitics appear mostly as proclitics, i.e. preceding either the inflected verb, compare (1), or the main verb in an infinite verbal construction, compare (2).

(2) Northeast Gheg (Serbia; 42.30917, 21.64986)
Ridvani *don* *me* *ja* *falë*
Ridvan.NOM.DEF want.PRS.3SG INF CL.DAT.3SG.CL.ACC.3SG give.PTCP
lojën *edhe* *e* *hup*
game.ACC.DEF and CL.ACC.3SG lose.prs.3sg
'Ridvan wants to let him win and loses the game.' (Lit. 'Ridvan wants to CL give him the game and loses it.')

In Standard Albanian clitics can be attached to the verb stem when combined with imperative verb forms, cf. (3).

(3) Northwest Gheg (Montenegro; 42.43041, 19.25936)
Hê, *ktu* *tek* *jam,* *po* *çil-ma-ni*
INTERJ here at be.PRS.1SG so open-CL.DAT.1SG.CL.ACC.3SG-PRS.2PL
derën
door.ACC.DEF
'Hey, here I am, so open-CL the door for me.'

2.2 Use of clitic doubling

One major function of the clitics is the phoric resumption of discourse referents; cf. (4), where the *të shoqen dhe të dy ushtarët* 'his wife and both soldiers' are referenced in the subsequent sentence with a clitic. This usage of pronominal clitics will not be addressed in this paper.

(4) South Gheg (Albania; 41.90111, 20.0475)
Sa vajtën, mreti e njofti të
once go.AOR.3PL king.NOM.DEF CL.ACC.3SG recognise.AOR.3SG ART
shoqen dhe të dy ushtarët. I pyti se
wife.ACC.DEF and ART two soldier.ACC.PL.DEF CL.ACC.3PL ask.AOR.3SG that
si ish puna
how be.IPF.3SG matter.NOM.DEF
'The moment they came, the king CL recognised his wife and both soldiers. He CL(=them) asked what their story was.'

Without exaggeration it can be said that almost any research on clitic doubling in Albanian focuses on 3rd person accusative clitic doubling. This interest in 3rd person accusative clitic doubling is due to the simple fact that all dative objects and 1st/2nd person accusative objects are unexceptionally doubled (Buchholz & Fiedler 1987: 444). On the other hand, grammarians have struggled to determine the usage of 3rd person accusative clitic doubling (hereafter clitic doubling if not stated otherwise) with a great amount of certainty (Buchholz 1977: 3–4).

Clitic doubling can only occur if the associated nominal or pronominal phrase has the syntactic status of direct object. Nominal phrases in the accusative which do not qualify as such cannot be associated with a coreferential clitic. Thus, bare nominal indefinites are never doubled (Kallulli 2016). These cases can typically be found in recurrent light verb constructions, cf. (5), but less frequent constructions fall under this category also, cf. (6).

(5) South Tosk (Albania; 40.2115, 19.68922)
Finoku as hante sa duhej, as
Finok.NOM.DEF neither eat.IPF.3SG as_much_as need.IPF.PASS.3SG neither
bënte muhabet si përpara
do.IPF.3SG conversation as before
'Neither did Finoku eat as much as he should, nor did he ∅ have conversations like before.'

(6) North Tosk (Albania; 40.52797, 20.97003)
Plaka gjen ustallarë dhe fillojnë
old_woman.NOM.DEF find.PRS.3SG mason.PL and begin.PRS.3PL
ndërtimin
constructing.ACC.DEF
'The old woman ∅ finds masons and they start to build.'

According to the notion of transitivity, as outlined in section 1, the status of the noun phrases in (5) and (6) as object becomes questionable in favour of another analysis, namely considering them as components of a verbal incorporation.

Once the status as a genuine direct object is identified, the use of clitic doubling becomes contingent on pragmatic factors. Buchholz (1977: 192) and later Buchholz & Fiedler (1987: 440) cite the "primary accent" (*Primärakzent*), i.e. focus, as an important factor, stating that clitic doubling is applied if the object is topicalized[4] and not within the focus domain, which, in general, is in compliance with the descriptions we find in other standard grammars (Agalliu et al. 2002) and in recent works on clitic doubling in Albanian (Kallulli 2016). This systematicity is well depicted in (7): when the key to room forty is mentioned for the first time in an object position, it is not doubled. In the subsequent clause, when the same referent, the key to room forty, occurs again in the object position and is topicalized, it undergoes clitic doubling.

(7) North Tosk (Albania; 40.52797, 20.97003)
Ky djali, pas një kohe, si u rrit, i kërkon të jëmës çelsat e pallatit. Dhe ajo i thotë se: - Çfarë të duhen ty çelsat?- Unë i dua, të di se çfarë ka në pallat. E ëma i jep tridhjetë e nëndë çelsa dhe i hap dhomat, por dhoma e dyzetë nuk i hapet me ato çelsa. Djalit i mbeti merak që e ëma nuk i dha çelsin e dhomës dyzetë$_1$ dhe, mbas lutjesh që i bëri i biri, ajo ia jep çelsin$_2$. Kur e hap djali dhomën, sheh varur një fotografi të një vajze.

'The boy, after some time, grew up and asks his mother for the keys to the palace. And she says to him: "What do you need them for?" "I want them to know what is in the palace". The mother gives him thirty-nine keys and he opens the rooms, but room forty does not open with those keys. The boy was worried that his mother did not Ø give him the key to room forty$_1$ and, after begging her, she CL gives him the key$_2$. When the boy opens the room, he sees a picture of a girl on the wall.'

Although very rare, clitic doubling is also possible in combination with indefinite nominal objects if the object is topicalized, cf. (8).

[4] They use the terms *theme* and *rheme*.

(8) North Tosk (Albania; 40.60275, 19.61929)
Një vajzë e një fshatari, tridhjetë e ca vjeçe, e
a girl ART a peasant thirty and some years_old CL.ACC.3SG
kërkoi mbreti ta merrte, se
WANT.AOR.3SG king.NOM.DEF SBJV.CL.ACC.3SG take.IPF.3SG because
ishte e bukur.
be.IPF.3SG ART beautiful
'It was peasant girl, thirty and a few years old, that the king CL wanted to have because she was beautiful.' (Lit. 'A girl of a peasant, thirty and a few years old, the king CL wanted to have because she was beautiful.')

While the rules outlined above suffice to explain most cases of clitic doubling in Standard Albanian, there are also cases which cannot be explained immediately on the same pragmatic grounds. Two of them are the quantifiers *të gjithë* and *të tërë* 'all' that are invariably clitic doubled (Kallulli 2016), cf. (9), and novel indefinite pronouns, including interrogative pronouns, which never occur in clitic doubling constructions irrespective of whether they bear the focus or not (Buchholz & Fiedler 1987: 444), cf. (10) and (11).

(9) South Gheg (Albania; 41.42836, 19.66541)
por pyet nonën ti, qi i ka
but ask.IMP.2SG grandmother.ACC.DEF you who CL.ACC.3PL have.PRS.3SG
provu të gjitha
experience.PTCP everything
'but ask the grandmother who CL has experienced everything.'

(10) South Gheg (Albania; 40.96166, 20.21805)
Çfarë kërkon ti nga unë
what want.prs.2sg you from me
'What do you ∅ want from me?'

(11) North Tosk (Albania; 40.52797, 20.97003)
Vajza Zili i thoshin kësaj në shtëpinë
girl.NOM.DEF Zili CL.DAT.3SG say.IPF.3PL DEM.DAT.3SG in house.ACC.DEF
e saj nuk pranonte asnjeri
ART her NEG accept.IPF.3SG no_one
'The girl – she was called Zili – did not ∅ receive anyone in her house.'

Cases such as (9) and (10) cannot be viewed completely isolated from the general dependency of clitic doubling on topicality. According to Kallulli (2016) doubling clitics trigger givenness of their associates and since 'all' -quantifiers are always non-novel they trigger clitic doubling. Likewise, the incompatibility of novel indefinite pronouns and clitic doubling can be attributed to the simple fact that they are [-given, -topic] and mostly also [+focus] and therefore prohibit clitic doubling. This is corroborated by the example (12). While the pronoun *disa* 'some' may be classified under the category indefinite pronoun, it differs from *çfarë* 'what' in (10) and *asnjeri* 'no one' in (11) in as much as it has an antecedent and is therefore [+given, +topic, -focus] so that clitic doubling is required.

(12) South Tosk (Albania; 40.2115, 19.68922)
Ajo Lubi kush e di sa njerëz ka
that Lubi who CL.ACC.3SG know.PRS.3SG how_many people have.PRS.3SG
mbytur e i ka vdekur si hakë për ujë,
drown.PTCP and CL.ACC.3PL have.PRS.3SG kill.PTCP as payment for water
po <u>disa</u> nuk <u>i</u> ka ngrënë.
but some NEG CL.ACC.3PL have.PRS.3SG eat.PTCP
'That Lubi, who knows how many people it has drowned and it has killed as a payment for water, but <u>some</u> (of them) it CL has not eaten.'

In summary, the description given so far attests to an already existing highly redundant use of clitic doubling in all Albanian varieties, making its use restricted only in 3rd person accusative.

2.3 Clitic doubling in Albanian dialects from an areal perspective

Varieties of one language very often undergo grammaticalization processes at different speeds and to a different degree. For Albanian, as a Balkan language with multiple contact languages, variations within dialects require analysis of those variations in the wider context of areal linguistics. This approach is corroborated by Friedman (2008: 36), who states: "Of particular importance is the fact that the phenomenon [clitic doubling] shows varying degrees of encoding (as pragmatic or grammatical devices) on the basis of areal rather than genealogical relations." Assenova (2002: 110), cited in Friedman (2008: 40), gives the following overview of the conditions for clitic doubling, which applies, by and large, to all Balkan languages:

- the object is most often marked with a definite article

- the object is more often pre-verbal than post-verbal
- clitic doubling is especially common when the object is a personal pronoun
- indirect objects are more redoubled than direct objects
- objects that are not definite are not reduplicated

Concerning the frequency and degree of grammaticalization of clitic doubling in Balkan languages, i.e. their standard varieties, the following ranking applies:

Table 2: Conditions for clitic doubling in Balkan languages (Kallulli & Tasmowski 2008: 9–10).

Macedonian	all definite direct objects and all indirect objects
Albanian	all IOs, DOs instantiated by first and second person pronouns, and all non-focal/non-rhematic DO DPs
Romanian	all full personal and definite pronouns, preverbal indirect objects and not [−specific] DPs, postverbal direct object DPs that are not [−specific] and are introduced by *pe*, and postverbal indirect object DPs which are not [−specific] and/or [−human] Goal
Greek	no obligatory context, except with *olos* ʻallʼ
Bulgarian	all objects that are interpreted as Experiencers and objects of *ima, njama* ʻthere is (not)ʼ

The overview is by no means exhaustive, but it suffices to point out the rough areal tendency in the Balkans to further grammaticalize clitic doubling from the East to the West, whereby the highest degree of grammaticalization has been reached at the intersection of Central Gheg, Western Macedonian and Northern Aromanian (Curtis 2012; Lopašov 1978). In this region clitic doubling is almost exclusively contingent on definiteness and consequently occurs very frequently. Friedman (2006: 662) points out the fact that in "Macedonian [⋯], unlike in the other Balkan languages, it can even occur (facultatively) with indefinite indeterminate pronouns such as *nikoj* ʻnobodyʼ". These cases, as sporadic as they may be, indicate an ongoing disengagement of clitic doubling from obvious triggers, like definiteness or givenness.

Many authors have stated the existence of such usage differences of clitic doubling between Albanian dialects which, furthermore, tend to match the general areal tendencies in the Balkans. For example, Curtis (2012: 310) states:

> [⋯] dialects of Albanian and Aromanian in contact with Greek do not show the same tendencies as those further to the north, namely that object reduplication is used for contrast and topicalization rather than as a strict grammatical obligation.

Regarding specifically the Albanian variety spoken in Kosova, Pani (2006: 70) remarks the following, using "double accusative" in the sense of clitic doubling and "Kosovar" as a term for the Albanian variety spoken in Kosova:

> Also in constructions with a double accusative object there are remarkable differences between Kosovar and Albanian. Speakers of Kosovar do not use proclitic pronouns in the same way as the Albanians do. On the other hand, constructions with double accusative object are used in Kosova in contexts where in Albania simple accusative objects are used.

Përnaska (2012) goes so far as to contend that Albanian, in general, shows the tendency to generalize clitic doubling, although this tendency is most evident in Northeast Gheg, especially the varieties spoken in Kosova.

The evidence which has been brought up so far allows for the assumption that the disparity is particularly striking between Albanian dialects spoken in today's Republic of Albania and those spoken in Kosova (Pani 2006; Përnaska 2012) and West Macedonia (Friedman 2008). Despite this evidence, down to the present, there have been no large-scale corpus-based analyses on the functional variation of clitic doubling between Albanian dialects.

3 Clitic doubling in Albanian dialects

3.1 Overview of Albanian dialects and the corpus

Figure 5 shows the territory in question and the Albanian dialects which are spoken today. The dialect map in Figure 5 is based on classifications as we find them in the current literature of Albanian dialectology, such as Gjinari & Shkurtaj (2000). On top of this classification, we will consider national borders, which leads to the division of some dialect areas into separate subareas, cf. table Table 3, Version A.

Gheg
(1) Northeast Gheg (NEG)
(2) Northwest Gheg (NWG)
(3) Central Gheg (CG)
(4) South Gheg (SG)
(5) Transitional dialects
Tosk
(6) North Tosk (NT)
(7) Lab/South Tosk (ST)
(8) Cham Tosk (CT)

Figure 5: Dialects of modern Albanian (http://dialects.albanianlanguage.net/)

A great many of dialect descriptions[5] provide transcriptions of spoken language material in the form of monologues, narratives, riddles etc., which lend themselves to quantitative corpus analyses. Similarly, the Albanian folkloristic literature[6] offers an extensive amount of narratives written in the dialect of the region they originate from. On the basis of samples from these two sources a small dialect corpus was compiled consisting of approximately 67,000 tokens and 3590 transitive clauses and covering 69 regions in the territory where Albanian is spoken, cf. Figure 6.

The available data is unequally distributed across the whole area in question, cf. Table 3, Version A. As can be clearly seen, very little data is available for some of the subareas that are not suitable for quantitative analysis. Since the corpus is relatively small overall for a quantitative analysis, the subareas Albania_CT and Albania_ST are grouped together into Albania_ST as well as the subareas Macedonia_NEG, Se_NEG and Kosova_NEG are grouped together into Kosova_NEG, resulting in Table 3, Version B; this second classification is used for the subsequent quantitative analyses. This approach is supported by the fact that the

[5]The dialectological sources which were consulted to compile the corpus: Ahmetaj (1989); Basha (1984); Beci (1974; 1982); Frano Luli (1975); Gecaj (2005); Gjinari & Shkurtaj (2000); Gosturani (1975; 1982); Keshi (2005); Lafe (1964); Mulaku (2005); Shefqet Hoxha (1975); Shkurtaj (1967; 1974; 1975; 1982); Topalli (1974)

[6]The folkloristic sources which were consulted to compile the corpus: Panajoti et al. (1988); Çetta (1982)

Table 3: Number of transitive clauses for each subdialect (dialect samples of Albanian dialects spoken in Greece are missing).

Version A

	Albania	Kosova	Serbia	Macedonia	Montenegro	Total
NEG	261	304	80	90		735
NWG	405	91			366	862
CG	391			260		651
SG	538					538
NT	360			224		584
ST	176					176
CT	44					44
Total	2175	395	80	574	366	3590

Version B

	Albania	Kosova	Macedonia	Montenegro	Total
NEG	261	474			735
NWG	405	91		366	862
CG	391		260		651
SG	538				538
NT	360		224		584
ST	220				220
Total	2175	565	484	366	3590

subareas Albania_CT, Albania_ST and Macedonia_NEG, Se_NEG and Kosova_-NEG show a comparable usage frequency of clitic doubling, despite the fact that it is obviously incorrect from a geopolitical point of view to make this grouping.

Not all available material could be included in the corpus for quantitative analyses. In the work at hand additional material was consulted for illustrative purposes if the corpus lacked language examples. Furthermore, the corpus contains exclusively dialect material. Standard Albanian data are missing resulting in a lack of comparative data which would have been useful to assess to which degree the respective varieties deviate from the Standard variety on a quantitative scale. Thus, the data on South and North Tosk spoken in Albania (i.e. the subareas Albania_NT and Albania_ST in Table 3, Version B) will be employed instead.

Figure 6: Regions covered by the dialect corpus.

This approach is legitimate in so far as the Albanian standard variety is based for the most part on the South Albanian dialect so that no considerable differences vis-à-vis the Standard variety are to be expected.

3.2 Clitic doubling from the perspective of functional transparency

The fastest and most intuitive approach to assess the degree of grammaticalization of clitic doubling is to measure its frequency in general. Such an approach requires that all objects be extracted, irrespective of the semantic and morphological properties, and are checked as to whether they undergo clitic doubling or not. Bare indefinites as well as the ʻallʼ-quantifiers *gjithë* and *tërë* were not included in the analysis since no variation could be detected vis-á-vis Standard Albanian (cf. section 2.2). On the other hand, novel indefinite pronouns, such as in (10) and (11), do show differences which is why they were included in the following analysis.

Figure 7 shows the ratio of doubled to non-doubled objects for each dialect area, irrespective of the countries they are spoken in, as described in Table 3, Version B.

In general, the frequency pattern in Figure 7 corroborates the existence of an

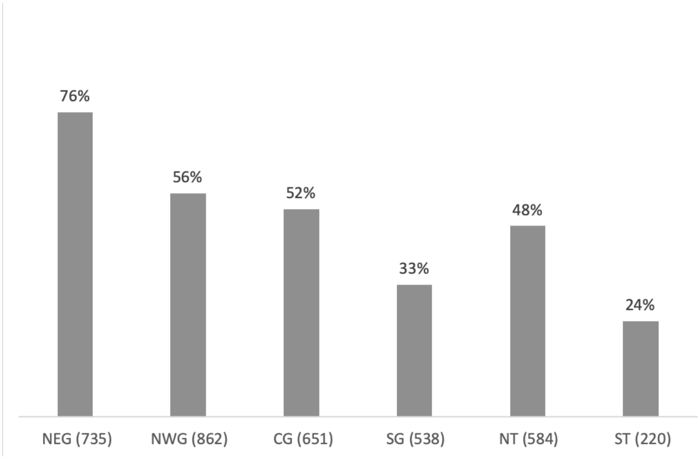

Figure 7: Frequency of clitic doubling in Albanian dialects. The bar charts display relative frequencies of clitic doubling in each dialect area. The number in brackets next to the abbreviation for the dialect area shows the absolute total number of cases of accusative objects for that specific area.

increasing frequency of clitic doubling towards the North of the Albanian speaking territory (Curtis 2012: 310). This picture would be immaculate if it was not for the high frequency of clitic doubling in North Tosk (52 %), which comes as a surprise and does not correspond to the overall areal tendency. A tentative explanation can be found when the same frequency analysis is applied on the areas as defined in Table 3, Version B, i.e. considering also the countries the respective dialects are spoken in (cf. fig. 8).

After including the second classification parameter, i.e. national borders, the areal development of clitic doubling is shown from a completely different perspective: it suggests that the frequency of clitic doubling is to a lesser extent dependent on the dialectal affiliation and/or the geographical area (North vs. South). Of central importance appears to be the division into centre and periphery which, more or less, corresponds to the national separation into a) dialects spoken within the Republic of Albania and b) dialects spoken in countries of former Yugoslavia (Kosova, Macedonia, Montenegro, Serbia). While North Albanian dialects within Albania, especially Northeast Gheg, also show a tendency to make more use of clitic doubling, an actual abundance of clitic doubled objects is noticeable only for the dialects spoken outside of Albania. This becomes most obvious when one compares the areas in Albania and Macedonia where North Tosk dialects are spoken (Albania: 33 % vs. Macedonia: 72 %). However, it must

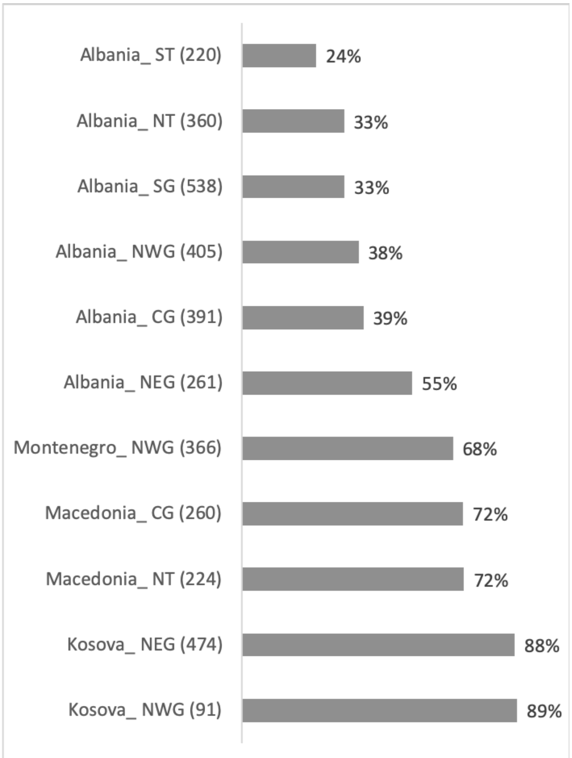

Figure 8: Frequency of clitic doubling in Albanian dialects considering the countries they are spoken in. The bar charts display relative frequencies of clitic doubling in each dialect area. The number in brackets next to the abbreviation for the dialect area shows the absolute total number of cases of accusative objects for that specific area.

be emphasized that the rather small amount of data and sparse coverage of the speaking territory requires further studies on the basis of larger amounts of data and focusing especially on the areas along today's national borders in order to assess the influence of these borders.

Such apparent differences in frequency usually go along with functional differences and require more elaborate analyses, ideally capturing aspects of information structure. However, annotating corpora on the level of information structures has proven to be a cumbersome and error-prone task. Instead, I will draw indirect conclusions on the basis of robust morphological and lexical criteria. According to the introductory remarks in section 1, we arrive at the trivial, yet helpful for the purpose at hand, conclusion that there is a strong tendency for arguments which are given to be also morphologically definite, topicalized and not focused, while newly introduced arguments are usually morphologically indefinite, not topicalized and within the focus domain. What is more, we can state that subjects are better candidates to be topic than objects, which subsequently leads to the conclusion that on a quantitative scale objects commonly tend not to be doubled, which has proven to be correct for most dialect spoken in Albania and especially for Tosk, cf. Figure 7. Lastly, I contend that pronouns outrank nouns within the referentiality hierarchy, i.e. indefinite pronouns are rated lower than indefinite nouns (for example: *whom* vs. *a man*) and definite pronouns are rated higher than definite nouns (*him* vs. *the man*).

This correlation between definiteness and topic acceptability allows for the sketching of clitic doubling frequency patterns along a morpho-lexical definiteness hierarchy, cf. Table 4. The classification made here is based on purely morphological and lexical criteria and does not claim to be complete. Thus, for example, the category "indefinite pronouns" also includes pronouns that, strictly speaking, do not qualify as such, such as in (12). Nevertheless, an additional division of the four classes would lead to an unnecessary complexification and not serve the purpose of the hierarchy, which is to describe general areal tendencies regarding the usage of clitic doubling on a quantitative scale and to compare these findings with the descriptions we find in the current literature on Albanian and other Balkan languages.

Table 4: Morpho-lexical definiteness hierarchy.

1. definite pronouns (prop_def)		
2. definite nouns (np_indef)	↑	Increasing frequency of clitic doubling
3. indefinite nouns (np_indef)		
4. indefinite pronouns (prop_indef)		

The underlying assumption is that clitic doubling would increase along this hierarchy which is confirmed by the results of the corpus analysis for the regions Albania_NT and Albania_ST (≈ Standard Albanian), cf. Figure 9.

As the figure shows: clitic doubling mostly occurs in association with definite objects. Despite this strong tendency, definiteness cannot be judged as the decisive factor for clitic doubling, otherwise a higher percentage of doubled definite objects would be expected. Table 5 displays the usage pattern of clitic doubling for each of the subareas as described in Table 3, Version B along the same morphosyntactic definiteness hierarchy.

Of particular interest remain the areas outside the Republic of Albania. The

Table 5: Frequency of clitic doubling along a morpho-lexical definiteness hierarchy in Albanian dialects, where n_{cd} is the number of cases with clitic doubling and n_{ao} is the total number of accusative objects.

Dialect regions	prop_indef n_{cd}	prop_indef n_{ao}	np_indef n_{cd}	np_indef n_{ao}	np_def n_{cd}	np_def n_{ao}	prop_def n_{cd}	prop_def n_{ao}
Albania_CG	1 (6%)	16	12 (13%)	93	137 (51%)	269	4 (31%)	13
Albania_NEG	1 (8%)	13	23 (55%)	42	112 (57%)	197	8 (89%)	9
Albania_NT	0 (0%)	24	5 (5%)	93	100 (44%)	226	14 (82%)	17
Albania_NWG	1 (3%)	32	14 (16%)	87	131 (48%)	275	7 (64%)	11
Albania_SG	0 (0%)	34	9 (6%)	152	150 (47%)	322	20 (67%)	30
Albania_ST	1 (5%)	31	1 (2%)	58	48 (38%)	128	3 (23%)	13
Kosova_NEG	2 (5%)	38	85 (90%)	94	321 (97%)	332	10 (100%)	10
Kosova_NWG	0 (0%)	9	7 (100%)	7	69 (99%)	70	5 (100%)	5
Macedonia_CG	0 (0%)	22	21 (35%)	60	161 (93%)	174	4 (100%)	4
Macedonia_NT	1 (5%)	20	3 (9%)	33	142 (92%)	154	15 (88%)	17
Montenegro_NWG	1 (4%)	28	67 (69%)	97	173 (75%)	230	9 (82%)	11

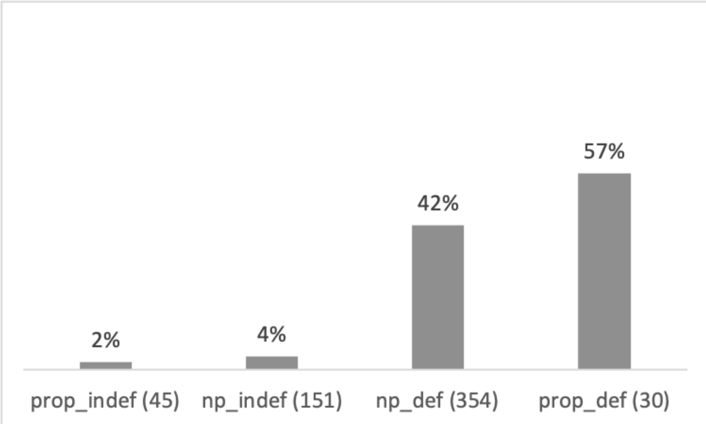

Figure 9: Frequency of clitic doubling in the regions Albania_NT and Albania_ST along the morpho-lexical definiteness. The bar charts display relative frequencies of clitic doubling. The number in brackets shows the absolute total number of cases of accusative objects.

patterns allow for positing grammaticalization along the morpho-syntactic definiteness scale: first, clitic doubling will become almost obligatory with definite pronominal objects, a process that is already in progress for some varieties in North Albania. Then definite nominal objects will follow as the main trigger of clitic doubling while still excluding most indefinite nominals, a stage that has been reached especially in Southwest Macedonia. Subsequently, instances of doubled indefinite nominal objects will become more common, as it is the case in Northwest Macedonia. Eventually, the majority of indefinite nominals will undergo clitic doubling in almost any context, a stage that has been reached in Montenegro and, even more so, in Kosova. Novel indefinite pronominal objects, however, remain very resistant to clitic doubling.

It is important to stress that Table 5 displays a continuous grammaticalization path and that exceptions from the general tendencies do occur in all of the areas in question. In the following, the Albanian speaking territories of Montenegro, Macedonia and Kosova will be subject to a cursory examination from a functional perspective. The leading question will be whether the higher degree of grammaticalization and frequency of clitic doubling in these areas can be viewed as a higher degree of functional transparency.

The entire region of Montenegro appears to be most opaque regarding the functional motivation of clitic doubling. On the one hand, the dense occurrence of clitic doubling shows a clear development towards a loss of any pragmatic, morphological or semantic restrictions whatsoever, a pattern that comes close to the situation we find in Kosova. This is, however, inconsistent with the relatively high number of exceptions: while most indefinite and definite nominals are doubled, a relatively large number of them is not. See, for instance, example (13), which presents the beginning of a story: The first object (*i djalë* 'a son') is not doubled which is less surprising as it is has the feature matrix [-given, -definite, -topic, +focus] and corresponds to the pattern of Standard Albanian. Note, however, that in the subsequent part of the introduction all other instances of an object undergo clitic doubling independent of whether they are [+given/-given], [+def/-def], [+topic/-topic], [+focus/-focus].

(13) Northwest Gheg (Montenegro; 42.44626, 19.4564)
Â' kenë i nanë e ka pa' i djalë. Ajo â' kenë fukara e e ka çuo djalin rrogtar për me mujë me jetuo. Djali â' kenë qiros edhe ka tejë tu 'i zotni rrogtar. 'I ditë prej ditsh djali â' ba me do fmi e kanë luoj bashkë. Njari prej asi fmísh e ka pa' i kapicë ën krye. Qirosi i ka lakmuo kapicës edhe prej atyt shkon fill tu nana e vet e i thotë: - Me ma ble 'i kapicë! Nana i përgjégj: - Ta ka pa' lanë baba 'i kapicë, por po ta gjêj.
'Once upon a time there was a mother and she ∅ had a son. She was poor and CL sent her son as a day labourer so that they would survive. The boy was bald and stayed with a lord as a day labourer. One day the boy gathered with some children and they played together. One of the children CL had a hat on his head. The bald boy also wanted such a hat and went from there to his mother and said: "Buy CL me a hat!". The mother answers him: "Your father CL left you a hat, I will find it for you".'

Especially in need of explanation are undoubled definite nouns. Later on, in the same story, a magic flute is introduced and doubled when it is mentioned the first time, cf. (14). The flute plays an important role in the subsequent part of the story (as it empowers the boy to summon a large army whenever he likes) and, therefore, is mentioned several times in the storyline. Nevertheless, in example (15) when a reference is made to the "story behind the flute" (*punën e fellit*) the respective object is not doubled.

(14) Northwest Gheg (Montenegro; 42.44626, 19.4564)
I ditë prej ditsh bâhet me çobana e ja sheh njaj çobanit fellin tye i ra. Prap shkon e i thotë nanës: - Nanë, me ma ble 'i fyell! Nana i përgjégj: - Qiroso, Qiroso, ma prune punën gusht! Ta ka pa lanë baba 'i dreq fellit, por ruoju,

se ke me ja pa sherrin! Çohet nana, ja gjê e ja nep fellin.

'One day he gathers with some shepherds and CL sees the flute of a shepherd and him playing with it. Again he goes to his mother and says to her: "Mother, buy CL me a flute". "My boy, you really put me in a difficult position! Your father CL left you a damn flute, but be careful because it will cause you many more problems!" She gets up, finds it for him and CL gives him the flute.'

(15) Northwest Gheg (Montenegro; 42.44626, 19.4564)
- Si â' kjo punë e ç' fuqi ke ti qi e ke gjidh këtushtri? Qirosi, si budallë, i kalzon e i thotë: - Tash me da' û' , tanë kta periherë i tres mos m' u duktë ma. Bija e mretit e bvét: - Si muç ti m' e ba ata? Ky i kuvet krejtsisht punën e fellit.

'"What's going on and what power do you have that you have this whole army?" The boy, stupid as he was, tells her: "Now, if I want, I could make the whole army disappear, as if it had never been there". The king's daughter asks him: "How can you do that?" He ∅ tells her in great detail the story behind the flute.'

The pragmatic status of the undoubled objects in example (13) and (15) allow us to draw on factors, such as focus or givenness, in order to explain the absence of the clitic. Such a solution is not satisfactory in as much as it fails to provide a holistic explanation of the usage of clitics in this variety. The scattered instances of clitic omission rather suggest that in the area in question clitic doubling is the default case in association with indefinite nominal and definite nominal and pronominal objects and may be left out facultatively for contrastive or focussing purposes.

Moving on the region of West Macedonia, the overall pattern appears to be more transparent. Table 5 shows that irrespective of the dialectological classification, i.e. Gheg vs. Tosk variety, in West Macedonia the tendency to almost exclusively double definite objects prevails. This tendency is somewhat stronger in the Southwest area than in the Northwest area where clitic doubling of indefinite objects is more common. In addition, cases with an undoubled definite object are recorded as well. This leads to the intricate question of how to account for these cases which clearly deviate from the overall pattern. Additional factors, alongside definiteness, such as specificity, focus or contrast, have been brought up in the current literature on clitic doubling in Macedonian, the main contact language (cf. for example Friedman 2008) which shows similar tendencies to double exclusively definite objects. While some cases, such as (16), clearly suggest contrast, alongside focus, as an important co-factor which prohibits clitic doubling in combination with definite objects, others are harder to account for, such as (17): the object *një plakë* 'an old woman' is doubled despite being [-given, -definite, -topic, +focus]. A possible explanation could be found if the referent is viewed as being *specific*. Drawing on specificity is also corroborated by example (18) which is comparable to (17): the first mentioning of *ni qakë* 'an old woman' [-given, -definite, -topic, +focus] is not doubled and, therefore, adheres to the general areal tendency. However, the second instance of the same phrase *ni qakë* 'an old woman' undergoes clitic doubling despite having the same features [-given, -definite, -topic, +focus]. One possible explanation would be to view the first instance as [-specific], as it does not make any reference to a specific person in the story, and the second as [+specific] since it refers to a specific person in the story.

(16) Central Gheg (Macedonia; 42.03503, 20.9161)

Gje	*kërkojshe*	*shatkën,*	*sot*	*kërkojshe*	*shatokin*
yesterday	want.IMP.2SG	duck.ACC.DEF	today	want.IMP.2SG	drake.ACC.DEF

'Yesterday you ∅ asked for the duck, today you ∅ asked for the drake.'

(17) North Tosk (Macedonia; 41.09028, 21.01325)

oxha ja vuri synë kësaj // po kjo mazalla s' e deshte // si t' ja bëjë ?! e thiri një plakë t' ia ndreqë punën // plaka tha : unë do ta regulloj që të marë // plaka mori një perusti dhe e vuri tersëne // çupa i thotë : moj plakë / nuku viet ashtu perustija / po ndryshe viet // po nuku di // zbrit e më trego //

'the Imam had an eye on her [the girl] // but she didn't want anything from him // what should he do now ?! he CL called an old woman to settle the matter for him // the old woman said: I'll make sure she takes you // the old woman took a tripod and puts it upside down // the girl says : you there / you don't put a tripod up like this // I don't know // come down and show me //'

(18) Central Gheg (Macedonia; 41.23853, 20.64221)

Hajduti i porosojti : Çitni ni qakë t' lipe vjom devje n' at mahallë ku u vdir devja , se ai deven e ka therrë ! E qaka, kur t' dale ne ta boe derën pagës me vjom! Mbasandoj ju shkoni bastojsni ! E çesin ni qakë . Qaka i merr shpojt me rent.

'The thief told them, "∅ Send an old woman to beg for camel fat in the area where the camel disappeared, because he [the other thief] slaughtered the camel already! And the woman, when she goes out of the house again, let her mark the front door with camel fat! Then you can search the house!" They CL send an old woman out. The old woman takes the houses one by one.'

While the argumentation above seems coherent, one cannot get around the fact that such explanations always bear a certain amount of vagueness and posit a certain degree of arbitrariness and optionality. In any case, drawing on specificity cannot explain the lack of clitic doubling in (19), as there is no reason why the referent *një çupë* 'a daughter', the main figure in the story, should not be regarded as being [+specific].

(19) North Tosk (Macedonia; 40.8876, 21.31207)
qënka një plak edhe një plakë / kanë edhe një çupë //
be.PRS.ADM.3SG a old_woman and a old_man have.PRS.3PL also a daughter
'once upon a time there was an old woman and an old man / they ∅ had also a daughter'

It should be emphasised that the entire Albanian-speaking territory of Macedonia poses another difficulty, its dialectological heterogeneity. A more fragmented division of the area into a Northern, central and Southern part would do more justice to the increasing frequency of clitic doubling towards the North where the varieties are actually (transitional to) Northeast Gheg and feature a similarly high frequency of clitic doubling as in the Albanian varieties of Kosova. It is also Northwest Macedonia where we find a case with a doubled indefinite pronoun *kërkân* 'no one', cf. (20). Note that Friedman (2006) proved the existence of such cases in Slavic dialects of Northern Macedonia, as well.

(20) Northeast Gheg (Macedonia; 42.16205, 21.61688)
ama kërkân s' un p' e zanë tu vedhë
but no_one.ACC NEG can PROG CL.ACC.3SG catch.PRS.3PL GER steal.PTCP
'but he couldn't CL catch anyone stealing'

The varieties in Kosova, both Northeast and Northwest Gheg, show a higher degree of homogeneity regarding the usage pattern of clitic doubling which is subject to barely any pragmatic or morphological restrictions whatsoever. While the overall picture is reminiscent of the findings on Albanian dialects in the Montenegrin area, the usage of clitic doubling is more pervasive and fewer exceptions occur. Most objects without clitic doubling fall under the category of indefinite pronouns, the majority of them interrogative pronouns, and only sporadic instances of undoubled nominals can be found, cf. example (21), where the interrogative pronoun *kâ* 'whom' is not doubled.

(21) Northwest Gheg (Kosova; 42.73953, 20.05389)
Kâ po pret ktu?
whom PROG wait.PRS.2SG here
'Whom are you ∅ awaiting here?'

Note, however, that in view of example (20) from North Macedonia, one should actually expect clitic doubling in example (21). In the analysis, no distinction was made between interrogative pronouns and indefinite pronouns as they mostly do not differ in their form in Albanian and share similar features regarding their degree of definiteness and givenness. In this context, it must be stated, that example (20) is marked as it contains a genuine indefinite pronoun in a left-dislocation, in contrast to example (21) which contains an interrogative pronoun, whose initial position is predefined and not marked in any way. Left-dislocated objects are notoriously associated with topicalization and thus predisposed for clitic doubling (Friedman 2008: 40). In order to draw direct comparisons other examples of left-dislocated indefinite pronouns are required. Unfortunately, these cases are very rare in the corpus used so far for quantitative comparisons. Thus, additional material from the folkloristic literature from the region of Drenica in central Kosova (hereafter called Drenica corpus) was searched manually. The search unveiled other cases of left-dislocated indefinite pronouns; clitic doubling occurred in two of them, cf. (22) (23). Nevertheless, not all instances of left-dislocation indefinite pronouns are doubled, cf. (24).

(22) Northeast Gheg (Kosova; 42.52, 20.85527 (Drenica corpus))
Pos teje qeterkan për nafakë nuk e due.
except_for you no_one.ACC for fate NEG CL.ACC.3SG want.PRS.1SG
'No one else I CL want as my husband except for you.'

(23) Northeast Gheg (Kosova; 42.52, 20.85527 (Drenica corpus))
Une qetërkân për nafakë nuk e due vetëm ktâ
I no_one.ACC for fate NEG CL.ACC.3SG want.PRS.1SG only him
'No one else I CL want as my husband, only him.'

(24) Northwest Gheg (Kosova; 42.73953, 20.05389)
Tjetër gjâ s' folën motrat.
other thing.ACC NEG speak.AOR.3PL sister.NOM.PL.DEF
'something else the sisters didn't ∅ speak'

The fact that all three cases (20), (22) and (23) with clitic doubled indefinite pronouns are [+human] deserves attention and raises the question whether the additional semantic factor [+human/-human] must be considered. Against this background the following excerpts from newspaper articles extracted from the Albanian National Corpus[7] may be classified as evidence for an ongoing grammaticalization process towards an obligatory clitic doubling of indefinite pronouns which are [+human]:

(25) Kosova sot[8]
Ja kë e falënderon e kë e shan
here whom CL.ACC.3SG thank.PRS.3SG and whom CL.ACC.3SG scold.PRS.3SG
M. Z.
M. Z.
'One can tell whom M. Z. CL thanks and whom he CL scolds.'

The sentences above, among many others in the Albanian National Corpus, appeared in newspapers from Kosova. This is remarkable in the sense that the same standard variety is used as the official language in Kosova, Albania and in the Albanian communities of Macedonia. The fact that the authors of the articles were not aware of this redundant use of clitic doubling may serve as an indicator for how far the grammaticalization process has gone in these varieties. Nevertheless, further studies with the aid of larger corpora and/or experiments are required to furnish proof.

The last desideratum that remains is to explain the cases with undoubled indefinite and definite nominals in the Albanian varieties of Kosova, which do not match the overall pattern at all. Their scattered occurrence allows for several different tentative explanations, all of them implying that clitic doubling serves an expressive function, leaving its omission in some cases at the discretion of the speaker. A similar conclusion by drawing on optionality was also made for the region of Montenegro to explain the rather arbitrary cases of clitic omission. One such explanation can be found in Buchholz (1977: 192–193), who contends that

[7] http://web-corpora.net/AlbanianCorpus/search/
[8] https://www.kosova-sot.info/lajme/19663/ndihmohen-femijet-e-drenices-ja-ke-e-falenderon-e-ke-e-shan-milaim-zeka/

the omission of clitic doubling in combination with non-novel definite objects emphasizes a change in the situation. Indeed, some examples with undoubled definite objects describe a turning point, such as (26), where the word order V O S is also marked. Example (27) is "marked" as well, in as much as the respective clause without clitic doubling is embedded in a chain of successive short clauses and therefore conveys a certain degree of dynamicity. Other cases, such as (28), speak in favour of viewing the associate object not as definite, despite its definite affix, but as a component of an incorporation into the verb, since the meaning of the noun-verb-construction is not compositional. Example (29), on the other hand, remains opaque since the object is not only [+given,+topic,+definite,-focus] it is also left-dislocated and therefore expected to undergo clitic doubling.

(26) Northeast Gheg (Drenica corpus;)

Kap	*shtagën*	*baba*	*e*	*shko*	*tu*	*begu*
grab.PRS.3SG	stick.ACC.DEF	father.NOM.DEF	and	go.PRS.3SG	to	bey.NOM.DEF

'The father ∅ takes the stick and goes to the bey.'

(27) Northeast Gheg (Kosova; 42.38441, 20.4285)

Çohet	*/ e*	*kish*	*pas*	*marr*
get_up.PRS.PASS.3SG	CL.ACC.3SG	have.PRS.3SG	have.PTCP	take.PTCP

etja	*// niset*	*për*	*shpi*	*// lyp*
thurst.NOM.DEF	set.off.PRS.PASS.3SG	for	home	look_for.PRS.3SG

kofen	*e*	*bunarit*	*me*	*pi*	*uj*	*//*
bucket.ACC.DEF	ART	well.GEN.DEF	INF	drink.PTCP	water	

kofa	*kërkun*
bucket.NOM.DEF	nowhere

'he stands up / he was thirsty // he heads for home // he ∅ seeks the well bucket to drink water // the bucket was nowhere'

(28) Northeast Gheg (Kosova; 42.38441, 20.4285)

Muer	*dyjênë*	*n'*	*sy*	*Baba Hasani*	*për*	*m'*	*u*
take.AOR.3SG	world.ACC.DEF	in	eye	Baba Hasan	SUPIN	INF	PASS

largue	*pej*	*shpije.*
leave.PTCP	from	house.ABL

'Baba Hasan set off to leave the house.' (Lit. 'Baba Hasan ∅ took the world in his eye to leave the house')

(29) Northwest Gheg (Kosova; 42.73953, 20.05389)

Mreti	*u*	*kallxoi*	: –	*Qeso*	*héshë*	*veç*
kingNOM.DEF	CL.DAT.3PL	tell.AOR.3SG		this_kind_of	food.ABL	only
grueja	*m'*	*goditke!*				
wife.NOM.DEF	CL.DAT.1SG	make.IPF.3SG				

'The king told them: "This kind of food only my wife ∅ made for me".'

4 Concluding remarks

Although peripheral Albanian dialects outside the Republic of Albania feature a higher frequency of clitic doubling than most Albanian dialects spoken in the Republic of Albania, the relatively high number of opaque usage cases does not allow us to view the redundant use of clitic doubling as evidence of a higher degree of functional transparency and, therefore, as a language change for the better. In case of Standard Albanian, most instances of clitic doubling in main clauses allowed for an explanation by defining whether the respective object was [+focus, -topic] or not. While pragmatic notions, such as *topic* or *focus*, prove to be intricate at first glance, once detected they can be applied to explain almost any instance of clitic doubling in Standard Albanian. Even those cases which were deemed exceptions, cf. (9) and (10), were largely compatible with the overall systematicity. In case of the dialects outside Albania, the data allowed for the sketching of an interim and coarse usage pattern along a morpho-lexical definiteness hierarchy which seems neat *prima facie* and suggests more easily detectable factors, to wit *definiteness*.

However, it is all the more difficult to explain cases which do not adhere to this usage pattern. In particular need of explanation are cases with undoubled definite objects. In contrast to Standard Albanian, one must avail of additional factors, such as *topicality*, cf. (20), (22), (23), *contrast*, cf. (16), *specificity*, cf. (17), (18), or even *animacy*, cf. (20), (22), (23), to explain the exceptional cases. What is even more important, the explanations offered in the work at hand are tentative and far from sufficient and do not offer a holistic description. The rather scattered and unsystematic cases of clitic omission in combination with indefinite nominals and definite nominals, especially in Albanian varieties spoken in Montenegro and Kosova, and the difficulties to pin down clear factors suggest a certain degree of optionality, which is not given in Standard Albanian and presumably in the majority of varieties spoken in the Republic of Albania. Thus, from a descriptive point of view, with the claim of finding regularities with a great amount of certainty, optionality can be regarded as an indicator of a higher degree of functional opaqueness.

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Chapter 6

Who needs posterior infinitives?

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In functional-typological as well as generative frameworks the notions of finiteness and tense have become more and more detached from each other over the past decades, especially if tense is understood in the broad sense of 'temporal relations'. Thus, temporally marked non-finites do not come as a surprise anymore. However, non-finites expressing anteriority seem to be much less surprising than non-finites expressing posteriority. Indeed, the latter appear to be considerably rarer than the former. Why should that be? The most straightforward version of a functional answer to this question seems to be: because we don't need such forms. The present paper sets out to show that things are not that simple, drawing on an example from German.

1 Introduction

Traditionally, finiteness has been defined as a contingent property of verbs, viz. being marked for tense and person (Nikolaeva 2007: 1). However, this definition has become more and more difficult to maintain in functional-typological as well as generative frameworks (cf. the recent overview by Eide 2016). Proponents of the former were aware early on that neither tense nor person (or agreement, for that matter) were universal categories, which eventually resulted in a gradual notion of finiteness, pertaining to clauses (e.g., Givón 1990: 852–864). Proponents of the latter departed from the tradition in making finiteness an essentially syntactic notion, hence also pertaining to clauses (e.g., Ritter & Wiltschko 2014). So across theories, tense and agreement have been downgraded to non-necessary ingredients of finiteness, the first of which will be focussed on in the present paper.

Tabea Reiner. 2020. Who needs posterior infinitives? In Dankmar Enke, Larry Hyman, Johanna Nichols, Guido Seiler & Thilo Weber (eds.), *Language Change for the Worse*, 145–182. Berlin: Language Science Press. DOI: ??

If finiteness can do without tense, then tense can do without finiteness. That is, we expect to find non-finites showing temporal marking –and indeed, we do. Consider examples (1) and (2).

(1) Ancient Greek (Indo-European, Kavčič 2016: 268)

ἅ	*φησι*	*δρᾶσαι*
what.ACC.PL	say.3SG.PRES	do.AOR.INF
αὐτὸν	*Ἡσίοδος*	
him.ACC	Hesiod	

'what Hesiod says that he did' (Plato, *Resp*. 277e8)

(2) Ancient Greek (Indo-European, Kavčič 2016: 268)

ἐγὼ	*δ'*	*ἡγοῦμαι*	*βέλτιστα*
I	but	think.1SG.PRES	best.ADV
σε	*πράξειν*		
you.ACC	do.FUT.INF		

'But I think that you will do it best.' (Isoc. 12.249)

According to Kavčič (2016: 268), the infinitive in 1 refers to anteriority, whereas the one in 2 refers to posteriority. I interpret these terms in an adapted Kleinian framework (Klein 1994; Reiner 2019: 305) to mean the following:

finite:	having a meaning with TSit and TT
non-finite:	having a meaning with TSit but without TT
infinitive:	form having a meaning with TSit but without TT
anteriority:	TSit before TX
posteriority:	TSit after TX,

where TSit is the time of situation, TT is the topic time (= time for which a claim is made), and TX is some specific time. Following Klein I remain agnostic as to whether these times are spans or points. Crucially, TX may but need not coincide with either TU (time of utterance) or the matrix verb' s TT. In particular, the infinitival situation is not claimed to be real by the current speaker.

These terms can now be applied to example 1. The infinitive' s TSit is located before TX and the latter presumably coincides with both TU and the matrix verb' s TT. Thus, the doing is before the time for which the current speaker claims the saying, but he does not claim the doing. Since the relation is 'before' (not: 'extending to') the example has been rendered by an English simple past instead of a present perfect. Example 2 is analysed mirror-invertedly (here, the current speaker happens to quote himself, though).

In this sense, we are dealing with TEMPORAL RELATIONS. Ancient Greek is special in displaying both kinds of temporally marked infinitives (at least in indirect speech): anterior ones as well as posterior ones. Compare this to English, where the structure of 1 might be mimicked by 3, while the structure of 2 can hardly be replicated, as witnessed by 4.

(3) what Hesiod says to have done

(4) *But I consider you to will do it best.

This seems to be a very common situation in languages: there is something like an infinitive of anteriority, though arguably interfering with perfect, but no infinitive of posteriority. Is this impression accurate?

Starting from the (albeit arguable) assumption that infinitives of anteriority are indeed run-of-the-mill, I searched grammars specifically for infinitives of posteriority. In more detail, I went through a random subsample of the 318 languages in Velupillai's (2016) areally and genetically balanced sample. In each of her alphabetically ordered sections "[languages with] two tenses" and "[languages with] three tenses" I took the first five languages that had at least a past/future contrast and checked the corresponding sources for infinitives marking anteriority and posteriority, respectively. These languages were: Betoi, Blackfoot, Cavineña, Chinantec/Lealao, Ilocano (each two tenses) and Aklan, Akoye, Alawa, Albanian, Ama (each three tenses). In addition, I repeated the procedure for all languages in the section "[languages with] one tense", where the source was readily available and that one tense was future.[1] These languages were: Bao'an Tu, Esselen, West Greenlandic, San Francisco del Mar Huave, Javanese, Kanamarí, Koyra Chiini, Krongo, Kunama, Kuteb, Navajo, Nii, Oneida, Spokane, Takelma, Thai. In order not to miss something obvious, I also included Livonian (Norvik 2015) and Mari (Alhoniemi 1993) as languages from the Finno-Ugric family, whose members are quite famous for having "a rich non-finite verb system" (Ross et al. 2010). On

[1] Crucially, Velupillai's definition of tense does not require markers to be obligatory, thus one-tense systems are possible (Velupillai 2016: 94 – 95; 117). Otherwise, the absence of a marker (or its allomorphs) for tense value x would imply absence of x in the concept-to-be-expressed, hence establishing a two tense system with overtly marked x and zero marked non-x (also cf. Bybee 1997: 33–34

similar grounds I added Turkish with its diverse options for verbal embeddings (Kornfilt 2007) to my mini sample.

Thus, the mini sample consists of 29 languages and is consciously biased towards infinitives of posteriority. Since the latter were defined largely in a semantic way above (forms meaning 'TSit after TX', not involving TT), instances had often to be searched manually in the sources, i.e. by checking a great number of examples, usually far beyond the pages given by Velupillai. As heuristic strategies, I excluded forms with consistently more-than-temporal meanings (Dahl 1985: 10; Dahl 1985: 23) as well as forms embedded directly below complementiser-like elements, which I treated as an indication for TT (following Klein 1994: 219–220). Moreover, I had to rely heavily on glosses and translations.

As a result, five candidates for infinitives of posteriority remained, most of which, however, come with certain problems to be explained below.

Maybe the most obvious candidate is from Turkish, which seems to replicate almost exactly the Ancient Greek structure:

(5) Turkish (Turkic, Kornfilt 2007: 312)
[Sen-i sınav-ı geç-ti] san-ıyor-um
you-ACC test-ACC pass-PST believe-PRSPR-1SG
'I believe you to have passed the test.'

(6) Turkish (Turkic, Kornfilt 2007: 312)
[Seni-i sınav-ı geç-ecek] san-ıyor-um
you-ACC test-ACC pass-FUT believe-PRSPR-1SG
'I believe you to pass the test (in the future).'

In 6, the addressee' s passing of the test appears not to be claimed directly (hence no TT) but it is situated after some specific time (hence TSit after TX). The absence of TT becomes even clearer in the following example.

(7) Turkish (Turkic, Kornfilt 2018: 557)
Herkes [ben-i üniversite-ye başla-yacak] san-ıyor
everybody I-ACC university-DAT start-FUT believe-PRSPR
'Everybody believes me to be starting university.'

Please note that according to the largely semantic definitions used here it does not matter whether or not our examples involve the Turkish infinitive suffix *-mAK* (Kornfilt 1997: 392), as long as the forms (*geç-ecek* and *başla-yacak*) convey the relevant meaning. In sum, Turkish seems to provide unambiguous and unproblematic examples for infinitives of posteriority. Next, consider Thai:

(8) Thai (Tai, Hudak 1987: 772; Hudak 2018: 692)
phǒm mây yàak cà rian wíchaa nán
I not want.to will study subject that
'I don't want to study that subject.'

Semantically, this example appears to be as clear as the Turkish ones: the studying is not claimed to be the case (no TT) but situated after some specific time (TSit after TX). Formally, however, one may dispute whether *cà rian* should count as one form (hence being able to meet the definition of infinitive given above). A similar problem holds for Koyra Chiini:

(9) Koyra Chiini (Nilo-Saharan, Mali; Heath 1999: 164)
a yee-kate ka ta filla [ŋgu goy di]
3.SG.S return-CENTRIP INF FUT repeat 3.REFL.SG work DEF
'He has come back to repeat (=continue) his work.'

Moreover, *ka ta* is not only non-obligatory (Heath 1999: 163) –which is compatible with the definitions used here –but "fairly rare" (Heath 1999: 164). In fact, Heath (1999: 311) gives various parallel examples without *ta* (numbers (592) c, d, g there). Likewise, *ta* can but not always does mark pure posteriority (or future, which I take to be posteriority relative to TU): it is also associated with "diffuse potentiality" as well as "irrealis" (Heath 1999: 163). So, in addition to sparse attestation, the question remains which meaning is at stake in example 9. Maybe the most intricate examples for a potential infinitive of posteriority come from West Greenlandic:

(10) West Greenlandic (Eskimo-Aleut, Fortescue 1984: 276) [2]
palli-ssa-llu-gu nangaa-vu-q
approach-FUT-CT-3SG.O.CT hesitate-INTR-3SG
'He hesitated to approach her.'

(11) West Greenlandic (Eskimo-Aleut, Fortescue 1984: 276)
niriursui-vu-nga aqagu urni-ssa-llu-tit
promise-INTR-1SG tomorrow come_to.FUT-CT-2SG.O.CT
'I promise to come to you tomorrow.'

[2] The contemporative mood seems to mark converbphrases (cf. Haspelmath 1995: 3). So a more (but not quite) literal translation of the first example could be: 'He hesitated before his approaching her'.

The relevant meaning (TSit after TX, no TT) seems to be present and *palli-ssa-llu-gu* / *urni-ssa-llu-tit* are generally considered word forms (but cf. Haspelmath 2018). Neither is it a problem that the CT-forms are not infinitives in a more traditional sense than the one chosen here. However, there is no consensus that *-ssa-* as such actually expresses anything temporal at all (Bittner 2005). As a last candidate for an infinitive of posteriority consider an example from Nii:

(12) Nii (Trans New Guinea, PNG, Stucky & Stucky 1976: 80)
si-mba e-ner-im
take-3.FUT do-NEG-3.COMPL
'He is not about to take (it).'

By all criteria this seems to be a pertinent example; however, Stucky & Stucky (1976) give considerably less semantic information than for example Heath, so I do not dare draw any definite conclusions. In total, I take the yield from my mini sample to be sufficiently poor to uphold the hypothesis that infinitives of posteriority are much rarer than are infinitives of anteriority.

Still, another strategy for identifying languages with an infinitive of posteriority might consist in picking retrospective languages in the sense of Ultan (1978) – possibly, for those languages, the picture is reversed and we find hardly any infinitives of anteriority but good candidates for infinitives of posteriority. However, the random sample above already includes at least three potentially retrospective languages (Aklan, Blackfoot, Spokane – if not all languages with only future tense) and those mentioned by Ultan (1978) also seem to lack infinitives of posteriority, maybe partly due to not having infinitives in any sense at all: Dakota (Boas & Deloria 1976 [1941]: 105, 156) [3] , Guaraní (Gregores & Suárez 1967), Hopi (Masayesva-Jeanne 1978, Hill & Black 1998), Onondaga (Barrie 2015, Woodbury 2018), Rotuman (Churchward 1940), and Tairora (Vincent 1973, especially p. 577; McKaughan 1973).

In view of all the data presented so far, I stick with the view that infinitives of posteriority are scarce in comparison to infinitives of anteriority. However, a more comprehensive survey on these phenomena definitely constitutes a desideratum.

As an aside, the asymmetry might be accompanied by a second one, i.e. one between infinitives of posteriority and future tenses: the latter abound, judging from Velupillai (2016). However, there is a risk that Velupillai's results have been

[3] Admittedly, there is relative tense; however, provided that relative tense involves TT (not just TSit and TX), it is fundamentally different from temporally marked infinitives as defined here. The same holds for Rotuman (Churchward 1940: 23).

skewed by the peculiarities of grammar writing: authors tend to distinguish very carefully past tenses form various aspects, whereas futures are rarely separated from prospective aspects (another danger to the candidates presented above). Thus, a number of futures in the survey might not be futures after all, for example in Kunama as documented by Böhm (1984) [4]. Therefore, I will ignore the second (potential) asymmetry and focus on the first one: there appear to be much more languages and much more contexts that allow infinitives of anteriority than of posteriority.

This asymmetry requires an explanation. Perhaps the most obvious one is a directly functional hypothesis: in most infinitival constructions, speakers need to mark anteriority rather than posteriority, since the latter is mostly given from context. However, directly functional explanations can run into problems, for example compare the following two quotations from Schmidtke-Bode (2009) on temporal and modal markings in purpose clauses.

> “The fact that the majority of purpose clauses come as deranked constructions and are hence often deprived of tense-aspect marking has a fairly straightforward explanation. It is part of the conceptual structure of purposive situations ([…]) that *purposes are intrinsically future-oriented*. In linguistic terms, purpose clauses inherently have what Noonan (1985:92) calls ‘determined time reference’ in relation to the matrix clause situation. *Consequently, there is no strict communicative need to overtly specify the temporal location of the purposive situation*. We find here a classic case of economical behaviour rooted in the predictability of information in discourse. Speakers can afford to omit overt temporal information, thus being able to make an economical choice for a shorter, less overtly marked non-finite purpose clause construction (cf. also Jespersen 1924 or Haiman 1983 for the general idea). This motivates the cases in which tense-aspect marking is absent form a purposive construction. As Givón notes, ‘the more predictable—i.e. continuous, coherent, non-switching—a clausal feature is vis-à-vis its immediate inter-clausal context, the more likely it is to be left unmarked—i.e. less finite’ (Givón 1991: 876, emphasis in original, (Schmidtke-Bode 2009: 42–43, my emphasis)

> “More generally, *overt mood marking in purpose clauses does certainly not come as a great surprise. Purposive situations are inherently modal* in a twofold way. On the one hand, they are necessarily hypothetical because the

[4] To be sure, the distinction between future and modality is taken very seriously by Velupillai (2016: 101).

> outcome of a purposeful action is yet to be achieved, i.e. non-realized at the moment of speech. As Hewitt (1987:40) aptly puts it. '[a]s the accomplishment of any intention may be foiled as events unfold, it is clearly appropriate if a language should choose to have recourse to a non-factual mood for the representation of purpose.' On the other hand, Palmer (1986:174) points out that purposes by their very nature contain a desiderative element, since they refer to someone's intention to realize a certain goal or to make a certain situation obtain in the future." (Schmidtke-Bode 2009: 45, my emphasis)

Thus, purpose clauses commonly (i) do not receive temporal marking, since they are inherently future-oriented and (ii) do receive modal marking, since they are inherently hypothetical-desiderative. Put in other words, one category *is not* overtly marked because it is already given, while another category *is* overtly marked because it is already given. So one and the same factor carries the burden of explaining two opposing outcomes.

Transferring this to infinitives of posteriority, even if we can prove that in most cases posteriority (but not anteriority) is given from context in infinitival constructions, we still have to choose between two predictions: posteriority will be marked simply because it is given or posteriority will not be marked precisely because it is already given. One might object that in contrast to the arguments quoted above, posteriority in infinitival constructions is not an *inherently* given property (at least not in all cases; obviously there is an overlap between infinitival constructions and purpose clauses). However, as far as I can see, nothing in those arguments hinges on the property being inherent. As an interim summary, the directly functional hypothesis ("in most infinitival constructions, speakers rather need to mark anteriority than posteriority, since the latter is mostly given from context") can explain both the asymmetry we find ("don't mark the obvious") *and* a hypothetical situation where posteriority as well as anteriority is regularly marked after all ("do mark the obvious"). However, an explanation that does not only account for the explanandum but also for its opposite does not appear very convincing.

There are two ways out of this, which presumably have to be combined: focussing on diachrony and focussing on (synchronic) systems as a whole. Both bring in additional factors and interaction among these factors, even including dysfunctional analogies (Newmeyer 1998: 161–164, Seiler 2015, Cristofaro & Zúñiga 2018: 3). Crucially, this means that certain phenomena in isolation might be very hard to motivate by functional factors like expressive power or speaker/hearer economy. Examples from German are given by Seiler (2015: 246), for instance the requirement that the prefield position be filled by exactly one constituent −despite the fact that this position is used for topicalisation and speakers might want to topicalise information that is encoded in more than one constituent. For any such phenomenon, the challenge is motivating it anyhow by taking into account its syntagmatic, paradigmatic, and historical connections.

Thus, the asymmetry between infinitives of anteriority and infinitives of posteriority might receive a more complex but still functional account, even if the few existing infinitives of posteriority should prove completely useless in isolation. In the present contribution I do not intend to give such a full account but confine myself to scrutinizing a sixth candidate for an infinitive of posteriority, which is (right headed) [INF [*zu werden*$_{\text{INF}}$] from German (cf. §§2.1, 2.2). I will argue that this structure as such is hard to motivate functionally even from a diachronic perspective and hence may be the result of analogy-for-analogy's-sake (§2.3). If this analysis is on the right track, we are dealing with a local but not necessarily global change for the worse.

2 Case study: [INF [*zu werden*$_{\text{INF}}$]] in German

2.1 The phenomenon: an infinitive of posteriority in German

As might be expected from the small survey in §1, the sixth candidate for an infinitive of posteriority, i.e. the one from German, is not an entirely clear case either. I will deal with the problems in §2.2, after presenting the structure as such in the current section. For ease of exposition I will switch back and forth between the terms *infinitive of posteriority* and *posterior infinitive* with no difference in meaning intended (accordingly for *infinitive of anteriority* and *anterior infinitive*).

The German infinitive of posteriority can be demonstrated best by way of constructed examples, later followed by real ones. To begin with, consider the finite source structure, first, in an independent clause 13, then in a subordinate clause (14). The first example is finite in every possible way, the second one is less so for the very reason that it is subordinated (cf. Givón's notion of finiteness as [−integration]; Givón 1990). Conveniently enough, this difference does not play a role using the definitions from §1.

(13) German (Indo-European)
Er wird schlaf-en.
he will.3SG sleep-INF
'He will be sleeping.'
non-posterior meaning: 'Probably, he is sleeping (right now).'
posterior meaning: 'Probably, he will be sleeping.'

(14) German (Indo-European) [5]
...dass er schlaf-en wird.
that he sleep-INF will.3SG
'...that he will be sleeping.'
non-posterior meaning: '...that probably he is sleeping (right now).'
posterior meaning '...that probably he will be sleeping.'

Now, consider the non-finite version of each example, given in 15 and 16, respectively.

(15) German (Indo-European)
...dass er schlaf-en werd-en muss.
that he sleep-INF will-INF can
possible meaning: '...that he must [sleep in the future].'

(16) German (Indo-European)
Er hofft, schlaf-en zu werd-en.
he hope.3SG sleep-INF PART will-INF
possible meaning: 'He hopes [to sleep in the future].'

Both the bare infinitive *schlafen werden* in 15 as well as the particle infinitive *schlafen zu werden* in 16 appear to fulfil the definition of posterior infinitives given in §1 above (TSit after TX, no TT). Furthermore, the particle infinitive can have characteristics of an inherently embedded clausal structure of its own, while the bare one cannot; rather it forms one clause with its higher predicate, here *muss* (Rapp & Wöllstein 2013). Note that in the example at hand this clause is itself an embedded one. So the question arises for 15 but not for 16 whether the immediate clausal environment of the posterior infinitive may also be an independent clause. Such examples can easily be constructed, cf. 17.

[5] This use might be restricted (Wilmanns 1906: 195–196, Gelhaus 1975: 230) or not (Hilpert 2008: 27); in any case it is possible in principle.

(17) German (Indo-European)
Er muss schlaf-en werd-en.
he must.3SG sleep-INF will-INF
possible meaning: 'He must [sleep in the future].'

However, for practical reasons laid out in Reiner (2018) I leave aside this type. Likewise, the issue of entirely independent infinitives (Fries 1983), including the question whether those should be called *infinitives* at all, is not covered here. Thus, the central patterns for the purposes of this paper are the ones exemplified in 15 and 16, which may be generalised as right-headed [INF [(*zu werden*$_{\text{INF}}$]]. Just before turning to real examples for this structure and addressing those examples' properties, I would like to contrast the infinitive of posteriority with its anterior counterpart, i.e. right headed [PSTPTCP [*(zu) haben/sein*]], shown below with *haben*. Again, the bare infinitive is presented first, then the particle infinitive.

(18) German (Indo-European) [6]
...dass er geschlafen hab-en muss.
that he sleep.PSTPTCP have-INF must.3SG
'...that he needs to have slept [e.g., before going to work].'

(19) German (Indo-European)
Er behauptet geschlafen zu hab-en.
he claims sleep.PSTPTCP PART have-INF
'He claims to have slept.'

In parallel to posterior infinitives, the sleeping is not claimed (at least not directly, in 19 the factive matrix predicate adds this meaning), hence no TT is conveyed by the form. Likewise, TSit is located before some specific time, hence TSit before TX. Please note that the semantics described here might count as aspectual in other frameworks (cf. Abraham 2004: 116–117).

In contrast to posterior infinitives (see below), anterior infinitives are considered part of the standard inventory of Standard German (cf., e.g., Zifonun et al. 1997: 2159–2160). As such, they are presumably known to speakers (even in case they are not used extensively in everyday speech) and might act as a model in analogy, which will become important in §2.3.

After presenting the structure of the posterior infinitive as well as of its anterior counterpart both by means of constructed examples, some real examples

[6] Depending on co(n)text, an epistemic reading of the embedding modal might be preferred.

are in order. These come from an extensive corpus study within the DeReKo (sub-corpus TAGGED-C-öffentlich) where, as a result, 267 instances of the bare version were found and 4 of the particle version (a discrepancy to be discussed in §2.2). Details of this study can be found in Reiner (2018); let me just note here that all examples have been checked manually and that both numbers (267 as well as 4) outrank the numbers for comparable slips of the pen, which had been searched for comparison.

First, consider some examples for the bare infinitive of posteriority. They are sorted according to (i) general type of finite embedding verb (modal vs. auxiliary), (ii) aktionsart type of the most deeply embedded (i.e. lexical) infinitive, (iii) [+/-] indication of posterior meaning from context, in particular via temporal adverbials, (iv) selected syntactic characteristics.

(i) Of the 267 finite embedding verbs 250 were modals: *können* 'can' (136), *müssen* 'must' (96), *sollen* 'should' (8), *dürfen* 'may' (6), *wollen* 'want to' (3), *mögen* 'like to' (1) and 16 were auxiliaries: conditional *werden*, i.e. *würd-* (3), for forming various periphrases (e.g., the future-in-the-past) and finally future *werden* itself (13). The occurrence of the latter was expected in light of Rothstein' s works on double futures (Rothstein 2012, Rothstein 2013a, Rothstein 2013b). The one remaining matrix verb is *haben* 'have', only appearing in one peculiar example. Here is a typical example with *können* as the finite verb (*könne*):

(20) German (Indo-European)
Er rechne allerdings damit, dass Scharon wieder sprech-en und
he expects though on.this that Sharon again speak-INF and
versteh-en werd-en könne.
comprehend-INF will-INF can
'He expects that Sharon will be able to speak and comprehend again.'
(lit.: can will comprehend)

Next is an example with *würd-* as the finite verb, as a whole representing a future-in-the-past:

(21) German (Indo-European, Niederösterreichische Nachrichten, 22 January 2007)

Geprägt von guten Aktionen beider Mannschaften, war lange Zeit nicht ersichtlich, wer sich schlussendlich durchsetz-en werd-en würde.
characterised by good moves of.both teams was long time not obvious who REFL eventually prevail-INF will-INF will.3SG.COND
'Characterized by good moves of both teams, it was not clear for a long time who would eventually prevail.' (lit.: would will prevail)

And, to conclude segment (i), here is another example from the sports pages, showing future *werden* itself as the finite verb (*wird*):

(22) German (Indo-European, Niederösterreichische Nachrichten, 21 May 2008)

Inwieweit sich Tamara im Finale behaupt-en werd-en wird, werden dann wieder Nuancen entscheiden, denn dort warten schon weitere Riesentalente auf die Finalentscheidung.
to.what.extent REFL Tamara in.the final hold.one's.own-INF will-INF will.3SG will then again nuances decide for there wait already other giant.talents for the final.decision
'The extent to which Tamara will hold her own in the final will then be decided by nuances again, as there will already be other giant talents waiting for the final decision.' (lit.: will will hold her own)

(ii) As to the aktionsart type of the most deeply embedded (i.e. lexical) infinitive, no tendency towards either atelic or telic verbs could be noted. Below is one example for each type, atelic (*konkurrieren*) in 23 and telic (*aufnehmen*) in 24.

(23) German (Indo-European, Nürnberger Zeitung, 21 March 2007)
Er wies darauf hin, dass die Bundeswehr angesichts der
he pointed.out that the *Bundeswehr* in.view.of the
bevorstehenden geburtenschwachen Jahrgänge etwa ab 2008
imminent low-birthrate years ca. from.on 2008
zunehmend mit der Wirtschaft um Arbeitskräfte konkurrier-en
increasingly with the economy for workers compete-INF
werd-en müsse.
will-INF must.3SG.QUOT
'He pointed out that the Bundeswehr [German armed forces] would have to compete increasingly with private enterprises for workers from 2008 onwards in view of the low birth rates in that age group.' (lit.: must will compete)

(24) German (Indo-European, St. Galler Tagblatt, 20 March 2000)
In einem Schlussvotum verlieh Alex Thalmann, Präsident der
in a final.vote gave Alex Thalmann President of.the
Museumsgesellschaft Bischofszell, seiner Hoffnung Ausdruck, dass in
Museumsgesellschaft Bischofszell his hope expression that in
naher Zukunft ein Kulturbeauftragter sein Amt in Bischofszell
near future a cultural.commissioner his office in Bischofszell
aufnehm-en werd-en kann.
take.up-INF will-INF can.3SG
'In a final vote Alex Thalmann, President of the Museumsgesellschaft Bischofszell [Municipal Society for Museums], expressed his hope that in the near future a cultural commissioner could take up his office in Bischofszell.' (lit.: can will take up)

More generally, only a few lexemes occurred more often than once as the infinitive in [INF *werden*$_{\text{INF}}$]. These were:

absagen – 'cancel' (2), *antreten* – 'compete' (3), *aufbringen* – 'raise (funds)' (2), *auskommen* – 'get by (financially)' (3), *beginnen* – 'start' (2), *bewältigen* – 'overcome' (2), *bezahlen* – 'pay' (3), *entscheiden* – 'decide' (2), *erfüllen* – 'fulfil' (3), *fahren* – 'ride' (2), *genießen* – 'enjoy' (3), *gestalten* – 'shape' (2), *halten* – 'keep' (10), *hinnehmen* – 'put up with' (3), *in Anspruch nehmen* 'use' (3), *investieren* – 'invest' (2), *konkurrieren* – 'compete' (3), *Kredit aufnehmen* 'borrow (money)' (2), *lassen* – 'let' (2), *leben mit* – 'cope with' (3), *mitspielen* – 'play (with others)' (2), *nutzen* – 'use' (2), *präsentieren* – 'present' (2), *sehen* – 'see' (2), *sich befassen mit* – 'concern oneself with' (2), *sich durchringen zu* –'bring oneself to do sth.' (2), *sich leisten* –'afford' (10), *sich verabschieden* –'say goodbye' (2), *sprechen und verstehen* –'speak and comprehend' (3), *tun* –'do' (2), *über die Bühne gehen* –'go smoothly' (2), *übernehmen* –'take over (e.g., expenses)' (3), *umgehen mit* –'dela with' (2), *umsetzen* –'implement' (3), *verzichten auf* –'do without' (3), *copular werden* –'become' (5), *passive werden* (7), *zahlen* –'pay' (2), *zurückgreifen auf* –'resort to' (3), *zurückzahlen* –'pay back' (3), *zusammenarbeiten* –'collaborate' (2).

Thus, apart from *halten* –'keep' and *sich leisten* –'afford' with ten attestations each (which is possibly epiphenomenal, cf. Reiner 2018), there do not appear to be any lexical clusters. Moreover, some of the small accumulations are merely a methodological artefact: whenever a given example appeared in two (or more) newspapers or editions, I counted it two (or more) times, because presumably this meant that two (or more) times the sequence had been approved of by a professional. If these cases are subtracted from the numbers above, the small accumulations for *absagen*, *investieren (in)*, *lassen*, *sich durchringen zu*, *über die Bühne gehen* and *sprechen und verstehen* vanish. Likewise, *halten* and *zurückgreifen auf* lose one instance each.

Interestingly, there are two cases where the replication between editions was not exact. I present these below with minimal glossing only to show how small the differences are.

(25) German (Indo-European, Niederösterreichische Nachrichten, 14 July 2009)
Die heurige Witterung bestätigt die Aussage von Klimaforschern, dass wir mit längeren Trockenperioden aber auch vermehrten Extremereignissen wie Starkregen
leben werd-en müss-en.
live will-INF must-3PL
'This year's weather confirms the statement of climate researchers that we will have to live with longer dry periods but also with increased extreme events such as heavy rain and hail.' (lit.: must will live)

(26) German (Indo-European, Niederösterreichische Nachrichten, 14 July 2009)
Die heurige Witterung bestätigt die Aussage von Klimaforschern, dass wir in unseren Breiten mit längeren Trockenperioden aber auch vermehrten Extremereignissen wie Starkregen und Hagel
leben werd-en müss-en.
live will-INF must-3PL
'This year's weather confirms the statement of climate researchers that we will have to live in our latitudes with longer dry periods but also with increased extreme events such as heavy rain and hail.' (lit.: must will live)

(27) German (Indo-European, Nürnberger Nachrichten, 15 September 2007)
Und der Präsident stimmte seine Landsleute auf etwas ein, was viele angesichts der verfahrenen politischen Lage im Irak seit langem befürchten: dass die USA sich kaum in absehbarer Zeit dort
verabschieden werd-en könn-en.
say.goodbye will-INF can-3PL
'And the president put his compatriots in the right mood for something that many have long feared in view of the muddled political situation in Iraq: that the USA will hardly be able to say goodbye there in the foreseeable future.' (lit.: can will say goodbye)

(28) German (Indo-European, Nürnberger Nachrichten, 15 September 2007)
Und der Präsident stimmte seine Landsleute auf etwas ein, was viele angesichts endloser Gewalt und der verfahrenen politischen Lage im Zweistromland seit langem befürchten: dass die USA sich kaum in absehbarer Zeit dort
verabschieden werd-en könn-en.
say.goodbye will-INF can-3PL
'And the president put his compatriots in the right mood for something that many have long feared in view of endless violence and the muddled political situation in Mesopotamia: that the USA will hardly be able to say goodbye there in the foreseeable future.'(lit.: can will say goodbye)

I take these small differences as an indication that one version of each pair is an edited one. Then the posterior infinitive survived editing, which suggests that it was not noted as deviant. See, however, §2.2 for a discussion of acceptability as well as for a special property of the examples adduced above.

(iii) As to the question whether posterior meaning is indicated also in the context, an overwhelming majority of 212 examples contained such an indication, 42 did not, and 13 were unclear in this respect. Such indications are, among others, prospective verbs (Reiner 2013) like *rechnen mit* 'expect' in 20 [7] as well as future adverbials like *in naher Zukunft* 'in the near future' in 24. Here is another example with a temporal adverbial, i.e. *erst 2001* 'no earlier than 2001':

(29) German (Indo-European, Oberösterreichische Nachrichten, 20 October 1999)

Moderier-en	soll	die Tagungen	die	„Stadterneuerung"	des
chair.INF	should	the conferences	the	„Stadterneuerung"	of.the

Landes,	der	Amstetten	ob	der	langen	Warteliste
state	to.which	Amstetten	because.of	the	long	waiting.list

erst	2001	beitret-en	werd-en	könne.
no.earlier.than	2001	join-INF	will-INF	can.3SG.QUOT

'The conferences are supposed to be chaired by the state' s Stadterneuerung [urban renewal], which Amstetten will be allowed to join only in 2001 because of the long waiting list.' (lit.: can will join)

This distribution will become relevant in §2.3.

(iv) As to syntactic characteristics, occasionally the clause at hand contained more than three verbs (so that an additional layer went in between *werden*$_{\mathrm{INF}}$ and the finite verb); furthermore, some examples showed the main clause pattern (cf. 17 above), although this had not been explicitly searched for. Below is an example for both characteristics at once:

[7] Which are the precise temporal relations in that example depends on whether *können* 'can' is regarded as a prospective verb as well. If it is, the relations are: '*sprechen und verstehen*' after '*kann*' after '*rechne mit*'; if it is not, the relations are: '*sprechen und verstehen*' overlapping (but not before) '*kann*' after '*rechne mit*'.

(30) German (Indo-European, St. Galler Tagblatt, 18 November 1999)
Das Ausmass des Schadens wird man erst ermess-en werd-en
the extent of.the damage will.3SG one only measure-INF will-INF
könn-en, wenn der Schnee abgeschmolzen ist und die Wege durch die
can.INF when the snow melted.away is and the paths through the
Wälder wieder passierbar sind.
forests again passable are
'The extent of the damage can only be measured once the snow has melted and the paths through the forests are passable again.' (lit.: will can will measure)

Another relevant syntactic characteristic, i.e. the ability to form a so called Oberfeld, will be treated in §2.2.

Summarising the corpus findings for [INF *werden*$_{\text{INF}}$], i.e. bare infinitives of posteriority, the results are strongly reminiscent of what Rothstein (2013a) found for the special case [[INF *werden*$_{\text{INF}}$] *werden*$_{\text{FIN}}$], i.e. for double futures: the structure does not appear to be distributionally restricted in any unexpected way. However, there are two exceptions to the match between the two studies. For one thing, I have some concerns about Rothstein's example for epistemic readings of the pattern as a whole (Rothstein 2013a: 115, see §2.2 for discussion). For another thing, Rothstein (2013a: 103–104) did not look for tense variation in the finite verb, in particular he did not consider preterites (for good reasons confined to his special case, cf. Bogner 2009: 107). I did and hardly found any preterites. This apparent restriction will be discussed in §2.2 as well.

Now, let's turn from bare infinitives to particle infinitives of posteriority, i.e. [INF [*zu werden*$_{\text{INF}}$]]. As stated above, only four instances of this structure could be found in the corpus; here is one of them:

(31) German (Indo-European, Nürnberger Zeitung, 16 June 2006)
Dem widersprachen die Spieler und betonten, auch ohne Geld
this objected the players and emphasised also without money
für ihr Land spiel-en zu werd-en.
for their country play-INF PART will-INF
'The players objected to this and emphasised that they would play for their country even without remuneration.' (lit.: to will play)

Please note that in this example there is no additional indication of posteriority in the sentence as such, but there is one in the wider context: the passage is about continuing to play in the world championships despite still waiting for premiums of EUR 50,000 (out of loyalty to their coach). In the three remaining examples for particle infinitives of posteriority, the temporal relation is indicated directly in the respective sentence, two times via the adverb *künftig* 'future', one time via implicature. Thus, also the particle infinitive appears to prefer temporally specified contexts, as far as one can tell from only four attestations.

The apparent lack of more instances is another topic for §2.2. In order to present at least one more example and to conclude this section, I add one below from a pilot study (again involving *künftig*). Here the posterior infinitive is directly opposed to its anterior counterpart.

(32) German (Indo-European, Rhein-Zeitung, 25 January 1996)

Lotz	versicherte,	für	die	CDU	alles	nur	Mögliche
Lotz	assured	for	the	[political party]	everything	ever	possible.NMLZ

getan	zu	hab-en	und	das	auch	künftig	tun	zu
do.PSTPTCP	PART	have.INF	and	this	also	in.the.future	do.INF	PART

werd-en.
will-INF

'Lotz assured that he had done everything possible for the CDU [a German political party] and that he will continue to do so in the future.' (lit.: to will do)

After presenting the phenomenon, i.e. [INF [*zu* *werden*$_{\mathrm{INF}}$]], in some detail and treating it as an infinitive of posteriority, several problems with it have to be addressed, most notably certain alternatives for its morphosyntactic as well as semantic analysis, its restrictions, and its acceptability among native speakers.

2.2 Problems

The literal translations of the German examples into English given in §2.1 sound deviant to say the least (likewise cf. (4)) and also most reference grammars of German do not include any infinitive of posteriority (Heidolph et al. 1981: 567, Zifonun et al. 1997: 1686, Helbig & Buscha 2001: 95 – 96, Eisenberg 2013a: 192, Wöllstein 2016: 487). Some even state explicitly that such a form does not exist (Erben 1980: 122, Hentschel & Weydt 2013: 128). To a large extent the same pattern, i.e. neglect or denial, can also be found in the more specialised literature (e.g., Bech 1983: 95, Fabricius-Hansen 1986: 148, Heine 1995), one of the rare exceptions besides Rothstein's works on double futures is Abraham (2004: 116). [8]

[8] For a more extensive research survey cf. Reiner (2018)

Against this background and with the problems in mind that were indicated in the last section, I would like to discuss four alternative analyses of [INF *werden*$_{\text{INF}}$], all of which would boil down to not treating the structure as an infinitive of posteriority. Three of the alternative analyses are morphosyntactic, one is semantic. In the same vein, the apparent quasi restrictions (no embedding under preterites, almost no particle version) need to be evaluated. Through the whole section also issues of acceptability will be approached.

Alternative morphosyntactic analysis no. 1. Recall examples 25 to 28 for the bare infinitive of posteriority, the first of which is repeated below with full glossing.

(33) German (Indo-European, Niederösterreichische Nachrichten, 14 July 2009)

Die heurige Witterung bestätigt die Aussage von
the this.year's weather confirms the statement of

Klimaforschern, dass wir mit längeren Trockenperioden aber auch
climate.researchers that we with longer dry.periods but also

vermehrten Extremereignissen wie Starkregen und Hagel leben werd-en
increased extreme.events like heavy.rain and hail live will-INF

müss-en.
must-3PL

'This year's weather confirms the statement of climate researchers that we will have to live with longer dry periods but also with increased extreme events such as heavy rain and hail.' (lit.: must will live)

In these examples, the analysis of the verbal cluster might be disputed: since agreement for 3PL (as well as for 1PL) is homonymous with the infinitive suffix *-en*, it is morphologically possible that in fact not *werden* but the last verb is the non-finite one. Thus, there are two contrasting analyses:

original analysis:

leben	*werd-en*	*müss-en*
live	will-INF	must-3PL

alternative analysis:

leben	*werd-en*	*müss-en*
live	will-3PL	must-INF

Under the alternative analysis, [INF *werden*$_{\text{INF}}$] is not at stake here. This analysis, however, can be ruled out on syntactic grounds for Federal Standard German, since in this variety the finite verb virtually always comes last Wurmbrand (2017: 4626) (see below for the so called Oberfeld). Still, the analysis has some plausibility for Austrian Standard German (Patocka 1997: 281–282) and as you might have noticed the example is from Austria. Just to be on the safe side, one may generally count solely those examples that involve a morphologically distinct finite verb, different in shape from *werden*. When doing so, the total number decreases from 267 to 47 but all highlighted relations remain practically constant: the frequency ranking for embedding modals and auxiliaries only changes in that *dürfen* and *sollen* switch places, most of the lexical accumulations for the embedded infinitive simply disappear, and the number of examples with some indication of posteriority in the context is still more than four times as high as the number of examples without such an indication. All examples for the bare posterior infinitive presented in this paper, except 25 to 28, were taken from the unambiguous set. Please note, however, that the evidence from non-editing adduced above pertained to 25 to 28, so this evidence is not as conclusive as it seemed.

Alternative morphosyntactic analysis no. 2. Native speakers confronted with utterances like *konkurrieren werden müsse* from 23, tend to point out that this must be a performance error in producing *werde konkurrieren müssen*. Thus, the two contrasting analyses might look like this:

original analysis:

konkurrier-en	*werd-en*	*müsse*
compete-INF	will-INF	must.3SG.QUOT

alternative analysis:

werde	*konkurrier-en*	*müssen*
will(3SG.QUOT)	compete-INF	must(INF)

underlying structure (alternative analysis):

werde	*konkurrier-en*	*müssen*
will.3SG.QUOT	compete-INF	must.INF

The underlying structure of the alternative analysis contains a so called Oberfeld, i.e. it represents one of the few exceptions to the rule that the finite verb comes last in Federal Standard German. In more detail, if the finite verb is one of the auxiliaries *werden* or *haben* and at the same time the cluster contains a modal, the finite verb may or must come first, before the main accent of the verbal cluster, thereby creating what is then called the Oberfeld (Bech 1983: 62–64, Schallert 2014, Wurmbrand 2017: 4626). Please note that this situation is different from the one discussed under the heading "Alternative morphosyntactic analysis no. 1", since there the first verb was definitely not the finite one but the lexical infinitive.

The alternative morphosyntactic analysis at stake here, i.e. no.2, takes the Oberfeld structure as its input, has the finite form of *werden* move to a position between the two other verbs and, additionally, exchange its morphosyntactic features (or at least the realisation of them) with the modal. As complicated as this might seem, the analysis cannot be so easily dismissed. It receives some plausibility from two considerations. First, there is a certain semantic affinity between the underlying structure of this analysis and the original one anyway: a future requirement (alternative analysis) and a required future (original analysis) seem to be very similar states, if not equivalent. Second, unexpected positions and swapping of morphosyntactic features within German verbal clusters are well known from the so called Skandalkonstruktion Vogel (2009).

However, there are three reasons that jointly cast doubt on alternative morphosyntactic analysis no.2. First, there is at least one example (albeit involving four verbs) with an Oberfeld of its own and I do not see a way in which the analysis could derive such structures. I give the example in full below; the Oberfeld is constituted by *wird*.

(34) German (Indo-European, Wikipedia 2005)
Einige behaupten, dies würde Israel nicht verpflichten irgendwelche
some claim this would Israel not oblige any
Flüchtlinge aufzunehmen, während andere behaupten, dass Israel ein
refugees take.in while others claim that Israel some
paar Flüchtlinge wird aufnehm-en werd-en müss-en.
refugees will.3SG take.in-INF will-INF must-INF
'Some claim that this would not oblige Israel to take in any refugees, while others claim that Israel will have to take in a few refugees.' (lit.: will must will take in)

Second, double futures pose a serious problem for the alternative analysis. Consider the relevant part of example 22, given below as 35.

(35) German (Indo-European, Niederösterreichische Nachrichten, 21 May 2008)
Inwieweit sich Tamara im Finale behaupt-en werd-en
to.what.extent REFL Tamara in.the final hold.one's.own-INF will-INF
wird, *[⋯].*
will.3SG [⋯]
'The extent to which Tamara will hold her own in the final [⋯].' (lit.: will will hold her own)

If we try to derive this example by the alternative analysis and contrast this with the original analysis we end up with the following triplet.

original analysis:

behaupt-en	*werd-en*	*wird*
hold.one's.own-INF	will-INF	will.3SG

alternative analysis:

wird	*behaupt-en*	*werd-en*
will.3SG	hold.one's.own-INF	will-INF

underlying structure (alternative analysis):

wird	*behaupt-en*	*werd-en*
will.3SG	hold.one's.own-INF	will-INF

It can be seen from this example that the alternative analysis does not get rid of *werden*$_{\text{INF}}$ after all. More generally: the alternative analysis treats the finite verb as underlyingly non-finite but in the case of double futures this means that it is simply the other future auxiliary that now has to be regarded as non-finite. So even when favouring the alternative analysis one has to recognise [[INF *werden*$_{\text{INF}}$] *werden*$_{\text{FIN}}$].

Third, if one also takes the particle version, i.e. [INF *zu werden*$_{\text{INF}}$], seriously, one has to acknowledge anyway that non-finite *werden* may embed another infinitive – and then it seems parsimonious to treat the bare version alike. The question is whether the particle version with its merely four attestations in the corpus is in fact to be taken seriously. I will seize the opportunity to present results from a questionnaire study, the details of which are laid out in Reiner (2018). In an online survey, participants were asked to comment freely on eleven sentences, including four instances of [INF *werden*$_{\text{INF}}$] and two instances of [INF *zu werden*$_{\text{INF}}$], all taken from the corpus study (in case of the bare infinitive from the unambiguous set of attestations). In more detail, the task was answering an e-mail from a friend who has near-native competence in German but needs advice in writing natural sounding newspaper articles.

The open task certainly demanded a great deal of effort –on both the participants' side as well as on the analyst's side –but allowed to control authenticity better than is usual in online studies (no quick clicking through possible) and it provided space for fine-grained assessments of the structure under scrutiny (as of everything else in the sentences). In total, 47 speakers without linguistic background or native dialect competence took the trouble to complete the task and – surprisingly –judged mostly categorial, see Table 1.

Table 1: Acceptance rates for INF (*zu*) *werden*$_{\text{INF}}$

	item 1 with *zu*	item 2 with *zu*	item 1 without *zu*	item 2 without *zu*	item 3 without *zu*	item 4 without *zu* (double future)
not corrected	22	19	11	12	11	11
corrected	25	28	36	35	35	36
unclear	0	0	0	0	1	0

The important finding here is that acceptance rates for the particle version with *zu* are in fact better than for the bare version. [9] I take this as an imperative to acknowledge the particle infinitive of posteriority once we acknowledge the bare one. Therefore, the particle infinitive is available in the third argument against alternative morphosyntactic analysis no.2.

With this said, however, it will not have gone unnoticed that the overall acceptance rates are low. Then again, they are never near zero. I interpret this mixed result as an indication that there is some reality to posterior infinitives in German while they are far from established.

Alternative morphosyntactic analysis no. 3. Up to this point, [INF (*(zu) werden*$_{\text{INF}}$], like its finite counterpart [INF *werden*$_{\text{INF}}$], has been treated as a verb form, albeit a periphrastic one. This is the traditional analysis but by no means the only one (cf. Müller 2013: 241 – 246 for a purely syntactic analysis of [INF *werden*$_{\text{INF}}$]). Thus, if one has trouble accepting posterior infinitives in Thai (cf. §1), then the candidates from German are not very convincing either.

Summarising the morphosyntactic concerns addressed, I conclude: provided that we believe in periphrases as equivalent to true word forms, there are indeed posterior infinitives in German but their distribution as well as their acceptability is remarkably limited.

Besides alternative morphosyntactic accounts, however, there is also an alternative semantic interpretation of [INF *(zu) werden*$_{\text{INF}}$]. Possibly, the structure does not express posteriority after all but rather, e.g., a certain flavour of modality

[9] Or at least not worse; for statistic details cf. Reiner (2018).

(cf. the corresponding long standing debate on its finite counterpart summarised and continued in, among others, Hacke 2009). The lack of preterite matrix predicates might be considered as a hint in this direction, depending on one's convictions about the syntactic organisation of mood vs. tense and about the (possibly atemporal) meaning of present tense forms.[10] Generally, assessing the meaning of [INF *(zu) werden*$_{\text{INF}}$], very much like assessing the meaning of its finite counterpart, is an intricate issue, which relates to many strands of research –to what extent do speakers distinguish between future and uncertainty (both conceptually and linguistically), do aspectual relations play a role, what is the pragmatic value of the structure, are we in the midst of a grammaticalisation process,⋯? I deal with these issues at length in Reiner (2018) and arrive at the conviction that the meaning of [INF *(zu) werden*$_{\text{INF}}$] is indeed pure posteriority. Since I cannot reproduce the argument here in full, let me just single out three points that militate against a purely modal account.

First, if *werden* in [INF *(zu)* $_{\text{INF}}$] was an epistemic modal then it would constitute a hard-to-explain exception to the generalisation that epistemic modals do not have infinitives in German (Abraham 2001, Kiss 2005: 118–119). Second, my corpus data do not contain any example that is unambiguously epistemic and although absence of proof is not proof of absence I take this finding as a hint against a purely modal account. Third, the one example of a double future that is given as evidence for epistemic readings by Rothstein (2013a: 115) can be interpreted temporally as well:

(36) German (Indo-European, Rothstein 2013a: 115)
Bin gespannt, was du jetzt sag-en werd-en wirst
am curious what you now say-INF will-INF will.2SG
'I am curious what you might be saying right now/what you're going to say.' (lit.: will will say)

Admittedly, *jetzt* usually translates as *now* but it is well known that future interpretations are possible as well, namely when the speaker wants to establish a connection between a future TSit and TU (Imo 2010: 34–35). In the context at hand I consider such an interpretation even the more probable one, since the utterance (a post in an online forum) is first and the (expected) reaction next. Moreover, even if this example or another double future could be interpreted epistemically, this interpretation might still be due to an epistemic reading of

[10] Throughout this paper I sidestep issues of syntactic theory, as far as possible. But note that non-finite *werden* might constitute a problem for certain models of clause structure (Erb 2001).

the outer instance of *werden*, i.e. of the finite one. Hence, it would not tell us anything about the meaning of *werden*$_{\text{INF}}$ [INF *werden*$_{\text{INF}}$].

In sum, I consider the meaning of [INF *werden*$_{\text{INF}}$] to be pure posteriority, i.e. TSit after TX (no TT). Please note that this semantic characterisation is not foiled by the form's preference for contexts that are already specified for posteriority as long as we are ready to accept truly anterior infinitives that prefer contexts already specified for anteriority.

Summarising both, the morphosyntactic as well as the semantic reflections, I repeat the conclusion drawn from the morphosyntactic subsections: there are infinitives of posteriority in German but only if periphrases count as forms (which I assume for the rest of this paper), and even then their distribution and acceptability are remarkably limited. Nonetheless, one may ask to what extent posterior infinitives (where they do exist) might serve a function in system and use. In the following section I will demonstrate that the answer is in fact elusive; the posterior infinitive appears to eschew obvious functionality.

2.3 How can it be motivated (functionally)?

I start from the assumption that motivating a phenomenon functionally requires more than just noting that it encodes some meaning like for example posteriority (Newmeyer 2017: 130). Rather, I intend to assess functionality in the sense sketched towards the end of the introduction. In order to do so, a diachronic perspective is needed. Unfortunately, I do not have reliable diachronic data on the posterior infinitive in German (but cf. Reiner 2015: 511–512 for early attestations). What I can do, however, is contrast two hypothetical stages and ask how a transition between these two could be motivated functionally in principle. Stage 1 is characterised by a present infinitive conveying the general meaning 'not completely before TX' (Eisenberg 2013a: 192–193; Eisenberg 2013b: 102–103), hence covering both the concepts 'overlapping with TX' and 'after TX'. Stage 2 involves the same present infinitive but in addition –and in a way redundantly –there is a specialised posterior infinitive that singles out the second concept by an extra encoding. Thus, the hallmark of stage 2 is a privative opposition in the sense of Deo (2015: 16). [11] The two stages can be visualised like in Figure 1.

[11] There are two important differences between Deo's work and the present contribution. First, Deo treats a different phenomenon, i.e. the historic connection of imperfective and progressive. Second, she is concerned with in total four stages, which together constitute a cyclic development. However, the mechanisms of change she establishes are expected to hold more generally (Deo 2015: 46–48) and only two (types of) stages happen to be relevant to the present paper.

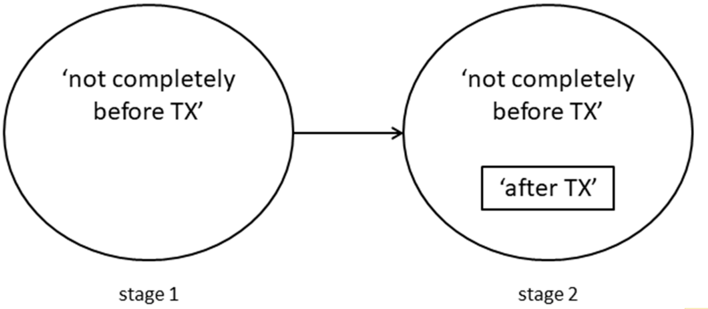

Figure 1: transition from a stage with no opposition to a stage with a privative opposition (based on Deo 2015)

As announced above, the question now is: how could a transition from stage 1 to stage 2 be motivated functionally? According to Deo (2015: 23), such a transition starts as follows: "*In underspecified contexts*, participants may make explicit efforts towards [⋯] disambiguation" (my emphasis). For posterior infinitives in German this means: if these forms are beginning to bring about stage 2, they are expected to be more frequent in temporally underspecified contexts than in unambiguously posterior ones. However, the corpus results show exactly the opposite pattern: posterior infinitives occur around five times more often together with another indication of posteriority than without (bare and particle versions both counted here). Thus motivating the existence of these forms by a desire for disambiguation most likely will not work out.

If it is not disambiguation within a scenario along the lines of Deo (2015), maybe it is extravagance within a scenario along the lines of Haspelmath (1999). The term *extravagance* refers to a conversational maxim: "talk in such a way that you are noticed" (Haspelmath 1999: 1055). So the question here is: do speakers create posterior infinitives (more or less consciously) in order to stand out from others? Before delving deeper into this question, let me add another maxim adduced by Haspelmath, termed conformity: "talk like the others talk" (ibid.). According to Haspelmath (1999: 1063), conformity does not cancel out extravagance – an asymmetry, which is supposed to explain the unidirectionality of grammaticalisation processes. However, I am under the impression that Haspelmath does not take into account conformity at the earliest stages of change (cf. pp. 1057–1058). Here I cannot follow his proposal easily since, as far as I can see, conformity is at work in basically every usage event. Now, if we do take into account conformity at all points in time, it is hard to see why it should regularly be overridden by extravagance. Thus, I have general doubts about motivating language change by means of this maxim, at least within Haspelmath's account (Haspelmath 1999).

This leads me to the last option for a (hypothetical) functional motivation of posterior infinitives to be explored here. As speakers we do not only conform to peer norms and codified norms but possibly we conform to perceived norms as well. According to my own experience, one such perceived norm might be the requirement to use [[INF] *werden*$_{\text{INF}}$] whenever referring to the future. Although this is already an overgeneralisation (cf. Eisenberg 2013b: 102 – 103), it may be taken further by speakers to the effect that they feel pushed to use [[INF] *werden*] for future reference irrespectively of *werden*'s finiteness. That is, they create infinitives of posteriority via hypercorrection. Within the hypercorrection scenario, posterior infinitives are expected to be found predominantly in rather formal contexts. However, in a pilot study already briefly mentioned above, these infinitives were scattered across a whole range of genres with their associated degrees of formality (Reiner 2015: 507): from newspaper articles to blog entries to casual posts in online forums, the latter often conveying the impression that users do not care too much for standard language. So in light of the data, the hypercorrection scenario does not appear to be particularly plausible either.

After having explored and dismissed three different scenarios that provide a functional motivation for infinitives of posteriority, my best guess for the time being is: those speakers who use and accept the forms simply follow a strict principle of analogy. The rest of this section is dedicated to corroborating this idea and comparing it to syntactisation in the sense of Seiler (2015). Recall the anterior infinitive, introduced via examples 18 and 19 in §2.1, repeated here as 37 and 38 for convenience.

(37) German (Indo-European)
…dass er geschlafen hab-en muss.
that he sleep.PSTPTCP have-INF must.3SG
'…that he needs to have slept [e.g., before going to work].'

(38) German (Indo-European)
Er behauptet geschlafen zu hab-en.
he claims sleep.PSTPTCP PART have-INF
'He claims to have slept.'

As noted in §2.1, anterior infinitives can be found in the usual repertoire of Standard German. Equally common are passive infinitives, crucially involving the same auxiliary as [[INF] *werden*FIN/INF], i.e. *werden*. Here are two examples, 39 with the bare infinitive and 40 with the particle infinitive.

(39) German (Indo-European)
…dass er gesehen werd-en muss.
that he see.PSTPTCP PASS-INF must.3SG
'…that he must be seen.'

(40) German (Indo-European)
…dass er behauptet, gesehen zu werd-en.
that he claims see.PSTPTCP PART PASS-INF
'He claims to be seen.'

So there is a model for both, temporally marked infinitives and infinitives with non-finite *werden* as their core. In this sense, the ingredients for posterior infinitives have been there all along and presumably all that speakers do is put them together –whether or not the product enables them to convey extra information, makes them stand out from others, or helps them sound particularly correct. It is analogy-for-analogy' s-sake. [12]

This general picture is reminiscent of, but slightly different from Seiler' s syntactisation account of seemingly dysfunctional phenomena (Seiler 2015). At the heart of the latter proposal is the insight that two things may both be true: a given phenomenon has been shaped by expressional needs –but after some time certain signifiants from its typical contexts come to be interpreted as the phenomenon' s true triggers so that it analogically extends to all contexts where these signifiants are found, whether or not it can still serve its original function there. This insight and my conjecture above with respect to posterior infinitives in German share the explicit recognition that form and function do not always go hand in hand in an obvious sense; in fact the guess was motivated by Seiler' s proposal. However, there are also potential differences. For one thing, my conjecture, as it stands, does not involve any interim stage of functional motivation (apart from analogy as such and conveying some meaning). This is different from Seiler' s core example of prepositional dative marking in Upper German (Seiler 2015: 252–257), which does involve such a stage: the preposition facilitates dative focus (p. 255–256). Yet, my conjecture on posterior infinitives above does not exclude that for them such a stage is yet to come. For another thing, and quite conversely, Seiler' s example continues to a later stage, at which even the trivial function

[12] Another proposal is Reis (1979), **2017**, which I treat in some detail in Reiner (2018).

of conveying a (not purely syntagmatic) meaning has been lost. For posterior infinitives, as morphosemantic as opposed to morphosyntactic phenomena, this development is excluded by definition.

In any case, on both accounts, functionally blind analogy plays a central role. Crucially, though, the blindness is only local, not necessarily global: analogy increases systematicity so that utterances are more predictable, which in turn enhances processability of the respective language (Seiler 2015: 247–248). Thus, even seemingly superfluous change may serve a function after all.

2.4 Conclusion

The basic question of this contribution was: are there posterior infinitives in the languages of the world and if yes, what are they good for? Accordingly, I carried out a small survey on their occurrence in grammars, the result of which suggested that these forms are rather rare. This outcome reinforced the second part of the question: if many languages can do without such forms, then which function do they serve in others, where they do exist? Starting from the assumption that having a function is not exhausted by having a meaning, I explored the utility of posterior infinitives for one language that possibly has them, i.e. German. To that end, it had to be argued in the first place that the forms under scrutiny are in fact infinitives of posteriority. Then their potential merits could be explored, taking into account systematic as well as historical connections. In spite of the broad perspective, however, the forms appeared to lack an obvious asset. Only when the perspective was broadened even further, a plausible function of posterior infinitives in German surfaced: by analogically extending verbal paradigms they increase systematicity and with that processability of the language. In conclusion, even if a certain change seems to be pointless in every regard, i.e. a waste of effort, it might still have a function at a higher level.

Acknowledgements

I thank Viveka Velupillai for providing the sources for Ilocano, Aklan, and Alawa as well as two anonymous reviewers for pushing me towards a more comprehensive and transparent exposition of data as well as theory.

Abbreviations

Please note that abbreviations in examples adopted from other authors are spelled out in footnotes throughout.

1	first person
3	third person pronoun
3(s)	third person (singular)
ACC	accusative
ADV	adverb, adverbial
AOR	aorist
CENTRIP	Centripetal (‘motion towards the deictic center’ , cf.Heath 1999: 140)
COMPL	completive
COND	conditional
DAT	dative
DEF	definite
DeReKo	Deutsches Referenzkorpus (German reference corpus, partly searchable at http://www.ids-mannheim.de/cosmas2/web-app/)
FUT	future
INF	infinitive
NEG	negative
NMLZ	nominalization
PART	particle
PASS	passive
PL	plural
PRES	present
PRSPR	present progressive
PST	past
PSTPTCP	past participle
QUOT	quotative
REFL	reflexive pronoun
REFL	reflexive
S	subject
SG	singular
TSit	time of situation (Klein 1994)
TT	topic time (Klein 1994)
TU	time of utterance (Klein 1994)
TX	some specific time

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Chapter 7

The particular–characterizing contrast in Marathi and its historical basis

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The two-copula and two-auxiliary systems instantiated in a number of Indo-Aryan languages can be best analyzed as lexicalizing particular vs. characterizing meanings. The data is drawn from Marathi [mar, 71,700,000 speakers] but the pattern is observed across different sub-groups of Indo-Aryan, and is possibly inherited from Sanskrit. I provide historical data that indicates that while this contrast is not grammatically categorical in Middle and Old Indo-Aryan, it appears to be present through the interpretational possibilities for the *bhū* copula and its cognates. I use this observed categoricalization of a copular contrast to reflect on whether the overt marking of the particular–characterizing contrast represents a change for the better or for the worse.

1 Introduction

The goal of uncovering systematic principles governing cross-linguistic variation in (the realization of) meaning has been strongly pursued in semantics over the past two decades. One result of this research has been the identification of recurring similarities in the meaning contrasts that get reliably encoded across diverse grammatical systems. Yet another issue that emerges from the same pursuit is that of variation with respect to how a universal inventory of model theoretic components is mapped onto lexical/functional items. Specifically, we find that certain elements of functional meaning that are covert in some languages may find overt realization in others. For instance, languages differ with respect to whether "event-in-progress" and "habitual/generic" meanings are expressed by distinct aspectual markers (progressive and imperfective) or by a single imperfective marker (see Bybee (1994); Comrie (1976); Deo (2009; 2015) among others).

Ashwini Deo. 2020. The particular–characterizing contrast in Marathi and its historical basis. In Dankmar Enke, Larry Hyman, Johanna Nichols, Guido Seiler & Thilo Weber (eds.), *Language Change for the Worse*, 183–211. Berlin: Language Science Press. DOI: ??

Languages may also choose to lexicalize or keep covert the semantic contrast between "alienable possession" and "inalienable possession" (Clark (1978); Aristar (1996); Stassen (2009)). This variation in languages has to do with whether salient semantic contrasts are individually packaged and lexicalized, or whether they are subject to contextual disambiguation. Given typological variation in this respect, one might ask the question: Is the "individualized packaging" strategy more complex or a "contextual disambiguation" strategy?

In this paper, I will consider a previously un-described phenomenon – a morphosyntactic contrast in copulas/auxiliaries that is pervasive in several New Indo-Aryan languages. As I will show, restricting myself to the Marathi facts (with a brief nod to Hindi), the morphosyntactic contrast reflects a semantic distinction between particular and characterizing claims. When one considers the origin of this contrast, one finds that categoricality in the expression of this contrast is only to be found in the Modern New Indo-Aryan languages. While earlier stages of Indo-Aryan (Middle and Old Indo-Aryan) appear to show sensitivity to the semantic distinction between particular and characterizing claims, there is no specialized device for conveying particular claims in these systems. I suggest that the New Indo-Aryan languages may have transitioned into a strategy in which this contrast is categorically expressed as a secondary consequence of a change in their broader tense marking systems.

2 The phenomenon

Although they contain the same tensed form of the copula *be*, the (a) and (b) sentences of English in 1–3 are understood very differently with regard to their temporal reference.

(1) a. The baby *is* tired. Let's get the bath ready.
    b. The baby *is* tired by the time we pick him up from daycare. So let us start picking him up earlier.

(2) a. People *are* unhappy because they just raised the taxes.
    b. People *are* unhappy when they are on diets.[1]

(3) a. Sam *was* asleep. He had had a long day.

[1] http://www.brainyquote.com/quotes/quotes/m/mireillegu530744.html

b. Whenever Mary telephoned on a Friday, Sam *was* asleep. (Partee 1984: 246)

The (a) sentences intuitively seem to be about a particular salient time – either the time of utterance or a salient past time. The (b) sentences, on the other hand, do not seem to make reference to any particular time, but rather describe a larger situation, extending over an indefinite interval, characterized by a predictable recurrence of relevant episodes under certain circumstances. For instance, while 1a conveys that the baby is tired at the time that the sentence is uttered, 1b conveys that (almost) every time (within some larger contextually understood interval) at which the baby is picked up from daycare is a time when the baby is tired. Similarly, 2a conveys that people are unhappy at utterance time because of a rise in taxes, while 2b conveys that there is a tendency for individuals to be unhappy during the times that they are on a diet.

Marathi morphosyntactically distinguishes between these two uses of the English tensed copula. In both the past and the present tenses, the language uses distinct copular paradigms to express the senses corresponding to (a) and (b). These are glossed as COP1 and COP2 respectively. To compare with English, note that 4a, which describes a single episode of the baby being tired, contains a form of COP1 *āhe*, contrasting with 4b, where the presence of the COP2 form *asta* signals that a recurring generalization over episodes is being described. Similar contrasts hold between the COP1 and COP2 sentences in 5 and 6, with 6 exemplifying the past referring copular forms.[2]

(4) a. bāḷ thaklel-a ***āhe***
baby.NOM.N.SG tired-N.SG COP1.PRES.3SG
The baby is tired.

b. bāḷ sandhyākāḷī thaklel-a ***as-ta***
baby.NOM.N.SG evening.LOC tired-N.SG COP2-PRES.3N.SG
The baby is tired in the evenings.

[2]The glosses used in this paper are as follows. PRES.PART = Imperfective Participle; PART = participle; IMPF = imperfective aspect; PAST = past tense; PRES = present tense; 1 = First person; 2 = Second person; 3 = Third person; NOM = nominative; ACC = accusative; OBL = oblique; INS = instrumental; DAT = dative; GEN = genitive; LOC = locative; VOC = vocative; PTCL = particle; M = masculine; F = feminine; N = neuter; SG = singular; PL = plural; INF = infinitive; NEG = negation marker; ACT = active voice marker; PASS = passive voice; GER = gerund; EXCL = exclusive clitic; POTEN = potential mood; INTER = interrogative particle; REL = relative pronoun; CORREL = correlative pronoun

(5) a. karvāḍh-i muḷe lok-a dukkhi ***āhe-t***
tax.increase-OBL because people-NOM.N.PL unhappy COP1.PRES-3PL
The people are unhappy because of the tax increase.

b. ḍāyeṭ kar-ṇāri lok-a dukkhi ***as-tāt***
diet do-PART.N.PL people-NOM.N.PL unhappy COP2-PRES.3PL
Dieters (lit. diet-doing people) are unhappy.

(6) a. rām sandhyākāḷī dukkhi ***hotā***
Rām-NOM.M.SG evening.LOC unhappy COP1.PAST.3M.SG
Rām was unhappy in the evening.

b. rām sandhyākāḷī dukkhi ***as-āycā***
Rām-NOM.M.SG evening.LOC unhappy COP2-PAST.3M.SG
Rām used to be unhappy in the evenings.

Hindi exhibits the same semantic contrast but the morphosyntactic devices used to convey the contrast are slightly different. Hindi has a single copular element and expresses characterizing claims by periphrastically combining the imperfective participial form of this copula with the tensed form. For example, 7a, which describes a single episode of the baby being happy, contains the simple tensed copular form *hɛ*, contrasting with 7b, where the periphrastic imperfective construction *hotā hɛ* signals that a recurring generalization over episodes is being described.

(7) a. bacchā khush ***hɛ***
baby.NOM.M.SG happy COP.PRES.3SG
The baby is happy.

b. bacchā shām=ko khush ***ho-tā hɛ***
baby.NOM.M.SG evening=DAT happy COP.IMPF.M.SG COP.PRES.3SG
The baby is happy in the evenings.

Copulas are commonly taken to be the carriers of tense/aspect/modality distinctions without any additional lexical semantic contribution. In many languages (including English and Marathi), copulas in non-verbal clauses are identical to auxiliaries in verbal clauses, enabling further articulation of TAM distinctions in the linguistic system. For instance, in its auxiliary function *be* is used in the realization of the progressive aspect (*is/was/will be V-ing*) as well as the prospective aspect (*is/was/will be going to V*) in English. The two Marathi copular paradigms behave similarly in that they are used as auxiliaries in marking the progressive and perfect aspects in the linguistic system, yielding contrasts in interpretation that remain covertly expressed in English.[3]

Consider the contrast between 8a-8b and 8c-8d. While the aspectual morphology remains the same in each pair, the interpretation of each member is clearly distinct. 8a asserts that the reference time is contained in an event of John smoking, while 8b conveys that all/most contextually relevant times (within some larger stretch of time) are contained in an event of John smoking. In 8c, the reference time is understood to be located after the time of an event of John's making dinner and setting the table. 8d, in contrast conveys that in general, the time of my return is located after the time of an event of John's making dinner and setting the table.

(8) a. John *is smoking* in the common room (right now). (episodic)
b. John *is* always/often *smoking* in the common room. (characterizing)
c. John *has made* dinner and *set* the table (right now). (episodic)
d. By the time I return, John *has made* dinner and *set* the table. (characterizing)

In English, the contrast between episodic/particular and characterizing interpretations of verbal periphrases is facilitated by the presence of quantificational adverbial material – lexical expressions in 8b and clausal material in 8d. In Marathi, while such disambiguating material may be present, the episodic vs. characterizing readings are clearly and obligatorily disambiguated by the choice of auxiliary – glossed AUX1 and AUX2. 9a obligatorily conveys that a smoking event is ongoing at reference time and can never be used (even with overt quantificational adverbs) to express something like 8b.[4] In fact, AUX1 is unacceptable in sentences that contain overt quantificational adverbs. 9b correspondingly has only a characterizing interpretation, even in the absence of quantificational adverbs.

(9) a.

John	sigreṭ	***pī-t***	***āhe***
John.NOM.M.SG	cigarette.NOM.F.SG	drink-IMPF.PART	AUX1.PRES.3SG

John is smoking a cigarette. (episodic)

[3]It is interesting that the distinction between the two copulas is neutralized in the non-finite part of the system. There are no non-finite forms of COP1 and only COP2 forms are available in non-finite contexts regardless of whether the claim is particular or characterizing.

[4]The imperfective participle+AUX1 periphrasis is the general exponent of the progressive aspect in Marathi.The imperfective participle optionally inflects for gender and number in this periphrasis.

b. John (nehmi/kadhi-kadhi) sigreṭ
John.NOM.M.SG. always/sometimes cigarette.NOM.F.SG
pī-t ***as-to***
drink-IMPF.PART AUX2-PRES.3M.SG
John is always/sometimes smoking cigarettes. (characterizing)

The same distinction is made with the perfect aspect, where the disambiguation between episodic and characterizing readings is effected by the choice of the tense auxiliary.

(10) a. John=ne svayampāk ***banav-lelā*** ***āhe***
John=ERG meal.NOM.M.SG make-PERF.M.SG AUX1.PRES.3SG
John has made dinner. (episodic)

b. John=ne svayampāk ***banav-lelā*** ***as-to***
John=ERG meal.NOM.M.SG make-PERF.M.SG AUX2-PRES.3M.SG
(By the time I return), John has made dinner. (characterizing)

This paper investigates this particular type of split copula/auxiliary system found in Marathi. In fact, this appears to be a genetic feature, since several Indo-Aryan languages, including Hindi, Gujarati, and Ahirani, also exhibit this abstract pattern differing only with respect to the exponents that realize it (as briefly shown for Hindi).[5] The observed pattern demonstrates that semantic distinctions in the interpretations of tensed sentences that are only covertly made in some linguistic systems (e.g. the English copula/auxiliary *be*) can be teased apart systematically due to how markers of temporal reference are lexicalized in the systems of other languages. The division of labor effected by this two-copula/auxiliary system in Indo-Aryan has not yet been described as a possible pattern in either the typological or the semantic literature, making its study particularly interesting from the typological perspective as well. The question for cross linguistic semantic variation presented by the observed system can be framed as follows: why do some linguistic systems employ the same grammatical device to convey both particular and characterizing claims while other linguistic systems obligatorily signal this difference with distinct devices? Related to the question of semantic variation is a diachronic question: how does a contrast

[5]Bangla and Oriya (Mahapatra (2009)) also exhibit multi-copula/auxiliary systems, but the presence of more than two such elements (as well as the possibility of zero-copula constructions) in these languages yields a different pattern than the one present in the more commonly attested two-copula systems. A thorough investigation of these patterns must be left for later investigation.

such as the one found in Marathi and other Indo-Aryan languages morphosyntactically emerge in languages? Focusing on this latter question here, I will suggest that the categorical nature of this contrast in Marathi arises from changes in the tense marking system in the transition from Middle Indo-Aryan to the Early New Indo-Aryan languages. In a nutshell, the Middle Indo-Aryan system is aspectually based and lacks the morphosyntactic means to mark the past-present distinction. In Late Middle Indo-Aryan, a new tense auxiliary emerges with specific properties: it presupposes contextually salient intervals and anchors the proposition to the utterance world. This innovation effects a contrast in the copula/auxiliary system in which the contrast between particular and characterizing claims gets obligatorily expressed.

The rest of this paper is organized as follows. §3 describes in detail the interpretations associated with the two paradigms in Modern Marathi. I will only consider the effect of the contrast in copular clauses without any quantificational adverbs since this is enough to show that there are clear differences in interpretation that obtain with individual-denoting vs. kind-denoting subjects and stage-level vs. individual-level predicates in combination with the relevant forms. In §4, I present data from Epic Sanskrit and Middle Indo-Aryan to show that this contrast, while not identically manifested at these stages, is already partly realized by the presence of a copula that overwhelmingly occurs with characterizing readings. In §5, I discuss the changes with respect to their effect on the overall complexity of the system and conclude.

3 The Marathi facts

The relevant paradigms of the present and past tense copulas/auxiliaries are given in Table 1 and Table 2. The forms exhibit agreement along the morphological categories of person and number, and also in many cases, gender. Gender-based contrast has been noted within each person-number cell in which it occurs, in the order masculine/feminine/neuter. The data presented henceforth contains examples only in the present tense since the facts are largely comparable for the past tense cases.

Table 1: Present tense copula/auxiliary paradigms of Marathi

	COP1		COP2	
	SING (M/F/N)	PL (M/F/N)	SING (M/F/N)	PL (M/F/N)
1	*āhe*	*āhot*	*asto/aste*	*asto*
2	*āhes*	*āhāt*	*astos/astes*	*astā*
3	*āhe*	*āhet*	*asto/aste/asta*	*astāt*

Table 2: Past tense copula/auxiliary paradigms of Marathi

	COP1		COP2	
	SING (M/F/N)	PL (M/F/N)	SING (M/F/N)	PL (M/F/N)
1	*hoto/hote*	*hoto*	*asāyco/asāyce*	*asāyco*
2	*hotās/hotis*	*hotā(t)*	*asāycās/asāycis*	*asāycā(t)*
3	*hotā/hoti/hota*	*hote/hotyā/hoti*	*asāycā/asāyci/asāyca*	*asāyce/asāycyā/asāyci*

3.1 Copular clauses

We now examine non-verbal predicational copular clauses, which consist of a subject, a non-verbal adjectival or nominal element or a postpositional phrase, and the relevant copula. The organization of the data is by the syntactic type of the subject – names and bare nominals, and within each category, by the episodicity of the predicate – i.e. whether it is most naturally construable as a stage-level or individual-level property.

3.1.1 Names

With stage-level predicates, the two copulas contrast particular temporally delimited claims (COP1) with habitual generalizations (COP2). In 11a the use of COP1 conveys that the property of being busy or angry holds of Anu at the utterance time. In 11b, the use of COP2 obligatorily conveys that over some indefinite interval of time, there are recurring, regularly instantiated episodes of Anu being busy or angry.[6]

[6]The use of the latter adjective does not convey that Anu is an angry person but rather that Anu is often/regularly found in a state of anger.

(11) a. anu vyasta/cidleli ***āhe***
Anu.NOM.F.SG busy/angry COP1.PRES.3SG
Anu is busy/angry (right now).

b. anu vyasta/cidleli ***as-te***
Anu.NOM.F.SG busy/angry COP2-PRES.3.F.SG
Anu is generally busy/angry.

12a and 12b provide examples in which the main predicate is a locative prepositional phrase, another instance of stage-level predication. The observation is identical: the two copulas contrast in whether the assertion pertains to the utterance time or conveys some generalization that holds at some larger interval including the utterance time.

(12) a. anu gharā-t ***āhe***
Anu.NOM.F.SG house.OBL-in COP1.PRES.3SG
Anu is in the house (right now).

b. anu gharā-t ***as-te***
Anu.NOM.F.SG house.OBL-in COP2-PRES.3F.SG
Anu is generally in the house (e.g. when the postman comes by.)

When the main predicate is individual-level and denotes a relatively permanent, intrinsic property of an individual, only COP1 is acceptable as shown in the contrast between 13a and 13b. The use of COP2 introduces the sort of oddity that is associated with the use of quantificational adverbs with individual-level predicates (Kratzer (1995); Chierchia (1995); Magri (2009) among others).[7] It conveys that Anu habitually or generally has the property of being cowardly, tall, or intelligent, which is infelicitous because it tends to give rise to a scalar inference that this property only holds discontinuously in time, i.e. that it is possible that there are times when Anu is not cowardly, tall, or intelligent.

(13) a. anu ghābraṭ/unca/huśār ***āh-e***
Anu.NOM.F.SG cowardly/tall/intelligent COP1.PRES.3SG
Anu is cowardly/tall/intelligent.

b. #anu ghābraṭ/unca/huśār ***as-te***
Anu.NOM.F.SG cowardly/tall/intelligent COP2-PRES.3F.SG
#Anu is (habitually) cowardly/tall/intelligent.

[7] This is the observation that a sentence like *John is generally/always/often/sometimes intelligent* is understood as deviant or unacceptable without context.

3.1.2 Bare nominal subjects

Like many languages without determiners, Marathi allows both bare singular and bare plural arguments, and, in subject position, these may be understood either as making reference to unique, contextually salient entities or as making reference to kinds. In Dayal (n.d.; 2004), Veneeta Dayal makes a convincing case for Hindi, using arguments from scopal (non)-interaction that bare singulars are not ambiguous between indefinite and definite interpretations in Hindi (and other determiner-less languages). The Marathi facts closely parallel the Hindi facts and I will investigate the range of readings of bare nominals in Marathi only in the context of copular clauses here.

Stage-level predicates

Consider the examples in 14a and 14b, which contain bare singular subjects and stage-level predicates. These sentences are most naturally interpreted as describing the properties of the contextually most salient dog in the utterance context – i.e. the bare nominal has a directly referential use – like an NP with the definite article in English.

(14) a. kutrā thaklelā/bhukelā ***āhe***
dog.NOM.M.SG tired/hungry COP1.PRES.3SG
The dog is tired/hungry.

b. kutrā thaklelā/bhukelā ***as-to***
dog.NOM.M.SG tired/hungry COP2-PRES.3M.SG
The dog is generally tired/hungry.

With locative predicates, the pattern remains the same: the contrast lies in whether the property of being in the house is said to hold of the most salient dog in the utterance context, at the utterance time (COP1) or more generally over an indefinite interval that contains the utterance time (COP2).

(15) a. kutrā gharā-t ***āhe***
dog.NOM.M.SG house.OBI-in COP1.PRES.3SG
The dog is in the house (right now).

b. kutrā gharā-t ***as-to***
dog.NOM.M.SG house.OBL-in COP2-PRES.3M.SG
The dog is generally in the house.

In both 14 and 15, the bare nominal subject has most naturally a directly referential reading – its referent is understood to be an entity that is most salient in the utterance context (in the actual world at utterance time).

However there is another non-referential reading of bare nominals that arises with the use of COP2. For illustration, consider 16b, which contains COP2. Here, the bare singular *rāṅgoḷī* does not refer to any particular contextually salient entity at utterance time in the actual world, but rather to the rangoli that gets drawn everyday by Anu in front of her door.[8]

(16) **Context**: My friend is telling me about her sister Anu, who draws elaborate rangoli motifs in front of her house everyday. She says:

a. anu roj rāṅgoḷī kāḍh-te
   Anu.NOM.F.SG everyday rangoli.NOM.F.SG draw-IMPF.PRES.3F.SG
   Anu draws a rangoli motif everyday.

b. rāṅgoḷī dārā-samor ***as-te***
   rangoli.NOM.F.SG door.OBL-in.front.of COP2-PRES.3F.SG
   The rangoli (that she draws) is in front of the (main) door.

In the given context, 16b conveys that for each day *d* within some indefinite interval overlapping with the utterance time, the unique rangoli r_d that Anu draws on *d*, is located in front of the main door. It is infelicitous to follow up 16a with 17, which contains COP1, since the bare nominal *rāṅgoḷī*, in this case, can only be taken to refer to the contextually salient rangoli *at utterance time.*

(17) #rāṅgoḷī dārā-samor ***āhe***
   rangoli.NOM.F.SG door.OBL-in.front.of COP1.PRES.3SG
   The rangoli is (right now) in front of the (main) door.

In addition to the directly referential and non-referential readings described above, bare singular subjects may also be understood as kind-denoting. For instance, 18 has two salient readings: on the definite referential reading of the nominal, it may describe the general coordinates of a specific clock salient in the utterance context (for instance, the one my uncle gave me for my birthday). On the other reading, the sentence describes a generalization about where clocks in general tend to be located (i.e. as a claim about the kind clocks).

[8] Rangoli (Marathi *rāṅgoḷī*) is a traditional art form in which decorative patterns are created on the floor using materials such as colored rice, dry flour, colored sand, or flower petals.

(18) ghaḍyāḷ bhinti-var ***as-ta***
clock.NOM.N.SG wall.OBL-on COP2-PRES.3N.SG
definite referential: The clock (my uncle gave me) is (generally) on the wall.
kind: A clock (in general) is on a wall (rather than on the floor).

In a slightly different context, the bare nominal in 18 can also be interpreted non-referentially. For example, in a context such as the one below, the bare nominal refers to the unique clock in each room in John's hotel that lacks a mantelpiece, and not to a unique entity in the utterance context.

(19) **Context**: John is describing the organization of the rooms in his hotel to his manager. In each room, the time-piece is placed on the mantelpiece above the fireplace, if there is one. If there is none, the time-piece is hung on the wall above the bed. John says to his manager: "When there is no mantelpiece…"
ghaḍyāḷ bhinti-var ***as-ta***
clock.NOM.N.SG wall.OBL-on COP2-PRES.3N.SG
definite non-referential: The clock (in a room without a mantelpiece) is (generally) on the wall.

Bare plural subjects differ from bare singulars in that the kind interpretation is much more easily available for clauses in which they occur regardless of copula or predicate type. 20 contains a stage-level predicate, COP1, and a bare plural subject, *kāmgār* 'workers'. On one reading, it is a claim about the worker-kind at utterance time; we might be talking about workers all over the world (or in the US) working in exploitative conditions without job-security, on the verge of a world-wide revolution.[9] But it can also be read as a claim about a contextually salient plural entity – for instance, the group of workers that works at an air-conditioning plant that is planning to close shop and declare bankruptcy. This is the directly referential reading of the bare nominal.

(20) kāmgār asantuṣṭa ***āhe-t***
worker.NOM.M.PL discontented COP1.PRES-3PL
kind: Workers (in general) are discontented (right now).
definite referential: The workers (working at the air-conditioning plant right now) are discontented (right now).

[9] This kind reading is also available when the subject is a bare singular but it is a little more difficult to access. There is no number morphology on the subject, but singular/plural reference is inferred through agreement marking on the copula.

With COP2 and a stage-level predicate, as in 21, the sentence is understood to report a generalization obtaining over an indefinite interval containing the utterance time. However, the content of the generalization depends on how the bare plural is interpreted. It may refer to the kind, it may refer to the contextually salient plural entity in the utterance context, e.g. the workers that work at the air-conditioning plant right now, or it may pick out (possibly different) groups of workers across different times – this is the definite non-referential reading.

(21) kāmgār asantuṣṭa ***as-tāt***
worker.NOM.M.PL discontented COP2-PRES.3PL
kind: Workers (in general) are (generally) discontented.
definite referential: The workers (who are working at the air-conditioning plant right now) are (generally) discontented.
definite non-referential: The workers (whoever happen to work at the air-conditioning plant at a given time) are (generally) discontented.

Individual-level predicates

With individual-level predicates and COP1, both bare singulars and bare plurals, are preferentially interpreted as referring to singular or plural entities that are salient in the utterance context rather than to the kind.

(22) a. kāmgār ghābraṭ/unca/huśār ***ahe***
worker.NOM.M.SG cowardly/tall/intelligent COP1.PRES.3SG
definite referential: The worker (at that air-conditioning plant) is cowardly/tall/intelligent.
kind: ?A worker (in general) is cowardly/tall/intelligent.

b. kāmgār ghābraṭ/unca/huśār ***ahe-t***
worker.NOM.M.PL cowardly/tall/intelligent COP1.PRES-3PL
definite referential: The workers (at that air-conditioning plant) are cowardly/tall/intelligent.
kind: ?Workers (in general) are cowardly/tall/intelligent.

However, the kind reading of bare nominals becomes available with individual-level predicates and COP1 given suitable context and supporting linguistic information. For instance, in a context in which one is contrasting workers in this age with workers of previous eras, one may use COP1 to describe “the worker of today” (in contrast to that of yesteryears) as being intelligent – 23a. Similarly, 23b, which contains a bare plural and COP1, is fully acceptable in a context where the evolutionary potential of donkeys is under consideration and and one considers the possibility of intelligence determining genes mutating to make donkeys stupid.[10]

(23) a. āj-cā kāmgār jāsti huśār ***ahe***
today-GEN.M.SG worker.NOM.M.SG more intelligent COP1.PRES.3SG
kind: The worker of this age (lit. today) is more intelligent.

b. gāḍhav-e huśār ***āhet***
donkey-NOM.N.PL intelligent COP1.PRES-3PL
kind: Donkeys, as a kind, are intelligent (right now).

With COP2 and individual-level predicates like *huśār* 'intelligent', definite referential readings are unavailable with bare nominals (both singular and plural). This can be illustrated with the example in 24.

(24) **Context**: One/two of the workers at the air-conditioning plant fix(es) a problem with the cooling mechanism in an ingenious way. I praise his/their ingenuity, remarking to the manager:
#kāmgār huśār ***as-to/as-tāt***
worker.NOM.M.SG/PL intelligent COP2-PRES.3M.SG/PL
#definite referential: The worker(s) (who fixed the problem) is/are intelligent.

In such contexts, where it is clear that the bare nominal must refer to a singular/plural entity that is salient in the utterance context, speakers always choose COP1 and reject COP2. In attempting to construe bare nominals in COP2 sentences as definite referential expressions, speakers encounter the same oddity observed with names in 13b – that the property holds of a contextually salient singular or plural entity discontinuously in time.

Both definite non-referential and kind readings are possible with bare nominals when combined with COP2 and individual level predicates. 25 and 26 contain examples of the contexts in which the definite non-referential and kind readings of bare nominals arise respectively.

[10] Of course, the definite referential reading is available for both examples in 22. In a context in which we are talking about the particular worker that has come in today to help with cleaning the machines, the singular expression, *ājcā kāmgār* can refer to this specific worker. Similarly, the bare plural *gāḍhav-e* can refer, in the right context, to my pet donkeys. It is the kind reading that is somewhat difficult to access with COP1, but can be made available given contexts such as those above.

(25) **Context**: One/two of the smarter worker(s) is/are assigned to work overtime each month to keep the machinery in working order and repair malfunctions. Because the workers are smart and already very familiar with the machinery, this system proves more efficient than calling outside expertise to service the machines. I explain this system to the manager saying:

kāmgār huśār ***as-to/as-tāt*** mhaṇun
worker.NOM.M.SG/PL intelligent COP2-PRES.3M.SG/PL therefore
kām lavkar āṭap-t-a
work.NOM.N.SG fast finish-IMPF.PRES.3N.SG

definite non-referential: The worker(s) (that get assigned to the job) is/are intelligent (smart) (and) so the work gets done faster.

(26) **Context:** I am explaining to my students in a class on Labor Dynamics that they should always be transparent in their interactions with labor unions and try to understand their point of view.[11]

kāmgār prāmāṇik ***as-tāt*** mhaṇun tumhi suddhā
worker.NOM.M.PL honest COP2-PRES-3M.PL therefore you also
prāmāṇik as-āva
honest be-POT.N.SG

kind: Workers (in general) are honest, therefore you should also be honest (in your interactions with them).

3.2 The generalization

The distribution of the two (present tense) copulas detailed in the previous section is summarized below in Table 3. The terms D-ref., D-non-ref., and kind-ref. stand for the definite referential, definite non-referential, and kind-referring readings of bare nominals.

[11]The sentence has a kind reading with the adjective *intelligent* as well, but it was difficult to construct a context in which such a sentence could be uttered without there also being some bias in the context that workers are not intelligent. The change from *intelligent* to *honest* is in order to avoid invoking such a bias.

Table 3: Readings associated with copular clauses in Marathi

	COP1		COP2	
Subject NP	SLP+COP1	ILP+COP1	SLP+COP2	ILP+COP2
names	episode in actual world at UT	property in actual world overlapping with UT	generalization over episodes across time (invariant NP referent)	**induces oddity**
bare nominals D-ref.	episode in actual world at UT	property in actual world overlapping with UT	generalization over episodes across time (invariant NP referent)	**induces oddity**
bare nominals D-non-ref.	**unavailable**	**unavailable**	generalization over episodes across time (variable NP referent)	generalization over properties of individuals across time (variable NP referent)
bare nominals kind-ref.	episode involving the kind in actual world at UT	property of the kind in the actual world overlapping with UT	generalization over episodes involving kind-instances across time	generalization over properties of the kind across time

What is immediately apparent through the table is that the type of copula influences the range of readings available to bare nominal subjects. Specifically, COP1 forces a referential interpretation of bare nominals (i.e. the nominal must pick out an individual (singular, plural, or kind) in the actual world at utterance time). COP2, on the other hand, is unacceptable (oddity inducing) when neither the subject denotation nor the predication of the property of the subject denotation may be construed as variable across time. Intuitively, the meaning of COP1 sentences seems to depend on the valuation of the embedded predication at utterance time in the actual world, while the meaning of COP2 sentences seems to require consideration of the valuation of the embedded predication at times beyond the utterance time. In other words, the morphosyntactic devices COP1 and COP2 allow Marathi to distinguish between descriptions whose interpretation is anchored to the utterance time i_0 and the utterance world w_0 on the one hand and those that lack such anchoring on the other.

This contrast is typologically interesting since, as far as I know, it has not been described as being the basis of a multiple-copula system in any language-(family). As reported in the introduction, the distinction is wide-spread in the New Indo-Aryan languages. While the choice of devices may differ, all languages systematically disambiguate interpretations that are anchored to the utterance world and time from those that are not. The question we turn to next is: How/when does this semantic contrast become morphosyntactically expressed in Indo-Aryan languages in a categorical way? To answer this question, I will consider facts from Epic Sanskrit (Old Indo-Aryan) and Prakrit and Apabhraṃśa (Middle Indo-Aryan).

4 Historical basis of the contrast

4.1 Old Indo-Aryan (Epic Sanskrit)

Old Indo-Aryan, like most Ancient Indo-European languages, inherits two PIE "be" verbs – *as* (PIE $*h_1es$) and *bhū* (PIE $*b^hueh_2$). The precise distribution of the two forms in Epic Sanskrit is not well-established, but there are some observed environments in which each copula occurs.[12] For instance, *as* is the tensed element of choice in existential clauses but it can also be used in predicational clauses. In both constructions, it can be used to make both particular and characterizing claims. *bhū*, in contrast, as a copular expression, only appears in predicational clauses and in those structures, appears to be compatible only with non-referential, characterizing readings.[13] Notice that this distribution, in which one copular element tends to have non-referential characterizing readings in its stative uses, yields a partially articulated contrast between particular and characterizing claims. To the best of my knowledge, this interpretive contrast between the two copular expressions has not been explicitly described for Sanskrit, although, in §5, I point out that this appears to be a contrast instantiated in Old English as well, potentially pointing to a tendency inherited from the PIE system. Consider the examples below from the Mahabharata, one of the two Epic

[12] A reviewer observes that using Epic Sanskrit as the only source for investigating the distribution of the two copular forms in Old Indo Aryan is an unfortunate choice. The reasoning is that "the Epic Sanskrit corpus is not coherent and in quintessence it is not even Old Indo-Aryan. It varies massively diachronically and diatopically." It is indeed conceivable that the writers of the Sanskrit Epics, are, in fact, native speakers of a language with a Middle Indo-Aryan type system, leading to peculiarities of Middle Indo-Aryan entering the Epic corpus. We know that the Middle Indo-Aryan Prakrits were the vernacular languages in the region at least since 300 BCE (based on Aśokan inscriptions). However, the limited goal of this paper is to establish that the semantic contrast observed in Marathi (and other new Indo-Aryan languages) is not present in the same categorical way in the diachronically prior systems although there is a tendency to associate the *bhū* copula with characterizing claims. I therefore take showing the existence of such tendential data in the Epic corpus to be sufficient for this goal.

[13] *bhū* also has an inchoative use where it corresponds to a verb like "become" or "happen". This is an eventive use of the verb which I will be ignoring for the purposes of this paper.

Sanskrit texts, that illustrate this distribution.[14]

(27) a. madadhīn-o ’-*si* pārthiva
me.dependent-NOM.M.SG **as**-PRES.2.SG king.VOC.SG
O King, you are dependent on me. (Mbh. 1.78.35b)

b. abhijāt-o ’*s-mi* siddh-o
high.born-NOM.M.SG **as**-PRES.1.SG accomplished-NOM.M.SG
’*s-mi* na *as-mi* kevalamānuṣ-aḥ
as-PRES.1.SG NEG **as**-PRES.1.SG ordinary.man-NOM.M.SG
I *am* of high birth, I *am* accomplished, I *am* not an ordinary man. (Mbh. 12.28.7a)

c. y-e *s-anti*
Those.REL-NOM.PL **as**-PRES.3.SG
vidyātapasopapann-ās te-ṣāṃ
knowledge.ascetism.possessed-NOM.M.PL those.CORREL.GEN.M.PL
vināśa-ḥ prathamaṃ tu kār-ya-ḥ
destruction-NOM.M.SG first PTCL do-POTEN-NOM.M.SG
Those who *are* possessed of knowledge and ascetic virtue, their destruction should be undertaken first. (Mbh.3.99.19c)

In 27a and 27b, both predicational copular clauses, the copula *as* is used to convey that the referent (the addressee and the speaker of the utterance context, respectively) has the relevant property at utterance time in the utterance world. 27c, a more involved sentence, describes a resolution arrived at in terms of a course of action to be undertaken at utterance time. The subject referent, in this case, is the set of all individuals in the utterance world at utterance time, who are possessed of knowledge and ascetic virtue. Crucially, the sentence does not express a general claim about how such people are to be treated across all situations.

In 28a and 28b, both existential clauses, we see that the *as* copula is used to make characterizing claims. 28a makes the generalization that kingless-kingdoms have neither rain nor Gods while 28b asserts the existence of cowardly and brave men across different indices of evaluation – not only at utterance time.

[14]The Mahabharata text is attributed to a single author Vyāsa but is usually understood to be a compiled text (dateable to ~100BCE) with interpolations from multiple authors.

(28) a. arājak-eṣu rāṣṭr-eṣu na ***as-ti*** vṛṣṭi-r na
king.less-LOC.PL kingdom-LOC.PL NEG **as**-PRES.3.SG rain-NOM.SG NEG
devatā-ḥ
God-NOM.PL
In kingdoms without a king, there *is* no rain and no Gods. (Mbh. 1.99.41a)

b. ***s-anti*** vai puruṣ-āḥ śūr-āḥ ***s-anti***
as-PRES.3.PL PTCL man-NOM.M.PL brave-NOM.M.PL **as**-PRES.3.PL
kāpuruṣ-ās tathā
coward-NOM.M.PL likewise
There *are* brave men, and likewise those that *are* cowards. (Mbh. 5.3.2a)

When we study the distribution of the *bhū* copula, it appears that its stative uses involve only characterizing readings, as in the examples in 29.[15] 29a describes what is said in the code – a guideline to be followed not just at utterance time but more generally. 29b describes the defining properties of the Rākśasa women kind and the clause containing the *bhū* copula predicates the property of being many-formed to the kind.

(29) a. sakhībhartā hi dharm-eṇa bhartā
friend.husband.NOM.M.SG PTCL code-INS.M.SG husband.NOM.M.SG
bhava-ti *śobhane*
bhu-PRES.3.SG beautiful.VOC SG
O beautiful one, the husband of a friend, according to the code, *is* also one's husband. (Mbh. 1.78.20c)

[15] I searched through John Smith's electronic text version of of the Bhandarkar Oriental Research Institute's critical edition of the Mahabharata (1933–66) for instances of the 3rd singular and plural present indicative forms of *bhū* – *bhavati* (362 occurences) and *bhavanti* (114 occurences). Examining the first fifty occurrences among the results from each set did not yield a clear instance where *bhu* appeared as the main predicate in a copular clause, was interpreted statively with present reference, and gave rise to a particular claim. The electronic edition used is available here.

b. sadyo hi garbha-ṃ rākṣas-yo labh-ante
immediately PTCL embryo-ACC.SG R-NOM.F.PL receive-PRES.3.PL
prasav-anti ca kāmarūpadhar-āś ca eva
give.birth-PRES.3.PL and desire.form.holding-NOM.F.PL and PTCL
bhav-anti bahurūpiṇ-aḥ
bhu-PRES.3.PL many.formed-NOM.F.PL
The Rākśasa women give birth the very day they conceive, and being able to assume any form at will, they *are* many-formed.
(Mbh.1.143.32a-c)

What is crucial is that the verbs *as* and *bhū* do not seem to stand in free variation in the Epic Sanskrit system. While *as* is used to make both particular and characterizing claims, there is a strong tendency for the *bhū* copula to NOT be used in clauses that describe a state determined by the valuation of the embedded predication at utterance time in the actual world – in other words, the uses that I examined occur in clauses that convey generalizations. I take these facts to suggest that there is some evidence in Old Indo-Aryan for a dedicated device for expressing non-referential characterizing claims but there is no clear-cut division of labor between the two copulas of the kind one sees in Marathi and other New Indo-Aryan languages.

4.2 Middle Indo-Aryan

4.2.1 Maharashtri Prakrit

The changes from the inflectional system of verbal contrasts in Old Indo-Aryan to the relatively morphologically impoverished inflectional system of Middle Indo-Aryan have been described in terms of "erosion" or "simplification", primarily because many of the rich conjugational paradigms and the semantic categories expressed were lost in Middle Indo-Aryan (Bloch (1965); Beames (1872-79); Bubenik (1998; 1996); Pischel (1900); Vale (1948); Masica (1991) and others). Of the several changes in the expression of tense-aspect-modality distinctions,[16] critical is the loss of a morphosyntactic distinction between the past and present tenses.

[16]The Middle Indo-Aryan tense/aspect system inherits only the Present, the Perfective Participle, and the Sigmatic Future paradigms from Old Indo-Aryan. The rich system of past tense markers is lost. Pischel (1900), on the basis of careful textual study, reports that the Imperfect, the Aorist, and the Perfect occur in Middle Indo- Aryan texts only as a few scattered forms for a few verbs. From among the past-referring forms of Epic Sanskrit, only the perfective participial paradigm remains and it is used regularly to refer to past time events in Middle Indo-Aryan.

This subsection describes the resulting contrasts in the re-organized aspectually based system in which temporal reference is established through contextual cues (Deo 2012).[17] The examples in 30 and 31 illustrate the basic Middle Indo-Aryan pattern, which forms the backdrop for an innovation in Late Middle Indo-Aryan. In 30a, the Old Indo-Aryan Present paradigm, glossed IMPF, has present reference, while in 30b, the same paradigm has past reference.

(30) a. nipphala-ṃ duma-ṃ pakkhiṇ-o vi
fruitless-ACC.N.SG tree-ACC.N.SG bird-NOM.M.PL also
paricchaya-nti
abandon-IMPF.3.PL
Even birds *abandon* a fruitless tree. (VH.DH 31.24-25) *imperfective present reference*

b. *tato aham aṇṇayā kayāi*
Then I.NOM.SG other some time
āyariya-giha-rukkha-vāḍiyā-e joga-m ***kare-mi***
teacher-house-tree-garden-LOC.F.SG yoga-ACC.M.SG do-IMPF.1.SG
Then, sometimes, I *would perform* Yoga in the orchard at my teacher's house. (VH:DH 37.1) *imperfective past reference*

In 31, a set of consecutive sentences reports part of a past episode about a monkey who entered a mountain cave and mistook some sticky liquid tar to be water. 31a describes a past event using perfective marking while 31b and 31c also with past reference, describe past activities using the temporally unmarked imperfective.

(31) a. te-ṇa palāyamāṇ-eṇa purāṇakuv-o
that-ERG.M.SG running-ERG.M.SG old.well-NOM.M.SG
taṇadabbhaparichinn-o ***diṭ-ṭho***
weed.grass.covered-NOM.M.SG notice-PERF.M.SG
That running one *noticed* an old well
covered with weed and grass. (VH.KH. 8.6) *perfective past reference*

[17] In brief, the reorganization is as follows: The Old Indo-Aryan Present tense realizes a tenseless imperfective and is compatible with both present and past imperfective reference. The Old Indo-Aryan Present Participle is also starting to be used in this function. The Old Indo-Aryan Past Participial form in *-ta* realizes the perfective aspect and is used to refer to completed events. Therefore, by default, the use of this form leads to past temporal reference. However, this form may also be used systematically to describe future eventualities.

b. tattha ayagar-o mahākā-o vidāriyamuh-o
there python-NOM.M.SG gigantic-NOM.M.SG open.mouthed-NOM.M.SG
gāsiukām-o tam purisam
swallow.desiring-NOM.M.SG that-ACC.M.SG man-ACC.M.SG
avaloe-i
observe-IMPF.3.SG
There a giant python, baring its mouth, eager to eat,
observed the man. (VH.KH. 8.9) *imperfective past reference*

c. sapp-ā bhīsaṇ-ā aṣiukām-ā
snake-NOM.M.PL fearsome-NOM.M.PL eat.desiring-NOM.M.PL
ciṭṭha-nti
stand-IMPF.3.PL
Fearsome snakes, eager to bite,
stood (in the well). (VH.KH. 8.9) *imperfective past reference*

To summarize, the core distinctions made in the Middle Indo-Aryan aspecto-temporal system are as follows:

non-future		*future*	
imperfective	*perfective*	*neutral*	*perfective*
IMPF or PRES.PART	PERF	sigmatic future	PERF

The Early New Indo-Aryan aspecto-temporal system is systematically built up from this aspectual core through periphrastic constructions based on tense auxiliaries, already visible in Middle Indo-Aryan (Bubenik (1996; 1998); Kellogg (1893); Beames (1872-79); Chatterji (1926) a.o.).

4.2.2 Apabhraṃśa

A key change in the Late Middle Indo-Aryan verbal system, specifically Apabhraṃśa, involves the loss of the Old Indo-Aryan *as* copula.[18] Additionally, we see the introduction of a new tense auxiliary, based on the verb *acch* 'sit' that establishes temporal reference with respect to speech time (Turner 1936). This auxiliary presupposes contextually salient reference intervals and anchors the embedded property to the utterance world. The present tense auxiliary paradigms

[18] It has been proposed that the loss of *as* is purely morphological; it is an athematic verb from the second conjugation, which is lost as part of the simplification of the verbal system (von Hinuber 2001: 293).

of several Indo-Aryan languages are cognate forms of this original auxiliary, as seen below.[19]

- *acchai* > *āhe* Marathi
- *acchai* > *ahai* > *hai* Hindi
- *acchai* > *chai* > *che* Gujarati
- *acchai* > *āchi* Bangla

In Late Middle Indo-Aryan, this auxiliary appears in copular clauses as illustrated below in 32. All examples here come from the *Paumacariu* of Svayambhudeva, a key Apabhraṃśa verse text from ~ 800CE.

(32) a. deva deva ki-u j-eṇa mahāra
Lord.VOC.SG do-PERF.M.SG that.REL-INS.M.SG great.sound.NOM.M.SG
acch-ai mattahatthi airāva
acch-PRES.3.SG musth.elephant.NOM.SG Airāvata.NOM.SG
Lord, the one who made a great sound, he is the elephant Airavata in musth season. (PC 1.11.3.4)

b. ***acch-ahi*** suha.dukkha.karamviya
acch-PRES.2.SG pleasure.pain.engrossed.PERF.M.SG
(You) are engrossed with pleasure and pain. (PC 2.33.5.2)

c. ***acch-ai*** kailāsa-ho uvari sāhu
acch-PRES.3.SG Kailash-GEN.SG on sage-NOM.M.SG
There is a sage on the Kailasa mountain. (PC 1.13.2.6)

The cognate of the *bhū* copula retains its properties observed in Old Indo-Aryan – in its stative uses, it gives rise to non-referential characterizing readings, as the examples in 33 illustrate.

(33) a. sappurisa vi cañcalacitta ***ho-nti***
good.man.NOM.M.PL even unsteady.mind.NOM.M.PL **bhu**-PRES.3.PL
Even good men are fickle minded. (PC 2.22.10.7)

b. sāsu-a ***ho-nti*** viruāriya
Mother-in-law-NOM.F.PL **bhu**-PRES.3.PL cruel.NOM.F.PL
Mother-in-laws are cruel (PC 1.19.4.8)

[19] I note here that in its early uses, the *acch* auxiliary is not always associated with present tense reference. It is compatible with both past and present temporal reference and uniformly conveys that a given state holds at reference time. In Early New Indo-Aryan languages, however, this form is exclusively used to convey present temporal reference.

c. has-iu purandar-eṇa are māṇava devasamāṇa
laugh-PERF.M.SG Purandara-INS.M.SG O human.VOC.SG God.equal
ho-nti kiṃ dāṇava
bhu-PRES.3.PL INTER demon.NOM.M.PL
Purandara (Indra) laughed: "O human, are the Gods equatable with the demons?" (PC. 1.8.8.8)

I speculate here that the Late Middle-Aryan innovation of a tense auxiliary built on *acch* 'sit' that anchors the embedded predication to the utterance world and contextually salient reference intervals, in fact leads to a reorganization of the copular/auxiliary system. The idea is as follows: the original Old Indo-Aryan system had a dedicated device for making non-referential characterizing claims (the *bhū* copula) but the *as* copula was underspecified and could be used in both particular and characterizing senses. This underspecified copular element was independently lost for morphological reasons in Middle Indo-Aryan. The innovation of a new tense auxiliary, anchored to the utterance world and time, in Late Middle Indo-Aryan system facilitated the "hardening" of the soft contrast between particular and characterizing claims found in the older systems. Specifically, I hypothesize that the innovated copular element was incompatible with characterizing claims, which led to a complementary distribution between the two copular forms in the domain of copular clauses.[20] There is much that is unknown about the precise development of tense marking in Indo-Aryan and a fuller understanding of the pathway associated with the copular contrast in New Indo-Aryan rests on that. I leave this investigation to future research, noting only that it is not the innovation of morphosyntactic tense marking per se that leads to the categorical realization of the contrast, but rather the particular temporal reference features associated with the auxiliary forms.

5 Concluding thoughts

Towards the beginning of this paper, I distinguished between morphosyntactic strategies in which salient contrasts within a semantic domain are overtly expressed or individually packaged vs. those in which such contrasts remain morphosyntactically unexpressed with the distinct meanings disambiguated in context. From the perspective of the questions that underpin this volume, one might

[20] This contrast is still realized in some languages (e.g. Hindi and Bangla) by the cognates of **acch** and **bhu**, while in other languages, other lexical items and paradigms get recruited to realize the same semantic contrast.

ask if an individualized packaging strategy is more or less complex than a contextual disambiguation strategy. That is, are semantic contrasts retrievable by means of form-dependent strategies "better" than contrasts retrievable only in context (e.g. Modern English)? Depending on the answer, the emergence of the categorical contrast between particular and characterizing claims in a linguistic system may be seen as a change for the worse. There are at least two considerations. On the one hand, successful use of the two-copula strategy observed in Marathi (and mirrored in other Indo-Aryan languages) involves the acquisition of two semantically distinct paradigms for temporal reference. While the two-form system guarantees communicative success, the acquisition process is rendered more complex since the distribution of two forms relative to a semantic domain must be learned. On the other hand, in a language that does not lexicalize the particular-characterizing contrast and has only a single form to convey distinct meanings (such as English), hearers must be contextually attuned so that the intended temporal interpretation is indeed retrieved reliably in a given context.

In the Indo-Aryan case, we observe a transition from a partially context-dependent strategy of meaning recovery to a form-dependent strategy of meaning recovery. While evaluating whether this transition is a worsening or complexification of the system, it is necessary to keep in mind that the categorical or "hardened" contrast between particular and characterizing meanings does not just emerge *spontaneously* in Indo-Aryan from the original soft contrast. Rather, it is situated within changes in the larger landscape of Middle Indo-Aryan temporal reference. The Middle Indo-Aryan system lacked dedicated devices corresponding to the present and the past tenses – a distinct morphosyntactic impoverishment in comparison to the Old Indo-Aryan system with three past-referring categories. In such a system, imperfective and perfective clauses are temporally under-specified and contextual cues are critical to the retrieval of information regarding their temporal reference. The development of the copular contrast described here was concomitant with the emergence of overt marking of tense distinctions via innovated tense markers. These tense markers (as illustrated here by the present tense forms) had the right anchoring properties – they anchor the embedded predication to the utterance time and the utterance world. The categorical marking of particular vs. characterizing claims became possible only after such devices were available in the linguistic system.[21] Thus, the transition

[21]To be clear, our earliest records of Marathi already show these tense auxiliaries with established function. In contrast, they are rather infrequent the Late Middle Indo-Aryan record. So it is likely that there might not be textual material that allows us to track the gradual development

to what might appear, on the formal metric, a more complex strategy of meaning packaging and recovery in the copular domain, turns out to be a consequence of a far more general change in the language – the development of overt morphosyntactic realization for the present and past tenses. If one argues that the development of basic temporal distinctions in the tense-aspect system does not constitute complexification, then the status of concomitant effects of this development becomes somewhat less clear.

To close the paper, I will use a counterpoint to underscore that the categorical copular pattern seen in synchronic Marathi (and other Indo-Aryan languages) crucially relies on particular historical facts about the Late Middle Indo-Aryan tense-aspect system. The counterpoint is Old English, which also inherited the two PIE "be" verbs – *is* (PIE $^{*}h_1 es$) and *bið* (PIE $^{*}b^h ueh_2$). Petré (2013) (also citing prior research) shows convincingly that in Old English, *is* was mainly used for predicating present states of specific subjects, and in identifying clauses, while *bið* was used to encode future situations and generic statements, which are connected to future situations through their implication of future validity. The pattern, while not identical to that of Epic Sanskrit, is similar in that the language morphosyntactically distinguishes between particular claims and characterizing claims (Petré's) "generic statements". The two examples in 34 illustrate the functional distribution of *bið* in Old English.[22]

(34) a. *Hit* ***by****ð dysig* þae*t man speca* ae*r* þ*one he* þae*nce*
It is foolish that man speak.SUBJ ere then he think.SUBJ
It *be* foolish that a man speaks before he thinks. (c1100. Prov 1 [Cox]: 2.2, via Petré 2013)

of these devices in the Indo-Aryan languages.

[22] Petré refers to a quantitative analysis by Kilpiö (1993), which suggests that the pattern is tendential rather than categorical – there is a soft rather than categorical contrast. According to Kilpiö, *is* is found with its typical semantic characteristics in no less than 86.4% of all instances in HC. For *bið*, its presence in the typical semantic domain associated with it, amounts to only about 56.7%.

b. *Wið stede & for gebinde, heortes haer* ***beo****ð*
against strangury and for constipation hart.GEN hair.PL are.IND.3.PL
swiðe gode mid to smeocanne wifmannum
very good with to smoke women.DAT
Against strangury and constipation, hairs of the hart *be* very good for women to fumigate with. (c1025. Med 1.1 [de Vriend]: 3.16, via Petré 2013)

If Petré is right, what is striking about the evolution from Old English to Middle English is that this functional contrast, which is soft, but remarkably stable in Old English, is eroded by the the grammaticalization of a future construction *sceal beon* "shall be". One result of this innovation is a drastic redistribution of the two "be" verbs, and finally their merger (the situation in Modern English). The hardening of soft semantic contrasts of this sort thus appears to be entirely dependent on patterns of innovation and loss in the larger system of temporal/aspectual contrasts.

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Chapter 8

The complexification of Tungusic interrogative systems

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The present study discusses the nature and development of a Tungusic phoneme **K*- that has proven difficult to reconstruct. It is only fully preserved in one subbranch of the Tungusic language family and today is usually considered a velar fricative **x*- (Benzing 1956). However, there is evidence from a Tungusic language called Alchuka hitherto almost unknown outside China (Mu Yejun 1985; 1986; 1987; 1988). In this language the phoneme is, somewhat irregularly, preserved as unaspirated *k*-, which corroborates the reconstruction as plosive (Rozycki 1993). The main focus of the paper is the role of the phoneme in the interrogative system of proto-Tungusic as well as the detrimental implications of its loss in most Tungusic languages. In proto-Tungusic the phoneme had the function of a *submorpheme* or *resonance* similar to English <wh> (Bickel & Nichols 2007; Mackenzie 2009). Its loss lead to incoherent interrogative systems with a large number of individual forms that are synchronically opaque, i.e. to complexification. Finally, the question is addressed whether this can be considered a "change for the worse" as indicated by the title of this volume.

1 Introduction

Tungusic is a small and highly endangered language family scattered over Northeast Asia. According to Janhunen (2012), Tungusic can be divided into the Jurchenic (IV), Nanaic (III), Udegheic (II), and Ewenic (I) subbranches. The former two form the southern and the latter two the northern branch of Tungusic (see also Georg 2004). The enumeration of the individual subbranches with roman numerals follows Ikegami (1974). Altogether, Tungusic encompasses some twenty different languages.

Andreas Hölzl. 2020. The complexification of Tungusic interrogative systems. In Dankmar Enke, Larry Hyman, Johanna Nichols, Guido Seiler & Thilo Weber (eds.), *Language Change for the Worse*, 213–243. Berlin: Language Science Press. DOI: ??

This chapter investigates Tungusic interrogatives, also known as interrogative words, question words etc. Most Tungusic interrogatives started with an initial consonant for which several different reconstructions were proposed (see Rozycki 1993). For the time being, the uncertainty of this consonant will be indicated with the label **K*-. The only subbranch that is known to preserve the feature in question is Nanaic, which consists of the languages Hezhen, Kilen, Kili, Nanai, Uilta, Ulcha, and Ussuri Nanai (e.g., Alonso de la Fuente 2011, Janhunen 2012). For a first impression, consider Table 1 which lists four interrogatives from five different languages that represent all four Tungusic subbranches. Roman numerals refer to the subbranches of Tungusic. In Nanai, all four interrogatives start with an initial *x*-, while in Manchu, Udihe, or Oroqen no such phoneme is present. An underscore indicates the lack of the initial that was regularly lost in these languages. Unexpectedly, however, there is an initial *k*- in a language called Alchuka. This language is not very well-known, but offers some crucial information for our understanding of Jurchenic and Tungusic in general (Hölzl 2017).

Table 1: Some selected cognates of interrogatives in Manchu (Norman 2013), Alchuka (Mu Yejun 1986), Nanai (Ko & Yurn 2011), Udihe (Nikolaeva & Tolskaya 2001), and Nanmu Oroqen (Chaoke 2007). Not all variants are listed.

Meaning	Manchu IV	Alchuka IV	Nanai III	Udihe II	Oroqen I
how	-	-	xooni	_ono	_ooni
how many	_udu	**kutu**	xado	_adi	_adi
what	_ai	**kai-**	xaɪ	_i:-	_i-
when	-	-	xaali	_ali	_aala

Two of the interrogatives were lost in the highly innovative Jurchenic subbranch. Apart from regular phonological changes, some progressive (Udihe *ono*, Oroqen *aala*) and regressive vowel assimilations (Manchu *udu*, Alchuka *kutu*) have slightly distorted the picture. But there can be no doubt that these forms represent a valid set of cognates (cf. Benzing 1956: 114). The interrogatives form one coherent system with an initial *x*- in Nanai. This can be called a formal *resonance* that will be shown with a tilde, i.e. *x~* (Hölzl 2018b). This is meant to indicate its partial analyzability as opposed to clearly analyzable morphemes that are indicated with a hyphen, e.g. Nanai *xaɪ-do* 'what-DAT'. As Bickel & Nichols (2007: 209) put it: "parts of words resonate with each other and can therefore be extracted as meaningful formatives or morphemes." They give the example of English demonstratives that share an initial /ð/. In English a similar phenomenon is also known from certain lexical items such as ***snore***, ***sneeze***, ***sniff***, ***snuff*** etc., all of which start with *sn~* and have a vague similarity in meaning. The concept of a resonance can also be usefully applied to interrogatives (Mackenzie 2009). The loss of the initial in Tungusic would be comparable with the loss of the <wh> in English, e.g. *(wh)at*, *(wh)en* etc. Usually, a resonance in the interrogative system is an indication of an old etymological connection. For instance, German ***wo*** 'where' and ***warum*** 'why' are synchronically unrelated, but share a resonance in *w~*. Historically, however, the first part of *war-um* (literally 'where-around') is cognate of *wo*, which lost the final *-r*, unless it was followed by a vowel. In this case, *warum* represents a *fused* form that is no longer analyzable (Muysken & Smith 1990). In German, there are only two interrogatives without an initial *w~*, which is due to a prefix, i.e. *in-**wie**-fern*, *in-**wie**-weit* 'how (far), to what extent' (literally 'in how far'). Tungusic languages only have suffixes and exhibit the word order Interrogative Noun (IntN). There is thus a natural tendency to build up resonances over the course of time. Rephrasing Givón (1971: 413), one might say that, in these languages, today's resonance is yesterday's morphosyntax.

The resonance in Tungusic is not as clear-cut as English initial /ð/ in demonstratives such as ***this***, because unlike in English there are many other words with the same onset. However, the loss of the phoneme in lexical items such as 'wind' had no effect on their meaning, e.g. Manchu *_edun*, Nanai ***x**ədun*, Udihe *_edi*, Nanmu Oroqen *_ədin*. There simply is no set of weather-related words with an initial **K-*. On the contrary, the Tungusic phoneme had a certain functional load in the interrogative system (cf. Langacker 2001). This is why the loss of the phoneme led to a very incoherent interrogative system with a high number of individual forms that are synchronically unanalyzable. It changed the interrogatives in Table 1 from a so-called *fused* to an *opaque* system that no longer exhibits any signs of a former etymological connection (Muysken & Smith 1990). Of course, derivational or inflectional suffixes remained unaffected by this. For example, Manchu (IV) *ai-**de***, Nanai (III) *xaɪ-**do***, Udihe (II) *iː-**du***, Chaoyang Oroqen (I) *i-**du*** 'where' (Hu Zengyi 2001: 261) are all still analyzable as 'what-DAT'. Nevertheless, it will be argued in this chapter that the loss of the phoneme led to the *complexification* of the Tungusic interrogative system. In Manchu, for instance, there is no indication that *ai* 'what' and *udu* 'how many' could once have been related etymologically. §2 addresses the question how the complexity of interrogative systems can be described cross-linguistically.

One of the main problems for the comparison with Alchuka is the irregularity of the occurrence of the initial *k-*. For instance, it would be expected to be present in the word for 'wind' as well, but this word has been recorded as _-*ɔduŋ* (Mu Yejun 1985: 6). At least in some cases, the irregular correspondences can be explained with borrowing from Manchu dialects that had a strong impact on Alchuka (cf. Aihui Manchu _*odon/ŋ*, Wang Qingfeng 2005: 162). For instance, the interrogative ***k****ai-* has also been recorded as _*ei* by Mu Yejun (1986: 10). In this case, it is plausible to assume a certain amount of variation among what were probably the last speakers of the language when the data were collected during the 1960s (Mu Yejun 1985: 5). Again, the variant _*ei* could represent a loan from a Manchu dialect (cf. Yibuqi Manchu _*ɛi*, Zhao Jie 1989: 127). Furthermore, the recording of the Alchuka data by Mu Yejun is not always reliable. In specific cases, it is unclear whether the differences found in the recordings are true variation in the language itself or simple spelling mistakes. Nevertheless, independent evidence from other Jurchenic varieties confirms that the initial consonant as such is a real phenomenon and cannot be due to mere spelling mistakes (e.g., Kiyose 2000). §3 considers these problems relating to the Tungusic interrogative systems further.

The following research questions will be addressed in this study: (1) Is Alchuka *k-* a reflex of proto-Tungusic **K*-? (2) What, exactly, is the nature of the proto-Tungusic phoneme **K*-? (3) What were the consequences of its loss for the complexity of the Tungusic interrogative system? (4) How can the complexity of interrogative systems be defined cross-linguistically? (5) And finally, can this development be considered a "change for the worse" as indicated by the title of this volume?

The chapter has five subsections, including this introduction (§1). §2 briefly introduces seven different dimensions of complexity and defines the complexification of interrogative systems. Based on this general outline, §3 analyses the Tungusic interrogative system as well as its development through time. Given the rediscovered data from Alchuka, a new reconstruction for the proto-Tungusic phoneme **K*- is proposed. §4 evaluates the loss of the phoneme as well as its consequences and inquires whether it can be considered a change for the worse. §5 presents some conclusions.

2 The complexity of interrogative systems

Language is a very complex phenomenon. Every language requires a certain degree of complexity to be useful and engaging (cf. Norman 2010). In comparison, differences between languages are relatively minor, but nevertheless clearly observable. There are different approaches to complexity. For instance, Miestamo

(2008) draws a distinction between absolute (i.e., objective) vs. relative (i.e., subjective) complexity on the one hand and between local vs. global complexity on the other. Following Miestamo (2008), this study is only concerned with *absolute* and *local complexity*, i.e. it tries to objectively describe the complexity of one domain of the Tungusic languages. It will not evaluate the overall complexity of entire languages and will not refer to the relative difficulty in acquiring Tungusic interrogatives or the like.

Complexity can tentatively be defined “as the number of parts in a system or the length of its description” (Miestamo 2008: 27). However, complexity also depends on the quantity and quality of the interconnections of these parts (e.g., Karlsson et al. 2008: viii) and on the status of the system in its linguistic environment (e.g., Turvey 2009). The degree of complexity of a certain phenomenon can be described along different dimensions. For the purposes of this chapter, seven such dimensions will be differentiated (Table 2).

Table 2: Dimensions of complexity included into this study (loosely based on McWhorter 2007; Karlsson et al. 2008; Turvey 2009; Trudgill 2011).

Number	Dimension	Simple	Complex
1	regularity	regular	irregular
2	redundancy	underspecified	overspecified
3	analyzability	analyzable	unanalyzable
4	amount	few forms	many forms
5	organization	organized	unorganized
6	coherence	coherent	incoherent
7	delineation	bounded	unbounded

Depending on the domains of language under investigation, a different set of dimensions will be more adequate. The dimensions of organization, coherence, and delineation have been inspired by Turvey’s (2009) discussion of the notion of a nonsystem.

> What can be meant by nonsystem? A set of isolated pieces that don’t interact, or interact so weakly that their influences upon each other are negligible, seems to fit the bill. Even better, perhaps, is the notion of a collection of related pieces where the relations have no implications for the properties or behaviors of the pieces. Certainly lacking in the image of a nonsystem is

> the sense of shared influences or mutual dependencies; intuitively, a nonsystem exhibits no coherence or functional unity. Also lacking is the sense of a boundary, a separation of the pieces into "ground" (pieces that surround) and "figure" (pieces that are surrounded). (Turvey 2009: 98f.)

Interrogatives cross-cut several different word classes (e.g., Dixon 2012: 409). For this reason, an interrogative system is usually difficult to present in one table. Depending on the language, some of the interrogatives can often be inflected according to their word class, while others cannot. In Manchu, for instance, *we* 'who' and *ai* 'what' can be inflected for case, but *udu* 'how many' cannot. Instead, *udu* can take morphology specific to numerals, e.g. *udu-ci* 'how_many-ORD', *udu-te* 'how_many-DISTR' etc. Nevertheless, despite their inherent heterogeneity, interrogatives can still be said to form one functional domain. If we take the concept of an interrogative *system* seriously (e.g., Muysken & Smith 1990), it should exhibit all the hallmarks of a system described by Turvey. The more it resembles a *nonsystem*, the more complex and unsystematic it is.

Diachronic changes in complexity can be called *simplification* and *complexification* (Trudgill 2011). This paper is a case study in complexification, i.e. the emergence of more complex structures out of simpler ones. In the following, these seven dimensions will be briefly defined and exemplified with Tungusic data. For a better understanding of the different dimensions, some cases of simplification will be mentioned as well.

(1) The first dimension of complexity is **irregularity** (e.g., McWhorter 2007: 33-35, Trudgill 2011: 85ff.). Exceptions to rules or irregularities in language structure, such as suppletion, increase the number of elements the system has. An example for irregularity in the interrogative system can be found in several northern Tungusic languages. Most languages of this branch have a suffix that usually can only be encountered on one interrogative. In Udihe, for example, only the nominative or unmarked form of the interrogative *j'e-* exhibits the suffix *-u*. It is lacking on other interrogatives and is replaced if the interrogative is inflected for case, e.g. *j'e-**u*** 'what', *j'e-**du*** 'what-DAT' (Nikolaeva & Tolskaya 2001: 348). The suffix is also present in the closely related language Oroch. However, case markers regularly attach to the suffix, which in this case could be analyzed as an augmentation of the nominal stem instead, e.g. *jaa.**ʊ*** 'what', *jaa.**ʊ-du*** 'what-DAT' (Avrorin & Boldyrev 2001: 197). This is an example for the slight simplification of an interrogative system. In Manchu, there is no indication of the suffix left, e.g., *ya* 'which', *ya-de* 'which-DAT', i.e. the irregularity has been entirely lost.

Similar to cases of suppletion, exceptions from a resonance can also be considered an irregularity. The more exceptions from a resonance there are, the more irregular the interrogative system is. In Tungusic the two interrogatives **ŋüi* 'who' and **ja-* '(to do) what' were the only exceptions from the resonance in **K~*. The interrogative **ja-* has been entirely lost in Nanaic, which is also the only subbranch to have generally preserved the resonance. This can be considered a decrease in irregularity in Nanaic languages.

(2) **Redundancy** has also been called overspecification (e.g., McWhorter 2007: 21-28). It is here understood as the number of different expressions the same semantic category in a certain language has. Underspecification can lead to the creation of new forms and overspecification (or redundancy) can lead to competition and the loss of certain forms. A certain amount of redundancy must have already been present in the proto-Tungusic interrogative system. There seems to have been competition between two semantically very similar interrogatives that can roughly be reconstructed as **Kai-* and **ja-* '(to do) what, which'. These show an intriguing distribution among modern Tungusic languages (Hölzl 2018b: 315f.). The meaning 'to do what' is usually expressed with **Kai-* in southern, but with **ja-* in northern Tungusic. Ewenic and Jurchenic preserve both interrogatives, but Nanaic has completely lost **ja-* and Udegheic has almost entirely lost **Kai-*. It is only preserved in a few derived forms such as Udihe *i:-du* 'where'. In other words, both Nanaic and Udegheic have simplified their interrogative system by reducing the amount of redundancy. To this day, several languages preserve some of this redundancy in sometimes allowing both stems for the same derivations and inflections, e.g. Manchu (IV) *ai-de* vs. *ya-de*, Udihe (II) *i:-du* vs. *j'e-du*, Even (I) *i-du* vs. *ja-du* 'where' etc. In some Ewenic languages the stems have partly merged phonologically, e.g. Khamnigan Evenki *i(i)-* vs. *i(e/i)-* (Janhunen 1991), which is another example for simplification.

The presence of several resonances, such as English /h/ (*who*, *how*, *how many/much*) and /w/ (in all remaining interrogatives), can also be considered a form of overspecification. If a resonance, such as English *w~* is in fact a submorpheme that carries a certain functional load (e.g., Langacker 2001, Mackenzie 2009), the existence of a second submorpheme *h~* with the same function must be considered redundant.[1]

(3) The dimension of **analyzability** is understood here in the following sense: The more analyzable a form is with the help of the other elements in a system, the less complex it is.[2] But analyzability is not always clear-cut. Instead, there is usu-

[1] This should not be confused with the first dimension that here includes exceptions from any resonance.

[2] Notice that this dimension does not take into account the number of elements an analyzable form exhibits.

ally a scale of more and less analyzable forms. Partly analyzable forms, cranberry morphs, or resonances complicate matters considerably. Interrogatives in creole languages usually tend to be analyzable (Bickerton 2016 [1981]: 65; Muysken & Smith 1990: 884). However, the increase in analyzability is not necessarily restricted to creole languages. The Jurchenic branch of Tungusic, for example, is not a true creole but nevertheless exhibits some simplification due to non-native acquisition in its past (e.g., McWhorter 2007; Trudgill 2011; Hölzl 2018). Possibly, this can be observed in the interrogative system that exhibits a large amount of analyzable forms that are based on the interrogatives *ai* and *ya*, e.g. Manchu *ai-ba-*, *ya-ba-* 'where' (*ba* 'place') etc. If no new forms are created, analyzability tends to decrease over the course of time. For instance, Manchu *ai-ba-de* 'what-place-DAT' has a variant *ai-bi-de* 'what-?place-DAT'. The second element is a cranberry morph that most likely derives from *ba* 'place'. There is even a less analyzable variant *abi-de* that must be the result of an additional contraction (e.g., Norman 2013). Both *-bi-* and *a-* are no longer clearly analyzable within the system and therefore increase the number of elements. The suffix *-u* in Udihe only occurs on one interrogative and therefore is not analyzable with the help of other elements within the system.

From the perspective of analyzability, a resonance can be viewed as making a system more and less complex at the same time. On the one hand, a resonance by definition is only partly analyzable and therefore, makes individual forms with the resonance more complex. On the other hand, it allows at least a partial analysis of all forms that exhibit the similarity. The loss of a resonance leads to the loss of an etymological connection between the individual interrogatives and thus to a decrease in analyzability. Due to this loss of analyzability, the number of individual interrogatives rises considerably.

(4) The number or **amount** of interrogatives appears relatively straightforward: The more interrogatives a language has, the more complex it is. However, the number depends on the analysis. One possibility would be to include "basic" interrogatives, exclusively (Hengeveld et al. 2012). However, this approach suffers from the problems of analyzability mentioned above. Among Tungusic languages, the lowest number of basic interrogatives seems to be present in Udegheic. In Udihe, for instance, there are only four unanalyzable forms: *ni(:)* 'who', *ali* 'when', *adi* 'how many', and *ono* 'how' (Nikolaeva & Tolskaya 2001). As we have seen above, even *j'e-u* 'what' contains a suffix. Of course, Udihe has a wealth of additional interrogatives, but all of them are analyzable to different degrees. Most of them are derivations and inflected forms of *j'e-* '(to do) what'. Some of those have a parallel based on the stem *i:-* that is only preserved

in derivations (1).

(1) Some variants of Udihe interrogatives (Nikolaeva & Tolskaya 2001)
j'e-du, *i:-du* 'what/which-DAT > why, where'
j'e-le, *i:-le* 'what/which-LOC > where'
j'e-mi, *i:-mi* 'what/which-CVB > why'

The forms make the impression of mere variants and are perhaps perceived as such by the speakers, but they are really etymologically distinct (**ja-* vs. **Kai-*). In other words, the forms based on *i:-* are synchronically only partly analyzable, because they contain some form of cranberry morph. It is an open question whether such partly analyzable forms should be treated as "basic question words" or not.

The same problem applies to interrogative systems with a resonance. If, for example, a resonance is counted as one interrogative stem, Tungusic most likely had only three interrogatives, i.e. **ŋüi* 'who', **ja-* '(to do) what, which', and **K~* (e.g., Benzing 1956, Hölzl 2018b: 312-330). If, on the other hand, forms with a resonance that are otherwise unanalyzable are counted as well, their number increases substantially. If the loss of a resonance is a decrease in analyzability, the number of "basic" interrogatives should theoretically rise, too.

(5) Languages differ in their overall **organization** of the interrogative system. In Tungusic, for example, there is no special interrogative meaning 'where'. Instead, all languages employ case-marked interrogatives meaning 'what' or 'which' to express that notion. In these languages the interrogative meaning 'where' is simply part of a paradigm. The inclusion into a paradigm could be interpreted as a form of regularity. However, this kind of organization leads to anomalous case forms that differ semantically from the rest of the paradigm, e.g. Udihe *j'e-we* 'what (ACC)', but *j'e-du* 'where'. From this perspective, an interrogative system with a special locative interrogative, such as English *where*, could be considered more organized.

The dimension of organization can perhaps be applied to the semantic scope of a resonance. Ideally, the semantic scope of an interrogative covers a coherent region in semantic space (on which see Cysouw 2005; 2007; Hölzl 2018b: 82f. and references therein). More research is necessary on whether exactly the same principles can be applied to resonances. But because resonances usually emerge through the spread of one interrogative over several semantic categories and its subsequent decrease in analyzability, this is a plausible scenario. For instance, cross-linguistic research seems to indicate that the two categories THING ('what') and QUANTITY ('how many/much') can only be expressed by the same form if MANNER ('how') is also expressed in the same way (e.g., Cysouw 2005). However, in Kilen the resonance *χ~* can only be found on *χai* 'what' and *χadu* 'how many', but not on *_oni* 'how' (An Jun 1986). This unorganized system is the result of language contact in which the form *_oni* was borrowed from a northern Tungusic language. Nanai still has a more organized system with the form *xo:ni* instead (§3).

(6) Without doubt, **coherence** (what holds the system together) is the most important dimension for this paper. There are several possibilities, but this study describes the coherence of an interrogative system in terms of resonances (i.e., formal coherence). One of the most striking examples of complexification in Tungusic interrogatives was triggered by the phonological change pointed out in §1. Consider Table 3 and Table 4, which list Uilta and Evenki interrogatives as examples for coherent and incoherent systems, respectively. Uilta *ŋui* and Evenki *ni:/nɪ:* both go back to **ŋüi*. Tungusic **ja-* has disappeared without a trace in Uilta, but is still present in Evenki as *æ:-*. Finally, the resonance **K~* is preserved in Uilta as *x~* but has been lost in Evenki. Interestingly, Evenki has many forms starting with *i(:)/ɪ(:)~*, while no such vowel follows the initial in Uilta (see §3 for implications). This could be considered a secondary resonance in *I~* that has been built up following the loss of the original resonance. However, there are several other forms such as *ɔ:qin/ɔʁ:in* 'when' that do not conform to this pattern.

Table 3: The formally coherent interrogative system of Uilta (III) (Ikegami 1997).

Form	Meaning
ŋui	who
xaali	when
xaawu, xauwu	which one
xai(-)	(to do) what
xaidu	where
xaimi	why
xamaččuu	whence
xamačiga	what kind of
xasu	how many/much
xawasai	whither
xawwee	where, what place
xooni	how

An important problem for this study is the question whether the presence of

Table 4: The formally incoherent interrogative system of Aoluguya Evenki (I) (Hasibate'er 2016: 171, 238).

Form	Meaning
niː, nɪː	who
æːqɷn, æːʁɷn	what
æːχa	how
adɪ, addi	how many
ɔːqin, ɔʁːin	when
irəgeɕin, irgəːtʃin	what kind
iːdu	where
iːli	where
iːrba	how much
iːʂ	which
ɪraː	which one
ɪrɢaː	how much
ɪːla, ɪːra	where

a *resonance* is a complicating or simplifying factor. Perhaps, from the point of view of analyzability alone, a resonance makes things more complex by being only partly analyzable. From the point of view of coherence, however, one homogenous resonance as in Uilta (Table 3) could be said to be a simplifying factor instead because it holds the system together.

(7) The dimension of **delineation** (what differentiates the system from other elements) refers to the status of the interrogative system in a given language. A bounded system might exhibit certain phonological or morphological properties that are not found outside of the system. In English, for instance, an initial /ð/ is almost exclusively encountered in the demonstrative system (Bickel & Nichols 2007: 209). Perhaps an analogy from visual perception can help make this point even clearer (cf. Turvey 2009). A monochromatic piece of paper (a coherent interrogative system with one resonance) can be perceived much better than a multi-coloured one if they are held up before of a heterogenous background (the linguistic system). Of course, it can be perceived even more clearly if the colour is not found in the background at all (if the resonance is restricted to the interrogative system). An example can be found in the nearby Turkic language family. It has long been note that an initial *n-* in proto-Turkic was restricted to the interrogatives (see Hölzl 2018b: 354 and references therein). To my knowledge, no

comparable phenomenon is known from Tungusic interrogatives. Similar to English /w/ or /h/ in the interrogatives, the Tungusic initial **K-* also occurred on several other words.

However, there are some examples for the inflectional delineation of the interrogative system. In the Ewenic language Even, for instance, there is a suffix *-k*, which is cognate with Udihe *-u*, Oroch *-ʊ*, and Evenki *-qɷn*/*-ʁɷn* encountered before. Unlike these languages, Even *-k* can also be found on another interrogative and two demonstratives (Benzing 1955: 77, 79). In this case, there is coherence in a subset of the interrogatives. Often, the interrogative system is only weakly delineated from the demonstrative system (Diessel 2003). The two systems tend to have a certain amount of parallels and overlap in inflection or derivation. There can also be a formal resonance between interrogatives and demonstratives as a result of this, e.g. English *wh**ither***, *h**ither***, and *th**ither*** etc.

The different dimensions of complexity tentatively proposed in this section show complex patterns of interaction. For instance, the lack of analyzability is not only correlated with a higher number of individual forms, but also with incoherence. In Turvey's (2009: 99) terms, the lack of analyzability with the help of elements within the system leads to the lack of "mutual dependencies" and therefore, to less coherence. Another example of such an interaction exists between coherence and delineation. A formally coherent interrogative system with one resonance in all interrogatives is more easily delineated from the rest of the language than one without any coherence.

3 Loss of the resonance in Tungusic interrogatives

The phenomenon investigated in this section is the loss of the proto-Tungusic phoneme **K-* in word initial position.[3] As pointed out in 1, this regular phonological process was extremely detrimental to the interrogative system in most languages, where it fulfilled the role of a *submorpheme* similar to English <wh> (Bickel & Nichols 2007; Mackenzie 2009). The implications of the loss will be pointed out in §4. Tungusic is one of several language families in Northeast Asia (NEA) and surrounding regions to exhibit what has been called *K-interrogatives*: more than two interrogatives in a given language start with the same velar or uvular plosive or fricative (Hölzl 2018b: 6, 405f., 432). Other language families with this feature include, for example, Mongolic, and Turkic. As pointed out in §1, a resonance usually indicates an etymological connection. A similar resonance

[3] It may also have existed in word internal position, see Janhunen (2017) and references therein for some discussion. For reasons of space, this question cannot be addressed here.

across different language families is first and foremost a typological similarity, but could also indicate a certain connection in terms of language contact and/or a genetic relatedness. More research is necessary on their global distribution and origin, but K-interrogatives appear to be a relatively stable phenomenon in NEA and their loss in Tungusic is rare, if not unique.

Traditionally, it was believed that the phoneme **K-* was lost everywhere but in Nanaic (e.g., Benzing 1956: 41f.). There is, however, also some evidence that the phoneme may have been present in Ewenic at some point in time, where very few isolated relics with an initial *h-* were preserved in peripheral varieties (e.g., Vasilevich 1958; Doerfer 1973: 581), e.g. Sakhalin Evenki *_ure* 'mountain' (Nanai ***xurə̄n***), but ***hereki̅*** 'frog' (Nanai ***xərə***) (Bulatova & Cotrozzi 2004: 106f.). It has also been speculated that a form of Jurchen that can be called Jurchen A (Grube 1896; Kiyose 1977) may have a few forms with an initial **h-* as well (Kiyose 1996; 2000; Hölzl 2017). Certain modern Jurchenic varieties potentially also preserve an initial *h-* in some relics, e.g. Written Manchu *_amaha*, but ***hamuha*** 'afterwards, later, future' as recorded in Qitamuzhen (Nanai ***xama-***, dial. Evenki ***hama-***) (Hölzl & Hölzl 2019). However, it was previously not widely known that the initial may also have been preserved as *k-* in yet another language from the Jurchenic branch called Alchuka (Hölzl 2017; 2018b). If correct, this clearly demonstrates that the phoneme was present in proto-Tungusic and must have been lost at a later stage. Additionally, this could give additional evidence for the primary split of Tungusic into northern and southern Tungusic as proposed by Georg (2004) or Janhunen (2012). Most likely, **K-* was generally lost in northern Tungusic—there are only a few relics in Ewenic and none in Udegheic—, but was preserved in southern Tungusic. It could have been lost at a relatively late stage in the majority of Jurchenic.

There have been several different more specific reconstructions of the phoneme **K-*, the most important of which are collected in Table 5. The difficulty of the reconstruction is due to the fact that the phoneme is only fully preserved in Nanaic. The newly found data from a Jurchenic language can potentially contribute much needed information for its reconstruction.

Most of the reconstructions are rather problematic and contradict what is known from cross-linguistic research on language change such as the cline in (2).

(2) *k* > (*kx* >) *x* > *h* > Ø

As Bybee (2015: 29) points out: "These paths are unidirectional; that is, the changes always proceed from stop to affricate to fricative to /h/ to zero, and

Table 5: A summary of the most important previous reconstructions of Tungusic **K*-.

Source	Reconstruction	Description
Schmidt 1923: 232	*x-	voiceless velar fricative
Shirokogoroff 1931: 244f.	*Ø	later prothetic development
Cincius 1949: 250	*kxh-	aspirated voiceless velar affricate
Benzing 1956: 41ff.	*x-	voiceless velar fricative
Doerfer 1973: 579-591	*h-	voiceless glottal fricative
Cincius 1975: 300	*k' -	voiceless palatal plosive
Rozycki 1993: 211	*k' -	(un)aspirated voiceless (velar) plosive

not in the other direction." There is no evidence for an affricate in any Tungusic language (cf. Cincius 1949: 250), which has been put into parentheses. This general tendency also contradicts Doerfer's (1973) assumption of a change of Tungusic **h*- to Nanaic *x*-. If Alchuka *k*- can be shown to be an actual reflex of proto-Tungusic **K*-, the reconstruction would have to be changed to a plosive as well. Rozycki (1993), based on external comparisons, has also quite convincingly argued for the reconstruction as a plosive.[4] In addition, there are several areal parallels for a change from a velar plosive to a fricative in the interrogative system of, for example, Turkic and Mongolic languages (Table 6).

In order to better decide which, if any, of the reconstructions is the most adequate, the actual reflexes observed among Tungusic languages have to be consulted. Table 7 represents a part of the consonant inventory of the *International Phonetic Alphabet* (IPA). All attested reflexes in modern Tungusic languages are printed in boldface. As can be seen, there is a wide variety of different reflexes that include both one plosive (i.e., [k]) and six different fricatives differentiated by their place of articulation (i.e., [s], [ʃ], [ɕ], [x], [χ], and [h]). All fricatives and perhaps also the plosive are voiceless, which must be a feature inherited from the proto-Tungusic phoneme.

The sounds mentioned in Table 7 are a summary of the entire language family and cannot all be found in one single language. The plosive is only sufficiently attested in Alchuka. However, a Jurchenic variety that I call Chinese Kyakala potentially also has one example of an initial *k*-, i.e. Manchu *urun*, Chi-

[4] Please note that this study is mostly based on data from Tungusic languages. For reasons of space, external comparisons, such as with Mongolic languages, will be mentioned only briefly (e.g., Doerfer 1985, Rozycki 1993, Janhunen 2017 and references therein).

Table 6: Areal parallels for the lenition from plosive to fricative in the interrogative system (Hu Zhenhua & Imart 1987; Anderson 1998; Yamakoshi 2007; 2011).

Turkic	Fuyu Kirghiz	Khakas
what kind of	ɢadah, ɢadĭh	xaydaɣ
when	ɢajan	xaǯan
where	ɢayda	xayda
which	ɢayzĭ	xayzɨ
Mongolic	Khamnigan Mongol	Shineken Buryat
how many	kədui	xedii
when	kəzie	xezee
where	kaa-	xaa-
who	kən	xen

Table 7: IPA symbols for the phonetic space in question (voiceless / voiced). Attested reflexes of *K, including allophones but not Ø, are in boldface.

	Alv.	Postalv.	Alv.-pal.	Retr.	Pal.	Vel.	Uvul.	Phar.	Glot.
Plosive	t / d	-	-	ʈ / ɖ	c / ɟ	**k** / g	q / ɢ	-	ʔ / -
Fricative	**s** / z	**ʃ** / ʒ	**ɕ** / ʑ	ʂ / ʐ	ç / ʝ	**x** / ɣ	**χ** / ʁ	ħ / ʕ	**h** / ɦ

nese Kyakala ***kulun*** (or perhaps *kurun*) 'wife, bride' (see Hölzl 2018a, Hölzl & Hölzl 2019. Jurchen A and some peripheral Ewenic languages exhibit an *h*- (Doerfer 1973; Kiyose 1996; 2000; Hölzl 2017). All fricatives are otherwise only attested in Nanaic. For example, there are three different reflexes in Hezhen, which seems to be the maximum among Tungusic languages. Some exceptions apart, the nature of the sound can be predicted by the following vowel.

(3) Reflexes of *K- in Hezhen (An Jun 1986: 79f.)
**K- > ɕ- | _i*
**K- > x- | _ə, _u, (_i)*
**K- > χ- | _a, _o*

The set of reflexes in Table 7 differs significantly from that proposed in Benzing (1956: 41), who, apart from Ø, only mentioned *s*-, *x*-, *h*-, and, problematically, *n*-.

The nasal appears to be a mistake that resulted from a misunderstanding of a secondary innovation in Manchu. Benzing (1956: 43) mentions the two Manchu examples *(**n**)imenggi* 'oil' and ***n**imanggi* 'snow' that, the differences in derivational suffixes apart, correspond to, for example, Uilta *simuksə* and *simana*, respectively (Ikegami 1997). However, the correspondence of *n-* and *s-* is only valid at a first glance. Consider the comparison in Table 8. There is a relatively clear correspondence between *n-* in Manchu and Ø in Alchuka, especially with a following *m*.[5] Crucially, this is a later phenomenon that can also be found in loanwords such as *niman* 'goat' that do not have a Tungusic background, but derive from surrounding languages such as Khitan (see Tang 2011). In other words, the initial *n-* in Manchu cannot be a reflex of Tungusic **K-*. The presence of the initial *n-* in *(**n**)imenggi* 'oil' and ***n**imanggi* 'snow' must be considered a coincidence (cf. Hezhen *_imaχa* 'fish' etc.).

Table 8: A comparison of Manchu and Alchuka (Mu Yejun 1985; 1987; Norman 2013). JA = Jurchen A (Kiyose 1977).

	Manchu	Alchuka
fish	**n**imaha	_imaha
goat	**n**iman	_iman
mulberry tree	(**n**)imala(n)	_imala
oil	(**n**)imenggi	JA *_imengi
snow	**n**imanggi	_imaŋi

Concerning the reflexes of **K-* in Nanaic, consider Table 9. Only a selection of examples and sources available for Nanaic languages was chosen. The primary split of the phoneme in Nanaic appears to have been based on the following vowel. As seen for Hezhen above (3), the reflex usually is an *s*-like sound in front of *i* (or *ɪ*) and an *x*-like sound otherwise (e.g., Benzing 1956: 41f.). There are some language-specific problems that cannot all be addressed here. For instance, Tsumagari (2009: 2) notes that an /s/ in Uilta is only realized as [s] before the vowels *a* and *o* [ɔ]. Before all other vowels, including *i*, it is pronounced as a [ʃ] or [sJ].

Especially older descriptions suffer from an unclear and inexact notation of phonemes. It is not entirely clear, for instance, what sound the initial <ch> in Kilen mentioned by Jettmar (1937) in his German description represents. In Ger-

[5] There are, however, several irregularities regarding the initial (palatal) nasal in Jurchenic and Kilen that deserve a treatment of their own.

Table 9: Reflexes of **K-* in Nanaic according to several different authors in alphabetical and chronological order. Inner-Tungusic loanwords are given in parentheses. Not all variants are mentioned. Accents removed.

Language	back(wards)	wind	snow	Source
Hezhen	hami(kə)	hətɔ̃	himana, ʃimana	Ling 1934
	χamilə	xədun	ximanə	An Jun 1986
Kilen	(_amidʒikə)	hətɔ̃	(_imana)	Ling 1934
	?	?	chemana	Jettmar 1937
	(_amidʑgə)	(_ədin)	(_imanə)	An Jun 1986
Kili	(_amaski)	(_ədi^n)	(_emana)	Sunik 1958
Nanai	xamasi	x́edun	ximana, simota	Grube 1900
	xamasi	xödun [-ə-]	ximana	Schmidt 1923
	xamasi	xədun	sɪmana, sɪmata	Ko & Yurn 2011
Samar	?	xödu(n) [-ə-]	simana	Schmidt 1928
Ulcha	xamasi	xödu [-ə-]	simata	Schmidt 1923
	xamasi	xydu	xemana, simata	Majewicz 2011
Uilta	hamasai	huidö [-ə]	simana, simatta	Nakanome 1928
	xamaśa	xydu	simani, simat(t)a	Majewicz 2011
	xamasai	xədu	simana, simatta	Ikegami 1997
U. Nanai	hamela	hedou [-u]	?	Venjukov 1862
	χamas'ɪ	xədu(n-)	s'ɪm(a)na, s'ɪm(a)ta	Sem 1976

man, a <ch> would normally be pronounced as [ç] before an *e*, but it is doubtful that this rule should apply here. Most likely, it represents a [x] instead, which is another allophone of <ch> in German. This is one of several examples where a velar-like fricative is preserved in the word for snow. This, as well as the complementary distribution of the s-like and x-like phonemes, are the main arguments for the assumption that the same phoneme **K-* was present in this word and in similar cases.

Table 10 lists the Nanaic cognates of three interrogatives according to the same sources as in Table 9. Given that in no Nanaic interrogative the resonance was followed by an *i* or *ɪ*, the velar like phoneme is preserved everywhere (cf. §2).

The question whether Alchuka *k-* is a reflex of Tungusic **K-* is extremely complex and difficult to answer. Not all problems can be solved or even addressed in this chapter. As mentioned in §1, there are certain irregularities. Table 11 lists all attested interrogatives in Alchuka. Apparently, **ja-* has not been recorded.

Table 10: Reflexes of **K*- in Nanaic interrogatives according to several different authors in alphabetical and chronological order. Likely inner-Tungusic loanwords are given in parentheses. Accents removed.

Language	what	how many	how	Source
Hezhen	**hai**	?**hadu**	?	Ling 1934
	?	?	?	An Jun 1986
Kilen	**hai**	**hadu**	**hɔni-**	Ling 1934
	?	(_adi)	?	Jettmar 1937
	χai	χadu	(_oni)	An Jun 1986
Kili	(_ii-)	(_adi)	(_ōni)	Sunik 1958
Nanai	xai, **hai-**	xadu, **hadu**	xoń(e)	Grube 1900
	xai	xadu	xoṇe	Schmidt 1923
	xaɪ	xado	xo:ni	Ko & Yurn 2011
Samar	xai	?	?	Schmidt 1928
Ulcha	xai	xadu	xōni	Schmidt 1923
	xaj	?xadum	xon(i)	Majewicz 2011
Uilta	**hai**	-	**hôni**	Nakanome 1928
	xaj	-	xōni	Majewicz 2011
	xai	-	xooni	Ikegami 1997
U. Nanai	**haï**	?	**honi**	Venjukov 1862
	χaɪ	χado, χadʊ	χon'(i)	Sem 1976

Most likely, *p'ə* derives from **ŋüi*, but this cannot be a regular continuation (Hölzl 2018b: 314). The resonance is only present in five out of the ten remaining recorded interrogatives. Those without the initial might represent borrowings from Manchu dialects. However, only Bala has an *n* in the word for 'when' (Hölzl 2018b: 330).

In general, it is possible to identify several different categories. First, there are words with an initial *k*- that have a clear correspondence in Nanaic. Second, there are words with an initial *k*- that do not have a correspondence in Nanaic. Third, there are many words that would be expected to exhibit the initial *k*- based on Nanaic data, but do not. Fourth, in a few cases there is a potential external comparison outside of Tungusic (on which see also Rozycki 1993).[6] Table 12 mentions three examples of each category. Finally, there at least two cases in which

[6]Potentially, some of the interrogatives in Tungusic could have a Mongolic origin, too, but this requires further research.

Table 11: Interrogatives in Alchuka (Mu Yejun 1986; 1987; 1988) in comparison with Manchu (Norman 2013). Likely inner-Tungusic loanwords are given in parentheses (Hölzl 2018b: 317).

	Alchuka	Manchu
who	?pʻə	we
for what reason	(_ei) tʻuku	_ai turgun
how	katiram	_adarame
how many	kutu	_udu
to do what	kai-na-mei	_ai-na-mbi
what	(_ei)	_ai
what has happened	gai-na-hanbie	_ai-na-habi
what (is it)	kentʻaka	_antaka
when	(_antʻaŋgi)	_atanggi
where	(_ai-və-t)	_ai-ba-de
why	(_einu)	_ainu

the initial *k-* has comparisons in Jurchenic (Hölzl 2017). The list is not exhaustive, but sufficient for the purposes of this paper.

Theoretically, the initial *k-* in Alchuka could be a later prothetic development that is specific to this language (cf. Shirokogoroff 1931). Given the strongly suffixing character of all of Tungusic, it is implausible to assume an otherwise unknown prefix *k-*. One should not exclude the possibility of a prothetic development for some cases, especially those of category two that have no correspondence in Nanaic. However, there is evidence that at least in some cases the *k-* cannot be a secondary innovation. Given the fact that there are Nanaic correspondences in category one, the problem cannot be due to chance. These examples cannot be explained by borrowing from Nanaic either. For example, Alchuka ***k**utu* contains a vowel assimilation specific to Jurchenic and ***k**ai-na-* has a verbalizer that does not occur in this form in Nanaic. As indicated in §1, at least some examples of the third category can be readily explained with borrowing from Manchu dialects, which appear to have had a strong influence on Alchuka. In many cases, this might explain the absence of the initial *k-* that would otherwise be expected on the basis of a comparison with Nanaic. This is especially plausible if there are doublets such as ***k**ai-* vs. *_ei* 'what'. These must reflect an autochthonous and a borrowed form, respectively. It should be noted that the same problem exists for the three Nanaic languages Kili, Kilen, and Ussuri Nanai,

Table 12: A comparison of Manchu (Norman 2013), Alchuka (Mu Yejun 1985; 1986), and Uilta (Ikegami 1997). JA = Jurchen A, JM = Jing Manchu, Kh. = Khalaj, MK = Middle Korean, PM = proto-Mongolic. Not all variants attested for Alchuka are shown.

Category	Meaning	Manchu IV	Alchuka IV	Uilta III
1	how many	_udu	**k**utu	**x**adu
	twenty	_orin	(**k**)ɔrin	**x**ori
	what	_ai-	(**k**)ai-	**x**ai-
2	this	_e-re	**k**ə-r(ə)	_ə-ri
	this way, here	_ebsi	**k**eʼ uʐï	_əwəsəi
	to become	_o-	(**k**)ɔ-	_o-
3	nine	_uyun	_ujen	**x**uju
	what	_ai	_ei	**x**ai
	wind	_edun	_ɔduŋ	**x**ədu
4	twenty	_orin	(**k**)ɔrin	PM ***k**ori/n
	virtue	_erdemu	**k**ərdem	Kh. **h**är ‘man’
	-Q	_o	(**k**)ɔ	MK (**k**)o
5	nineteen	JA *_onioxon	(**k**)uniku	JM **k**uniu
	to meet	_aca-	**k**atʃʼ a-	Bala **h**atʃʼ a-

which have many loanwords from Ewenic, Udegheic, and Jurchenic without the initial. This explanation is especially convincing if a given loanword exhibits additional features that are only attested in another language. For instance, Kili *_ədi*^{n} ‘wind’ not only lacks the initial consonant that is present, for example, in Uilta *xədu*, but the vowel *i* in the second syllable is a feature specific to northern Tungusic (Benzing 1956). In the case of Alchuka, such identifying features are often difficult to find because all languages involved are relatively closely related. More research on Manchu dialects is necessary in order to identify the exact source of the borrowings.

Potentially, some of the words with an initial could also represent spelling mistakes that are not uncommon in Mu Yejun’s data. However, one should not jump to the conclusion that all of the examples can be explained in this way. For example, the initial *k-* in numeral nineteen has been independently confirmed by Aixinjueluo Yingsheng, who remembered to have heard the form ***k**uniu* in his youth (see Aixinjueluo Yingsheng 2014; Hölzl 2017).

Apart from the comparison with Nanaic, there are additional indications that the initial *k-* in Alchuka is neither due to chance, nor a spelling mistake. Crucially, there are a few potential comparisons outside of Tungusic that deserve further discussion. For instance, the question marker *=o* in Manchu that lacks a Tungusic background most likely is a loan from Middle Korean *-(k)o* (Hölzl 2018b: 213). Furthermore, there is one example (***k**atʃ’a-* ‘to meet’) that allows a comparison with an initial *h-* in Bala ***h**atʃ’a-* and Jurchen A *****h**ača-*. Problematically, this initial *h-* is similarly irregular (e.g., Jurchen A **_onioxon* ‘19’) and is only attested in a few words (Kiyose 1996; 2000; Hölzl 2017; Hölzl & Hölzl 2019). But it represents additional evidence that the *k-* in Alchuka is neither an isolated phenomenon, nor a spelling mistake. The initial *h-* in Evenki dialects is similarly problematic but is still accepted as a valid correspondence by Doerfer (1973).

Yet another problem concerns the nature of the phoneme in Alchuka. It is usually written as <k> in Mu Yejun (1986), but as <g> in Mu Yejun (1987; 1988) (see Table 11). Descriptions of Jurchenic varieties disagree on the nature of the plosives. More research on the phonology of Jurchenic is necessary to determine the exact phonetic value of the plosives. It is possible that, at least in some varieties and similar to Mandarin (e.g., Zhao Jie 1989), the distinction between <g> and <k> is only one of aspiration ([k], [k^h]) and not of voice as well ([g], [k^h]). But Norman (2004/5: 27) argues that, in Manchu, a <g> is only pronounced as a voiceless unaspirated [k] in initial position. In any case, Alchuka <k> (Mu Yejun 1986) also corresponds to what is usually considered a voiced velar plosive <g> in Manchu. If Alchuka *k-* is indeed a reflex of Tungusic **K-*, it must have historically merged with the reflex of the original **g-*. Interestingly, the irregularity in Alchuka seems to include both the reflexes of **K-* and **g-*. For instance, the interrogative *_ei* is attested in the complex expression *ei əl’un ə’ɔ* (Mu Yejun 1986: 10), a cognate of Manchu *ai gelhun akū* ‘how dare …’ (Norman 2013). The lack of several word internal consonants is a different problem. But the cognate in Alchuka also lacks an initial *k-* that would be expected in *_əl’un* ‘timid’. Thus, it seems that the question of the initial *k-* in Alchuka is a more general problem. Future research will have to explain the sporadic loss of the initial **g-* and some other consonants, which goes beyond the possibilities of this study.

Based on the evidence in this section, a more detailed reconstruction of **K-* might be possible. The Alchuka data apart, the reconstruction as **x-* is, of course, very convincing, because it fits very well into the proto-Tungusic consonant system and also has a potential areal parallel in Mongolic (Janhunen 2017). However, as seen above, the phoneme could well have been a plosive rather than a fricative. A crucial question is the general structure of the proto-Tungusic obstruent system (Rozycki 1993; Janhunen 2017). According to the traditional reconstruction (Benzing 1956: 27), Tungusic had the velar consonants **g* and **k* (i.e., [g], [kʰ]). In most languages, **K* shows a different set of reflexes than **g* and **k*. Consequently, it must have differed in some respect from the other velar plosives. Rozycki (1993: 211) assumes that there might have been a distinction in aspiration (i.e., [k], [g], [kʰ]), and indeed the Alchuka data potentially give additional evidence for this point of view. However, there are several additional possibilities such as a difference in the place of articulation instead of the manner of articulation. For example, several languages have an alveolar-palatal or uvular reflex of the phoneme **K-*, which suggests that it could theoretically also have been a [c] or [q], with or without aspiration, instead of a [k] (cf. Cincius 1975).

4 Complexification or a change for the worse?

To sum up the discussion thus far, there are arguments for the existence of a phoneme **K-* in proto-Tungusic that was lost in the majority of the daughter languages. Its possible existence in a Jurchenic language provides additional evidence against a later innovation (i.e., a prothetic development) and for its potential reconstruction as a plosive. Given that it used to have the function of a submorpheme in the interrogative system, its loss was more than a mere phonological change but also had functional implications.

More specifically, it had the consequence of making the interrogative system more complex on most or all of the seven dimensions mentioned in §2. Arguably, the interrogative system in Nanaic is more regular, less redundant, more analyzable, more organized, more coherent, and better delineated than that of most other Tungusic languages.

First, the interrogative system became **irregular** due to many exceptions from newly created resonances, such as *I~* in Aoluguya Evenki (see §3). Some languages, such as Udihe, lack a resonance entirely, i.e. there is no formal regularity in the first place.

Second, the new interrogative systems are **redundant** in sometimes having more than one resonance, e.g. *a~* and *y~* in Sibe (see below), although the spread of the resonance *y~* might have been independent of the phonological change observed in this paper.

Third, forms that used to be at least partly analyzable (e.g., Nanai *xado*, *xaɪ*) became entirely **unanalyzable** and etymologically opaque (e.g., Manchu *udu*, *ai*).

Fourth, in some languages this loss of analyzability led to an **increase in the number** of interrogatives, especially if the resonance in **K~* is considered some form of partially analyzable interrogative stem in its own right. If, on the other hand, the resonance is not granted such a position, its loss did not necessarily affect the number of interrogatives.

Fifth, at a first glance, the overall organization of the interrogatives appears to be unaffected. Because Tungusic languages have suffixes exclusively, inflectional paradigms and derivations generally remained intact. However, from the point of view of organization, the special position of Tungusic **ŋüi* 'who', which is even more pronounced in Nanaic, could also have its merit if this mirrors a special and salient position of the category PERSON in human cognition. In fact, there is empirical evidence for this assumption. In many languages, the personal interrogative stands apart phonologically or morphosyntactically from the rest of the interrogative system (Hölzl 2018b: 406). In addition, few languages have one category for both PERSON and THING and innovative interrogative systems such as in Manchu are usually based on 'what' or 'which', but rarely on other categories (e.g., Cysouw 2007). An interrogative system as in Uilta with a special position of the category PERSON and a larger set of forms with a shared origin is thus a very organized and natural outcome of general processes and tendencies. It indicates that in pre-proto-Tungusic times there may have been an innovative interrogative system with a large set of analyzable forms that resulted in the later resonance. Given that the resonance covers a historically grown (and ideally coherent) region in the semantic space of interrogatives (e.g., Cysouw 2005; Hölzl 2018b), its loss entirely **disrupted the organization** (i.e., the form-function mapping) of that system (but see below).

Sixth, and most importantly, the formal coherence of the interrogative system was lost. The new interrogative systems simply have no phonological or morphological marker in common but consist of a loose set of synchronically unrelated and **incoherent** forms that only share some semantic similarities.

At a first glance, the seventh dimension appears to be similarly unaffected as the fifth. The phoneme *K-* in Tungusic was not restricted to its function as resonance, but also occurred in many other lexical items (e.g., Ikegami 1997: 227-250). Although the same is true for the new systems, they are much less homogenous and therefore **less delineated** if taken as a whole. For example, there are chance resemblances to the demonstrative systems (e.g., Manchu ***uttu*** 'thus, like this', ***udu*** 'how many') and many lexical items.

The title of this volume is *Language change for the worse*. In the description of the workshop it is based on, "changes for the worse" were defined as those changes "that do not readily follow from an improvement in some other area of the language system". The complexification of the Tungusic interrogative system is an epiphenomenon of a phonological change. Even if the change in Tungusic had the consequence of a complexification—whether this is a change for the better or the worse is another question—, it was triggered by another change that may have been somehow beneficial (Dixon 2016: 195). By definition, the change in the interrogative system in Tungusic can only be considered a change for the worse if this phonological change was not an improvement in itself. However, the **evaluation** of the phonological change depends on the perspective taken.

Consider, for example, the so-called *preference laws* by Vennemann (1988), e.g.

> A syllable head is the more preferred: (a) the closer the number of speech sounds in the head is to one, (b) the greater the Consonantal Strength value of its onset, and (c) the more sharply the Consonantal Strength drops from the onset toward the Consonantal Strength of the following syllable nucleus. (Vennemann 1988: 13f.)

§4 has shown that the onset in Tungusic was most likely a plosive that changed to a fricative and then disappeared in most languages. In other words, there was a loss of the consonantal strength of the onset, a decrease in difference between onset and nucleus, and finally a loss of the head altogether. Notably, some parts of this change must have occurred not once but several times in the different branches and subbranches of Tungusic. From this perspective, both the phonological change and its implications were a change for the worse.[7]

From a different perspective, however, the lenition of the initial consonant can also be conceptualized "as a successive decrease and loss of muscular activity" (Bybee 2007: 950), i.e. a change for the better, because the articulation requires less effort. From this perspective, the changes in the interrogative system cannot be considered a change for the worse. Depending on which of the two perspectives we prefer, the change in Tungusic can be said to be either for the "better" or for the "worse". This example nicely illustrates that an evaluation is always based on specific purposes and perspectives. Note that this discussion only shifts the evaluation of the development in the interrogatives to another level. The evaluation would also require a cost-benefit analysis that almost impossible to achieve. Which is more important, the potential benefit of the phonological change or the functional implications in the interrogative system?

The qualitative evaluation of a language is both a problematic and dangerous endeavor (e.g., Lehmann 2006). In the following, this will be illustrated through

[7] Some languages such as Manchu dialects potentially have an initial glottal stop instead of the resonance, but this problem requires additional research.

a criticism of Dixon (2016: 213), who mentions “some of the features [...] which should be ideally present in every language, to ensure that it is an effective vehicle for identification, cooperation, communication, argumentation, and so on.” For example: “An ideal language will have a separate form for each of the standard interrogative words: ‘who’, ‘what’, ‘which’, ‘where’, ‘when’, ‘why’, ‘how’, ‘how much’, and ‘how many’” (Dixon 2016: 227). This appears to be a derivation of the “One-Meaning-One-Form principle” (e.g., Miestamo 2008: 34). However, Dixon’s (2016) argument is highly problematic. (1) The list of interrogatives is rather arbitrary. Dixon (2016) excludes interrogative words such as ‘to do what’ from the list because of their cross-linguistic rarity. Consequently, the other categories must have been chosen on this criterion as well. However, even Dixon’s (2012: 407) more extensive and otherwise very good discussion fails to give any cross-linguistic data on the frequency of these forms. The list would also require a clearly specified threshold of when any given category is included or not. (2) It is by no means clear what “separate” forms, also called “basic question words” (Hengeveld et al. 2012: 46), are, given that the analysis of interrogatives is often not clear-cut (§2). (3) Languages that lack a “separate” form for any of the categories mentioned above can still be an effective means of communication. For instance, there is no “basic question word” for the locative meaning ‘where’ in Tungusic. Nevertheless, all Tungusic languages have means of expressing the notion. Even if any of the categories would be entirely absent from a given language, it would presumably not have been required by the speech community.

Table 13 lists all nine categories mentioned by Dixon (2016), illustrated with some examples from the Jurchenic language Sibe. The Sibe interrogative system is similarly incoherent as that in Evenki. **ŋüi* is preserved as *və* and **ja-* as *ya* and its derivations. Similar to Manchu, the resonance in **K~* was lost, which made interrogatives such as *_afš* (Manchu *_absi*), *_ai* (Manchu *_ai*), or *_ut* (Manchu *_udu*) unanalyzable.

According to Dixon (2016), the Sibe interrogative system would most likely be considered “ideal” because no form is synchronically analyzable (one form, one meaning). However, why should only these categories be considered and not, say, ‘which one’. In Sibe, this category is expressed with the form *yam(kə^n)*, which can be partly analyzed as *ya* + *əm(kə^n)* ‘which + one’. In fact, the form *ya əmkə^n* is also attested. Thus, depending on the choice of the categories, the system can be said to be more or less ideal. Most certainly, a language-specific approach that takes into account the whole interrogative system would be more beneficial. For example, Sibe also has additional interrogatives that should be considered (e.g.,

Table 13: Some interrogatives in Sibe (Zikmundová 2013) with Nanai cognates (Ko & Yurn 2011). Not all forms and variants listed.

Category	Sibe	Nanai
who	və	ui
which	ya	-
how much	yask(ə)	-
where	yet	-
how	_afš	xaosi 'wither'
what	_ai	xaɪ
when	_aitiɴ	-
why	_a^{n}	-
how many	_ut	xado

ailiaɴ 'what kind of').

The loss of the resonance in Tungusic lead to separate forms that are synchronically unrelated. Following Dixon (2016), this should be considered a change for the better. However, as pointed out in §2, *analyzability* is only one of several dimensions. If the dimension of *organization* is taken into account, for instance, the analyzability of certain forms could well be a desirable factor. For instance, Sibe *yet* is still partly analyzable as *ya* + DAT and corresponds to Manchu *ya-de*. Given that this form is marked for case, it is part of a paradigm, e.g. Manchu accusative *ya-be* etc. A decrease in analyzability would certainly make the paradigm less organized, irregular, and thus more complex.

Instead of an evaluation, this chapter tried to *objectively* describe the complexity of the Tungusic interrogatives. Both evaluation and complexity can be applied locally or globally and both are graded categories that can be shown on a scale. However, evaluation is necessarily relative to a certain perspective (Lehmann 2006), while complexity is perhaps best described in absolute terms (Miestamo 2008). Bybee (2015: 10) is certainly correct in her assessment that changes as such "are natural to language and they are neither good nor bad." A language can only be better or worse for a specific purpose, e.g. expressibility, acquirability, processing, articulation etc. Whether the change in Tungusic is for the better or for the worse can be answered either way, depending on the perspective taken.

5 Conclusion

This study is a case study of complexification. It was mostly concerned with a phonological change in Tungusic languages spoken in Northeast Asia and its functional implications in a subsystem of these languages. Several problems were left open and require additional research. It has been shown that the initial was most likely a velar-like plosive, but its exact place and manner of articulation have yet to be identified. It is also an open question what was the original reason for the sound change and whether some sort of language contact may have been involved. Nevertheless, some problems such as the putative reflex *n-* in Manchu could be solved and some new evidence from a relatively unknown Tungusic language called Alchuka was presented.

Acknowledgements

I want to thank Bill Rozycki, the editors, and two anonymous reviewers for reading an earlier version of this paper.

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Chapter 9

For better and/or for worse: Complexity and person hierarchies

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Implementation of person hierarchies in verb inflection can produce indexation paradigms that are very complex by the usual standards for measuring complexity in paradigms. Criteria are proposed here for measuring hierarchical patterns in their own terms and more generally for describing relational, linear, and blueprint-driven properties of grammar.

1 Introduction

Consider the twisted willow (*Salix matsudana* ʻtortuosaʼ) or the corkscrew hazel (*Corylus avellana* ʻcontortaʼ) or similar plants.[1] The living organism is formed by a simple blueprint applying repeatedly to produce a one-dimensional object of the same type as a syntactic tree: an open graph consisting of a linear extension and occasional nodes defining a branching structure. But as we perceive the plant in space it is a tree diagram gone haywire in three dimensions: unpredictably convoluted and too complex to permit description in terms of constituents and dependency structure. Its two-dimensional projection is even worse, as it then has numerous intersecting branches.

The blueprint is the basic metaphor behind this paper. A paradigm is the linguist's description of the outputs of a series of decisions, processing steps, or applications of rules that occur in the production and interpretation of sentences – i.e. the output of a blueprint. To properly assess language complexity we need to

[1] Photographs: www.alamy.com/stock-photo/corkscrew-tree.html, www.puutarhakasvit.fi/tuote/peikonp%C3%A4hkin%C3%A4-corylus-avellana-contorta-/2000174700001/

Johanna Nichols. 2020. For better and/or for worse: Complexity and person hierarchies. In Dankmar Enke, Larry Hyman, Johanna Nichols, Guido Seiler & Thilo Weber (eds.), *Language Change for the Worse*, 245–262. Berlin: Language Science Press. DOI: ??

measure the complexity of both the output and the blueprint, and while recent years have seen much progress in measuring the complexity of outputs, little is known of blueprints and how to measure their complexity. My thesis here is that simple blueprints can produce highly complex outputs, polysynthetic grammars and their components being a particularly clear case. If complexity is assessed based only on paradigms and outputs, polysynthetic structures and hierarchical patterns are parade examples of complexity and as such must surely represent worse outcomes of whatever diachronic processes produce them. But if measured on their own terms they are models of economy, simplicity, and consistency. This chapter is a programmatic one, intended to propose some first steps toward measuring the complexity of blueprints and blueprint-driven structures in their own terms, beginning with the inflectional marking of argument roles and participant reference.

2 Measuring paradigm complexity as non-biuniqueness

Transparency can be measured as the number of departures from the one-form-one-function ideal of biuniqueness (Nichols In press[b],[a]), and the theory of canonical morphology and syntax (Corbett & Fedden 2016; Corbett 2015; 2013; 2007; Bond 2019, and many others) has identified a number of non-biunique, or non-canonical, patterns such as syncretism, allomorphy, zero morphs, paradigmatic gaps, and the like, which can be counted up to give a measure of complexity (Nichols 2015; In press[a]; Audring 2017). Importantly, the count of non-canonicalities correlates with what is known as *descriptive complexity* or *Kolmogorov complexity*, the amount of information required to describe a system: more information is required to describe a non-biunique (or less biunique) system than a biunique (or more biunique) one (for types of complexity see Dahl 2004; Miestamo 2008; Sinnemäki 2011). Examples are the Mongolian and Russian partial case paradigms in Table 1 and Table 2.

In the Mongolian paradigms there is one instance of allomorphy (the genitive endings, which are phonologically predictable) and an extension -*n*- in two of the cases. Describing the endings requires annotating nouns of the non-default type as requiring the extension, and stating the basis for the case allomorphy (referring to the morphophonology section of the grammar). In the Russian paradigms there are three patterns of syncretism: genitive-accusative (in 'brother'), nominative-accusative ('house', 'window', 'book', 'net', 'time'), and genitive-dative ('book', 'net', 'time'). For every case there is allomorphy based on declension class, gender, and animacy: two different genitive allomorphs and

Table 1: Partial Mongolian noun case paradigms (Svantesson 2003: 163; Janhunen 2012a: 297–298, 106–112, 66–68; Janhunen's transcription). Case suffixes are hyphenated off, extensions underlined.

Case	'book'	'year'
Nominative	nom	or
Genitive	nom-ÿn	or-n-ÿ
Accusative	nom-ÿg	or-ÿg
Dative	nom-d	oro-n-d

Table 2: Partial Russian noun case paradigms (forms transliterated). Under each noun gloss is the declension class, then the gender, of the noun shown. Case suffixes are hyphenated off, extensions underlined.

	'brother'	'house'	'window'	'book'	'net'	'time'
Declension	1	1	1	2	3	3
Gender	Masc.	Masc.	Neut.	Fem.	Fem.	Neut.
Nominative	brat-∅	dom-∅	okn-o	knig-a	set'-∅	vremja-∅
Genitive	brat-a	dom-a	okn-a	knig-i	set-i	vrem-en-i
Accusative	brat-a	dom-∅	okn-o	knig-u	set'-∅	vremja-∅
Dative	brat-u	dom-u	okn-u	knig-e	set-i	vrem-en-i

three for the other cases. There is an extension *-en-* in 'time'. Describing this requires annotating each noun for gender, declension class, animacy (grammatical animacy is largely but not entirely predictable from real-world animacy), and whether or not it takes an extension. Describing the Russian system takes more information than describing the Mongolian system (contrast the lines of print describing the two in this paragraph) and requires displaying more paradigms.

For both languages there are additional alternations that are phonologically predictable: for Mongolian these are mostly alternations in the affixal vowels, predictable from the noun stem structure (Janhunen 2012a: 106–108); for Russian they mostly involve the consequences of stress shifts and consonant palatalization. These phonological and morphophonological alternations are not considered in this paper, which deals only with morphological complexity.

Similar comparisons can be made in verb conjugation. For example, both Russian and Tatar (Turkic) have verbal indexation of the S/A, but wih considerable differences in complexity. Russian has coexponence of person-number with

TAM; Tatar does not. More precisely, Tatar, like most Turkic languages, has two series of person-number markers, one originally verbal and one originally nominal but extended to verb conjugation as former participles have been reanalyzed as tense forms. Russian too has allomorphy of its person-number marking, which define two conjugation classes; in addition, it has a category discrepancy in indexation: person-number in the nonpast tenses vs. gender/number in the past tense. Tatar has a single verb stem class; Russian, depending on how they are counted, has at least five (defined by conjugation suffixes, a.k.a. thematic suffixes, such as -*i*-, -*ej/e*-, -*aj/a*, -*i/a*-, -∅, to which the TAM-person-number suffixes are attached). Thus, in terms of affix conjugation classes, stem conjugation classes, and conjugation categories, Russian is considerably more complex.

These are all departures from biuniqueness, involving one-many and many-one and many-many relations of form to function. There are also differences in sheer numbers of categories; notably, Russian has only three tenses while Turkic languages generally have more; Turkic languages generally have evidentiality oppositions while Russian does not; Russian has an aspect opposition which Turkic languages lack. But these involve the number of elements in subsystems, i.e. inventory or taxonomic or enumerative complexity, which is not at issue here.

Canonicality theory has covered paradigms, especially inflectional paradigms, extensively and this enables us to make decisions like those above on what is and is not canonical in the case paradigms of Russian and Mongolian or the person-number paradigms of Russian and Tatar. What has not had due attention is the extent of non-canonicality in subject-object indexation patterns like those of Yimas, shown in Table 3.

There is an alignment disrepancy, namely the presence of three different alignment patterns: an anomalous one for 1du; three-way for the other first and second person forms; and ergative for third person. These could also be defined as syncretism patterns: A and O in 1du, S and O in the third person, none in the others. There are two additional syncretisms: 2pl A and 2sg O *nan*-; 2sg and 3sg A *n*-. There are also discrepancies in the linear order of the A and O prefixes: the higher-ranked prefix in a hierarchy of 1 > 2 > 3 is adjacent to the verb, shown in (1).

(1) Yimas (Foley 1991: 205)

a. *pu-* *nga-* *tay*
3PL.A- 1SG.O- see
'They saw me.'

b. *pu-* *ka-* *tay*
3PL.O- 1.SG.A- see
'I saw them.'

In addition, there is a suppletive portmanteau prefix for 1>2sg, shown in (2).

(2) Yimas (Foley 1991: 207)
kampan- *tay*
1.A>2SG.O- see
'I saw you.'

Several of these patterns are non-canonical: the alignment discrepancy (or, alternatively, the syncretisms), the additional syncretisms, the discrepant ordering, and the portmanteau morpheme.

Jingulu (Mirndi, northern Australia; Pensalfini 2003) has three different types of subject and object indexation: an explicit sequence of overt A and O markers, available for any two non-coreferential arguments except that 1sg>2 is impossible; monomorphemic fused forms for 3 > 1, 3> 2, 2> 1, 1 <> 2; and inverse *ni* plus A

Table 3: Subject and object prefixes in Yimas (Lower Sepik-Ramu, New Guinea) (Foley 1991: 200 sqq.)

	A	O	S	Alignment
1 du	ngkra-	ngkra-	kapa-	A=O; S
1 pl	kay-	kra-	ipa-	3-way
1 sg	ka-	nga-	ama-	"
2 du	ngkran-	ngkul-	kapwa-	"
2 pl	nan-	kul-	ipwa-	"
2 sg	n-	nan-	ma-	"
3 sg	n-	na-	na-	Ergative
3 pl	mpu-	pu-	pu-	"
3 du	mpi-	impa-	impa-	"

marker. Non-canonicalities are the existence of the three different types (which amounts to two-way or three-way allomorphy), the portmanteau morphemes, and the inverse marking, which can be described as creating allomorphy of object markers (since the A marker plus the inverse affix marks the O). The inverse marking and the portmanteau forms implement person hierarchies, disallowing sequences of lower-ranked A and higher-ranked O.

(3) shows direct and inverse indexation combined with case on an argument and role-marking agreement affixes in Southern Tiwa.

(3) Southern Tiwa (Kiowa-Tanoan, southwestern U.S.; Zúñiga 2006: 180 after Klaiman 1991: 219–220). Inverse marker bold.

a. *Seuan-ide ti-mų-ban.*
   man-SG 1SG.IIA-see-PAST
   'I saw the man.' (1sg>3sg)

b. *Seuan-ide-ba te-mų-**che**-ban.*
   man-SG-OBL 1sg.I-see-**INVERSE**-PAST
   'The man saw me.' (3sg>1sg)

(3b), in which a lower-ranked subject acts on a higher-ranked object, has an inverse suffix, which, however, is redundant as the A in (b) is case-marked and the 1sg affixes *ti* vs. *te* mark A vs. O functions. It contributes to inventory complexity but also to non-canonicality, in that the choice of which argument to index varies not according to syntactic role but to person ranking.

Hierarchical indexation in which two arguments compete for a single slot often entails non-canonicality. Table 4 gives a paradigm and (4) gives some examples from a Laz variety. The paradigm is very economical, using minimal overt marking to convey almost entirely unambiguous meaning. However, it has a number of non-canonical patterns. These include zeroes in the prefix paradigm for second person S/A and third person S/A and O; a position discrepancy, as third person A is marked suffixally while other persons are prefixal; and discrepancies as to which person prefixes overtly distinguish the argument roles (first person does; second and third do not, but in different ways: second person has only overt O, third person only A). There is either syncretism or a category discrepancy in the S/A suffix column in the plural: 3pl is unambiguously S/A person indexation, while the -t in 1–2pl is arguably either an S/A person index (thus, syncretic for person) or a plural marker (then there is a category discrepancy in this slot). All of these depart from the biuniqueness ideal.

Table 4: Subject and object indexation in Arhavi Laz (Kartvelian, Turkey; Lacroix 2009: 283). …= verb root + thematic suffix.

	S/A-	O-	…	-S/A
1sg	b-	m-		
2sg		g-		
3sg				-s/n/u
1pl	b-	m-		-t
2pl		g-		-t
3pl				-an/nan/es/n

(4) Arhavi Laz (Lacroix 2009)

b-dzir-om	‘I see him’
m-dzir-om-s	‘he sees me’
m-dzir-om	‘you$_{sg}$ see me’
g-dzir-om	‘I see you’
dzir-om	‘you$_{sg}$ see him’
dzir-om-s	‘he sees him’
b-dzir-om-t	‘we see him’
m-dzir-on-an	‘he sees us’
dzir-om-t	‘you$_{pl}$ see him’
dzir-om-an	‘they see him’

Another kind of departure from biuniqueness is illustrated by West Caucasian argument indexation. These languages have complex polysynthetic verbs, for which the main inflectional elements can be reduced to the family-wide structure shown in (5); there are additional slots in each language, including slots between the argument slots. Tables 5 and 6 give argument indexation paradigms for two languages.

(5) Shared West Caucasian verb template. {G+} is an open slot containing G (a.k.a. R, the more goal-like or recipient-like object of a ditransitive verb) and other G-like indexes (beneficiary, causee, applicative object, others), in the form of both bare person-number markers and incorporated PP’s.

S/O {G+} A Neg Caus ROOT Aktionsart {TAM Neg}

Table 5: Adyghe (West Caucasian: Circassian) argument indexation (Arkad'ev et al. 2009). OP = object of postposition (the whole PP is incorporated to index the argument).

	S/O	OP	G	A
1sg	sə-	s-	se-	s-
2sg	wə-	p-	we-	p-
3sg	Ø/me-	∅	je-	jë-
1pl	tə-	t-	te-	t-
2pl	ŝʷə-	ŝʷ-	ŝʷe-	ŝʷ-
3pl	Ø/me-	(j)a-	(j)a-	(j)a-

Table 6: Abkhaz (West Cauasian) argument indexation (Chirikba 2003). NH = nonhuman. M, F = natural gender of referent (there is no noun gender). All consonant-final forms have an epenthetic schwa in certain phonological contexts. Schwa = /ə/, except /a/ after pharyngeal.

		S/O	OP	G	A
1sg		s-	s-	s-	s- z-
2sg	M	w-	w-	w-	w-
	F	b-	b-	b-	b-
	NH	w-	w-	w-	w-
3sg	M	d-	j-	j-	j-
	F	d-	l-	l-	l-
	NH	j-	a-	a-	(n)a-
1pl		hˤ-	hˤ-	hˤ	hˤ- aa-
2pl		šʷ-	šʷ-	šʷ-	šʷ- žʷ-
3pl		j-	r- d-	r- d-	r- d-

The markers themselves, then, are nearly identical; only their occurrence in different slots distinguishes the argument roles. Is such a system more or less canonical, or more or less complex, than one with different marker forms for different roles? The next sections propose an approach to answering these questions and more generally to assessing the complexity of hierarchical and inverse patterns.

3 The relational axis

Saussure (1916) famously distinguished the paradigmatic and syntagmatic axes of language. The paradigmatic axis comprises sets of equivalent elements that are in complementary distribution or in opposition (as the members of a case paradigm are). It is this axis that canonical typology and much of morphological theory more generally have focused on in recent years (e.g. Bond 2019). The syntagmatic axis is simultaneously present elements, those that cooccur in a single phrase or clause in speech. The gist of that distinction is still essential in linguistics, but the understanding of syntax available to Saussure was so incomparable to what we now know that it is probably best to leave the term *syntagmatic* in Saussure's sense and devise new terminology. I tentatively use the term *relational* in this new sense. The relational axis of language includes the relation of head to dependent, word to its inflectional index, and index to independent token (e.g. pronoun or noun argument).

For a sentence to function in communication, its relational structure must be recovered. The next sections offer proposals on what is optimal for recovery of argument relations in the two salient arenas of inflectional morphology, verbs and nominals. For verbs, what needs to be recovered includes (a) relationality, i.e. the fact of a relation or dependency; (b) the type of relation (primarily argument roles: A, S, O, etc.); (c) properties of the argument (person, number, gender, case, etc.); (d) referentiality. For nouns they include (a) the fact of relationality in the abstract; (b) properties of the adnominal possessor (person, number, etc.); (c) referentiality.

4 Measuring complexity on the relational axis

Let us assume that the biuniqueness criterion of one form, one function also applies to the relational axis of grammar. Then indexation of argument properties such as person and gender together with marking of relationality amounts to coexponence, or cumulative exponence: one form has the two functions of indexing categories and marking relationality. This also pertains to marking of the type of relation (clause syntatic roles such as A and O, NP roles such as possessor) together with the abstract fact of relationality. From this perspective, the canonical ideal is whatever is closest to pure relationality, since that lacks the indexation categories that create the non-canonicality. By that criterion, canonical behavior is exhibited by the Jingulu or Yimas opaque 1 <> 2 portmanteau (which marks relationality but does not indicate which argument has which role) or Kabardian or Abkhaz argument indexation (where the forms mark person but not role).

Further support for the optimality of minimal coexponence is Siewierska's accessibility marking scale (2004: 176), in which accessibility is greatest at the left end, where overt independent marking is least: zero < reflexives < person affixes < person clitics and unstressed pronouns < stressed pronouns.

However, in any morphosyntactic approach the processor has to be able to recover who does what to whom or what; otherwise no message is communicated, and without a message we do not have language.[2] One way to do this is to make the argument structure and type of argument relation recoverable from the verbal lexeme itself, as when middle, causative, factitive, applicative, etc. morphology narrows down the valence and argument structure. Suppletive valence pairs such as *fear* and *scare* or *see* and *show* also make the argument structure clear. In the Yimas and West Caucasian examples (1), (2), and (5) above, the position of the indexation marker provides most of the needed information about its structure.

Another strategy is to make the argument markers distinguishable from other morphemes. They can occupy salient positions such as word edges, the sole prefixal slot, the first pretonic slot, etc. Or they can have an easy-to-distinguish canon form such as western American first person *n* and second person *m* in pronouns and indexes (Nichols & Peterson 1996; Nichols 2013). There can be strategic neutralization in other parts of the verb template, so that argument markers preserve full formal distinctiveness and are more informative.

Most important, which argument is which can follow from person and/or role hierarchies. In opaque 1 <> 2 morphemes (which are cross-linguistically common: see Heath 1991; 1998 for surveys and analysis) both the roles and the referents follow from the speech act itself and have no additional information involved in their identity; none is needed as both speaker and hearer know who did what. Much the same holds for egophoric (conjunct/disjunct) person marking, where the identities of the participants follow from the type of speech act.

Using this reasoning as springboard, Table 7 presents some thought experiments aimed at identifying the ideals or extremes on the relational axis.

The first point is probably the most important, reflecting the fact that universals do not need to be spelled out in full detail for every language or every paradigm but are stated once and for all outside of the specific grammar or part of

[2] Note that this point is expressed in terms of processing, i.e. information, and not learning, learnability, etc. The complexity or non-complexity of the job of the speaker, hearer, or language learner is a different matter from the complexity of the language system itself, an important one but not addressed here.

Table 7: Some parameters and ideals of relationality. < means 'less ideal than'; boldface marks the ideal.

Paradigm-specific < whole-language < **universal**[a]
Overt marking of roles on argument indexes < **hierarchical**
In templatic strings: All morphemes/syllables/phonemes equally salient and essential < a few **landmarks** or key items to anchor the string and guide processing
No neutralization < **neutralization** of non-landmark positions
Individuals < **sets** (where sets are based on some principle)
Undemarcated < **demarcated** sets (demarcated e.g. by rhyme, alliteration, or other shared phonological shape)

[a] Here and below I use *universal* loosely to include defaults and biases applying to more than the individual language, e.g. family biases, areal biases, cross-linguistically favored defaults, and universals if they exist.

grammar. Hierarchical patterns (including inverse marking) illustrate this principle: specific overt marking is not necessary where identities of arguments can be recovered from general principles. The general principles include the very common person ranking of 1, 2 > 3, the common 1 > 2 > 3, and the somewhat less common 2 > 1 > 3; for many examples of these and others see Zúñiga (2006). No single pattern dominates exclusively, but nonetheless a choice of one of them requires less information on the particular paradigm than a full explicit specification would.

Internally structured elements require processing, i.e. information, so less internal structure is relationally more canonical. Landmark positions or landmark items defocus other kinds of information to allow processing to target the relational ones, and likewise for neutralization; both reduce the information involved in processing relationality. The higher canonicality of sets compared to individuals involves the same principle as less internal structure: a set can be described with less information than the individual pieces one by one. Importantly, the set needs to be based on some principle; there is little economy to be gained by generalizing (or attempting to generalize) over a random collection rather than over a group sharing some common basis. Sets that are demarcated somehow, for instance by shared phonological properties, can more easily be targeted for relational processing. In general there is an inverse correlation between frequency of elements and their distinctiveness (Meylan 2018: 100–129), so that a shared phonotactic shape for (e.g.) person indexes can involve minimally distinctive segments (such as *n* and *m*, mentioned below) or identical elements such as rhyme or alliteration, reducing descriptive information without undermining the message.

All of these rankings boil down to two general principles: (1) reduce informational complexity by drawing on general or universal patterns; (2) increase the efficiency and economy of processing by making the relational markers more salient or identifiable.

The examples in section 2 above, illustrating the paradigmatic complexity and non-canonicality of inflection based on person and role hierarchies, are all quite canonical in relational terms. The person agreement of Yimas ((1), (2) and Table 3) implements hierarchies in at least three ways: the linear order of A and O prefixes uses a person hierarchy of 1 > 2 > 3; alignment of prefixes uses 1, 2 > 3; and linear order uses role (A > O or O > A depending on person). Opaque 1 <> 2 markers implement a person hierarchy, and for Arhavi Laz access to the sole prefix slot follows the hierarchies 1, 2 > 3 and A > O. All draw on language-wide or universal hierarchies instead of specifying information fully for each paradigm.

Minimization of internal structure within sets, and use of landmark positions or items to identify relational elements, are illustrated by West Caucasian indexation (Tables 5 and 6), which marks person but not role for each argument series, distinguishing role by relative position, and placing argument markers in the salient positions of word edge (initial) and pre-root or pre-stem. In addition, sandhi effects such as manner-of-articulation assimilation and schwa-zero alternations respond to a following morpheme and help narrow down the position slot occupied by the argument index, but as they are automatic phonological alternations they need to be specified only once for the language, in the morphophonology component, and not for each slot or filler.

Opaque markers, as noted, are common for 1 <> 2 person combinations where the identities of the participants are clear, but they occur with other combinations as well. Kiowa has a daunting set of 58 more or less portmanteau argument indexes for the combinations of three persons, three numbers, and two roles (Watkins & McKenzie 1984: 109–137). Though amenable to some comparative and internal reconstruction, they are synchronically best treated as unanalyzable, i.e. as a list for lookup by a processor (and memorized by speakers).[3]

[3] To the extent that they are analyzable into A and O morphemes, they utilize the following hierarchies for ordering: O > A; animate > inanimate; 1sg > other; nonsingular > singular

The existence of such systems suggests strongly that it is more efficient to scan or consult or memorize a closed set of high-frequency, high-saliency short items than to separately monitor A and O morphemes.

A possibly relevant example is consonant gradation in Finnish vs. its close sisters, the Saami languages. Consonant gradation in Finnish is largely phonologically predictable: a consonant is in weak grade if it precedes a closed syllable, in strong grade before an open syllable. In Saami, especially the eastern varieties Skolt and Kildin, similar alternations were once phonologically conditioned as in Finnic, but now, due to vowel loss and syllabic restructuring, they form a set of opaque morphomic patterns. Thus, while Finnish has a single declension class with phonologically predictable alternations of stem consonants, eastern Saami has several declension classes based on morphomic alternations. The Finnish system requires attention to the internal structure of words; the Saami one does not but requires memorization. In the terms laid out here, the Finnish system is paradigmatically canonical in having a single underlying form per stem and relationally canonical in drawing on the grammar-wide principle of consonant gradation; while the Saami one is relationally canonical in requiring no monitoring of the internal structure of paradigm elements, but non-canonical in utilizing different morphomic patterns rather than drawing on a single principle.[4]

Canonicality of sets and especially demarcated sets is illustrated by the numerous systems of pronouns and/or inflectional person markers structured by rhyme, alliteration and/or a common tone canon, including the widespread Eurasian person system with first person *m* and second person *T* (*T* = anterior obstruent, typically *t*, *č*, or *s*) or the western American one with *n* and *m* (Nichols & Peterson 1996, Nichols & Peterson 2013a, Nichols & Peterson 2013b; other examples are in Nichols 2001; 2012; 2013). Where these phonological onomatopoetic principles apply the members of the set are not maximally distinct; but as high-frequency items they do not have to be (Meylan 2018: 100–129).

A last relevant example may be the distinction of indexation vs. registration (as the terms *index* and *register* are defined in Nichols 1992: 48–49). In indexation, markers indicate relationality and relation types as well as copying categories of triggers; in registration, no categories are copied. Probably the best-known example of registration is Semitic construct state, where an affix or alternation on a noun indicates that it has a dependent (typically a possessor), i.e. it registers the possessor but does not agree with it in any category. Contrast possessive

(Watkins & McKenzie 1984).

[4] For the Saami languages mentioned see Sammallahti (1998), Nickel & Sammallahti (2011), Feist (2015), Kert (1971), and chapters in Bakró-Nagy et al. (in press).

marking of nouns in Turkic and Uralic languages, where the possessive suffix on a head noun agrees in person and number with the possessor, i.e. indexes it.

Uralic languages variously illustrate indexation, registration, and no marking of objects on verbs. In all branches verbs index person and number of subjects. In the eastern branches, in what is usually called the object conjugation verbs index the number but not the person of objects; in Hungarian the object number indexation is lost and the object conjugation registers an object but does not index it; in the Mordvin branch verbs index both person and number of objects; in the other western branches there is no object marking on verbs. The ancestral state is the eastern one, with partial indexation, and it may be of evolutionary interest that it has remained stable in four branches (Samoyed, Ugric, Permic, Mari) with one innovative change of indexation to registration and one change of partial to full indexation, as well as one or two losses of indexation (in Finnic and Saami, or once in Proto-Finno-Saami).

5 Discussion and conclusions

If ideal types, complexity, and what is canonical differ between the paradigmatic and relational axes of grammar, it is worth asking why only person, and not gender, seems to enter into hierarchical patterns. Give that the evolution of a hierarchical pattern can replace paradigmatic complexity with relative relational non-complexity, one would expect to see any and all indexation categories develop hierarchical patterns like those discussed here for person. The answer seems to be that person hierarchies are potential emergent patterns everywhere and readily grammaticalized and exploited where this is useful, while gender has no corresponding potential emergent pattern. This seems to be because only person is referential (in the sense of referential defined by Kibrik 2011: a person index refers, while a gender index can agree or copy features but cannot refer (for the full argument on this point see Nichols In press(b): section 5).

Furthermore, referentiality varies with person categories. Third person items (nouns, pronouns, and arguably also indexing morphemes on verbs) carry referential indices and make reference to time-stable entities, and their reference is established by the speaker. First and second persons (SAP's), in contrast, are shifters; they have no fixed reference and no referential index (or at least not a fixed one). They could be described as occupying not verb slots but speech-act slots; their reference is given or inherent in the speech act. Heath (1991; 1998) notes that opaque 1<> 2 morphemes are opaque for good reason: social-pragmatic considerations such as taboo, avoidance, politeness, and the awkwardness of asserting things about one's interlocutor to that interlocutor, make it expedient to suppress overt reference to an individual in these person combinations. I have noted in addition that the identity of the first and second persons is automatic and inherent in speech-act context and does not require specification; it suffices to have a morpheme indicating that the two interlocutors are involved. For these reasons, emergent hierarchical patterns can easily form at points where SAP's are involved. The same considerations explain why the cross-linguistically favored cutoffs in hierarchies occur between SAP's and third persons (i.e. 1, 2 > 3).

It is also worth considering whether the paradigmatic or the relational axis is the favored target of elaboration, simplification, etc. in language evolution. There are a number of examples of large, spreading inter-ethnic languages with complex verb morphology and person-rich indexation, many of them with hierarchical patterns and all with relational simplicity and paradigmatic complexity: several Mayan languages; Nahuatl (Uto-Aztecan, Aztec branch; contrast the more paradigmatically oriented Numic branch and Hopi), Ojibwe and Cree (Algonquian), Navajo and Hupa (Athabaskan), Ainu (isolate),[5] Circassian and Abkhaz (West Caucasian). An emergent example comes from the Amdo sprachbund (eastern Tibet), where in an intensive contact situation direct person marking is lost and replaced by egophoric marking under Bodic influence; the reverse does not occur (Janhunen 2012b). Since spreads usually involve absorption of adult L2 speakers, these languages can be regarded as having undergone decomplexification (Trudgill 2011). Such systems are also quite stable in families. The opposite picture is also true, however, especially in northern Eurasia, where we find large spreading inter-ethnic languages with extensive but regular paradigmatic structure, case-rich inflection, massively recursive morphology, and corresponding configurational morphosyntax: this is the type of the Turkic, Mongolic, Tungusic, and Uralic families. These systems are also very stable. It must be that the two axes are equally favored, and spread and contact situations select for consistency rather than for a particular axis.

This paper has identified and illustrated some principles of optimal relationality, but has not attempted to cover their interaction with each other or with other parts of grammar. The full picture is of course much more complex. Even within just the realm of hierarchical rankings, in Algonquian languages one finds all three of 1 > 2, 2 > 1, and 1 = 2, usually more than one within a single language (Macaulay 2009), and Yimas, as noted above, uses both A > O and O > A, depend-

[5] Ainu, a moribund remnant of the pre-Japonic linguistic population of Japan, is not usually thought of as a large spreading inter-ethnic language; but see Janhunen 2002.

ing on person, to determine prefix ordering. How such rankings work together is a question left open here (Macaulay makes a start for Algonquian).

The canonical complexity measures presented in § 2 are the analog to describing the branches of a corkscrew tree or its two-dimensional projection. Such structures are real and are products of selection in the biological and linguistic worlds, but they are not the whole story. This paper has attempted some first steps toward describing linguistic relational phenomena in their own terms and discerning the outlines of the blueprint that produces them.

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Chapter 10

Can language evolution lead to change for the worse?

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Can languages change for the worse? What does it actually mean for a language to be worse than another one? This chapter approaches this question from the point of view of evolutionary theory. It is argued that evolving systems can be compared with regard to their *fitness*, and "better" can be translated as "more fit". Seen this way, the initial question is an instance of the overarching problem *Can evolution reduce fitness?* While the general answer to this question is *yes*, it is argued that this is of little interest with regard to languages as a whole, since their fitness is mostly determined by extra-linguistic factors. However, it is shown that there are at least three scenarios where individual linguistic items can be replaced by less fit competitors during language change: (1) Inflationary use of extravagant expressions, (2) systematic directed replication errors, and (3) evolutionary drift in small populations.

1 Introduction

Before I can address the questions whether languages ever do change to the worse and if so, how this can be modeled, some clarification is needed in what sense a language A can be "worse" than another language B. Some ideas that spring to mind immediately are:

- *A is less regular than B*, e.g., has many declension classes where B has just one, or A has many suppletive forms in its paradigms.
- *A is more complex than B*, e.g., A allows a variety of syllable structures while B only uses CV-structure.

Gerhard J$_t$*ext*$_c$*omposite*$_p$*atch* : *ger*. 2020. Can language evolution lead to change for the worse? In Dankmar Enke, Larry Hyman, Johanna Nichols, Guido Seiler & Thilo Weber (eds.), *Language Change for the Worse*, 263–281. Berlin: Language Science Press. DOI: ??

- *A is harder to acquire than B*, e.g., because A's lexicon contains many synonyms and B's lexicon does not.
- *A is harder to use than B.* This may apply to the speaker — perhaps because the words in A are generally longer than those in B — or to the hearer, e.g., if A's syntactic structures lead to many local ambiguities.
- *Certain concepts or distinctions can easily be expressed in A but not in B*, e.g., aspectual distinctions or evidentiality.

These informal notions of *worse* are not necessarily mutually distinct, and the list is far from complete. To tackle the overarching question, a more precise notion of what it means for a language to be worse than another is needed.

An analogy from evolutionary biology might be helpful here. According to an often-quoted phrase due to Herbert Spencer (Spencer 1875: 453), Darwinian evolution is based on the "survival of the fittest". In Spencer's original formulation, *fittest* is used in an informal sense. A few lines later, Spencer writes: "While one saves its life by higher speed, another does the like by clearer vision, another by keener scent, another by quicker hearing, another by greater strength, another by unusual power of enduring cold or hunger, another by special sagacity, another by special timidity, another by special courage; and others by other bodily and mental attributes" (Spencer 1875: 454). So the comparison that organism A is less fit than organism B appears to be as vague and multi-faceted as the notion that language A is worse than language B. However, in modern evolutionary theory the term *fitness* has a precise quantitative meaning as the *expected number of offspring*. It does not apply to individual organisms but to populations thereof, which may be defined by heritable genotypic or phenotypic traits. *Evolution by natural selection* essentially means that the average fitness of a population of organisms increases over time.

Conceived in this way, the question *Is there evolutionary change that decreases fitness?* has a precise meaning, and the answer is not obvious.

Extrapolating these considerations to linguistics, one might tentatively say that language A is worse than language B if B is fitter than A. This only makes sense, though, if the biological notion of *expected number of offspring* is applicable to languages, or, in any event, to linguistic entities. Darwin certainly held the opinion that this is the case. In *The Descent of Man*, he notes:

> "The formation of different languages and of distinct species, and the proofs that both have been developed through a gradual process, are curiously

> parallel. […] Max Müller has well remarked: 'A struggle for life is constantly going on amongst the words and grammatical forms in each language. The better, the shorter, the easier forms are constantly gaining the upper hand, and they owe their success to their inherent virtue.' To these important causes of the survival of certain words, mere novelty and fashion may be added; for there is in the mind of man a strong love for slight changes in all things. The survival or preservation of certain favored words in the struggle for existence is natural selection." (Darwin 1871: 465–466)

The idea that language change shares certain characteristics with biological evolution has regained popularity in the past two decades (see for instance Croft 2000 and much subsequent work) and will be taken for granted in this article. To apply the notion of fitness to language change, however, it needs to be clarified what linguistic *offspring*, or, more generally, linguistic *replication*, amounts to.

Many researchers in the field of language evolution (Croft being a prominent example) draw inspiration from Richard Dawkin's work (e.g., Dawkins 1976). According to Dawkins, the notion of a *replicator* is central for evolution, biological or otherwise. They are "[t]he fundamental units of natural selection, the basic things that survive or fail to survive, that form lineages of identical copies with occasional random mutations" (Dawkins 1976: 253). This suggests that replicators are discrete entities replicating (almost) faithfully. There is a multitude of prima facie candidates for the status of "linguistic replicator", such as I-languages (or I-grammars) in the Chomskyan sense, E-languages, grammatical rules, constructions, words, morphemes, phonemes, etc. For all these linguistic units, it can be argued that they are culturally replicated in some sense, be it via language acquisition or via imitation in language use. However, unlike the prototypical Dawkinian replicators — genes —, neither of them is a discrete physical entity directly endowed with a replication mechanism.

However, the logic of Darwinian evolution via natural selection does not require the existence of discrete replicators and (almost-)faithful replication. This is made clear quite lucidly in the article *The nature of selection* (Price 1995) by the (among many other things) biomathematician George Price. This little-known article, written around 1971 but only published post-humously in 1995, spells out the conceptual underpinning of the *Price equation* (Price 1970), a mathematical model of Darwinian evolution.

2 The Price equation

Price sees selection as a very general mechanism that has been studied intensely in biology but is also at work in other domains. He writes programmatically:

> "Selection has been studied mainly in genetics, but of course there is much more to selection than just genetical selection. In psychology, for example, trial-and-error learning is simply learning by selection. In chemistry, selection operates in a recrystallisation under equilibrium conditions, with impure and irregular crystals dissolving and pure, well-formed crystals growing. In palaeontology and archaeology, selection especially favours stones, pottery, and teeth, and greatly increases the frequency of mandibles among the bones of the hominid skeleton. *In linguistics, selection unceasingly shapes and reshapes phonetics, grammar, and vocabulary.* In history we see political selection in the rise of Macedonia, Rome, and Muscovy. Similarly, economic selection in private enterprise systems causes the rise and fall of firms and products. And science itself is shaped in part by selection, with experimental tests and other criteria selecting among rival hypotheses." (Price 1995: 389; emphasis mine)

In this section I will briefly recapitulate the fundamental ideas of this article and spell out why Price's approach is useful for the study of language change. For a fuller account, the interested reader is referred to Jäger (2008).[1]

Price distinguishes two concepts of selection: *subset selection* and *Darwinian selection*. For instance, if ten out of one hundred applicants are admitted to college, the selected students form a subset of the total pool of applicants. Darwinian selection, in contradistinction, is about parents and offspring, which are disjoint sets. Both notions of *selection*, however, involve two sets which are ordered in time. Furthermore, there is a function (in the mathematical sense) mapping the later to the former population. For subset selection, this is just the identity function. For biological selection, this is the *parent-of* function if reproduction is asexual. For sexual selection, one has to resort to the level of genes, and the relevant function is *is a copy of*. Price's mathematical model of selection is applicable to any scenario of this sort, i.e., two sets where one is considered to be later in time than the former, and a function from the later into the former set. For ease of reference, I will call the "earlier" set *parents* and the "later" set *offspring*.

Selection can be iterated, i.e., the offspring can become parents of another round of selection etc.

[1] See also Frank (1995) for a very good overview of Price's work in evolutionary theory.

For the mathematical study of selection, furthermore (at least) two functions are required: *w* measures the amount of entities of the two sets. Formally, it maps subsets of the parent and offspring sets to non-negative real numbers. The simplest example *w* would be counting, mapping each finite set to its cardinality. However, *w* can also be a more complex measure function such as social influence, economical value etc.

The function *x* measures some quantitative character whose evolution is being studied. It could be the body size of organisms, the consonant-vowel ratio of a text or what have you. Formally, *x* maps subsets of the parent and offspring sets to real numbers.

A schematic example of such a scenario is shown in the left panel of Figure 1.

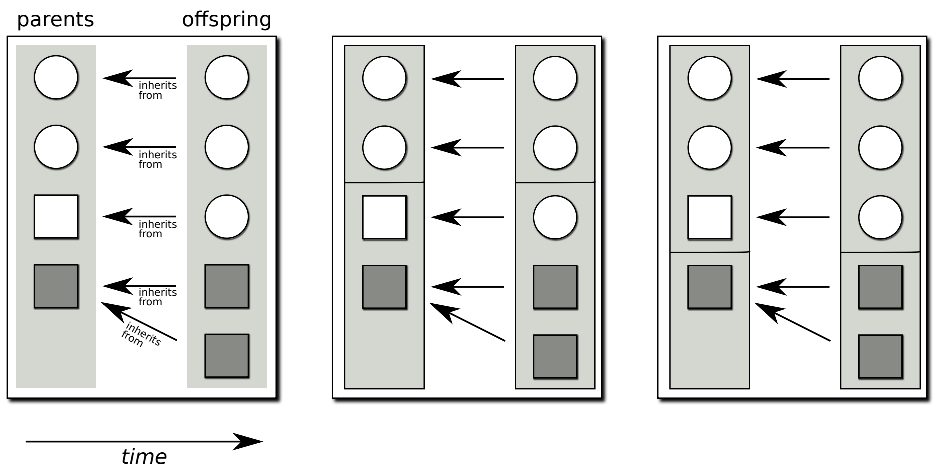

Figure 1: Schematic example of selection

We have two populations of objects of different color and shape. The left population are the parents and the right one the offspring. The arrows map each offspring to its parent.

In the next step, the parent population is partitioned according to some criterion. The middle panel of Figure 1 partitions it according to shape and the right panel according to color. The parent-of function induces a corresponding partition in the offspring population. Note that the third offspring in the middle panel is placed in the group corresponding to square-shaped parents, even though it is round rather than square-shaped, because its parent is square-shaped.

The *fitness* of a group, in the technical sense, is the amount of offspring in that group as measured by *w*, divided by the amount of parents in the corresponding group. Formally, if w_i denotes the amount of group i among the parents and w_i' the amount of the corresponding group among the offspring, the fitness f_i of group i is defined as $f_i = w_i'/w_i$.

If we assume that w simply counts the objects in our example, the fitness of the round parent objects and their offspring is $2/2 = 1.0$, and $3/2 = 1.5$ for the square-shaped parents plus offspring. So the square-shaped parent objects have a higher fitness than the round ones, because they have, on average, more offspring.

For the grouping according to color, as shown in the right panel, we have a fitness of $3/3 = 1.0$ for the white and $2/1 = 2.0$ for the gray objects.

The total fitness off the population, f, is defined as the amount of offspring divided by the amount of parents. In our example this is $5/4 = 1.25$, regardless of the grouping structure.

Regarding the function x, for a group i, x_i is defined as the value of the parent group i under x, divided by w_i. In other words, x_i is the density of x in group i. Analogously, x_i' is the density of x in the corresponding offspring group i. For the whole population, x and x' represent the average density of x among parents and offspring respectively. The notions $\Delta x_i = x_i' - x_i$ and $\Delta x = x' - x$ refer to the groupwise and global difference in the density of x between offspring and parents.

In our example, let us suppose that the function x counts the number of gray objects in a set. Then we have $x = 1/4 = 0.25$ and $x' = 2/5 = 0.4$, so $\Delta x = 0.15$.

Under the groupings both in the middle and the left panel, $x_1 = x_1' = \Delta x_1 = 0$, since there are no gray objects on either of the upper groups. For the lower groups, we have $x_2 = 1/2 = 0.5$, $x_2' = 2/3 = 0.\overline{6}$ and $\Delta x_2 = 0.1\overline{6}$ in the middle panel, and $x_2 = x_2' = 1$, $\Delta x_1 = 0$ in the right panel.

The quantity w_i/w can be interpreted as the *probability* of group i. With this move, it follows from the definitions that[2]

$$f\Delta \mathrm{E}(x) = \mathrm{Cov}(f, x) + \mathrm{E}(f\Delta x). \tag{10.1}$$

This is the celebrated *Price equation* (first published in Price 1970). Here, Cov and E denote the *covariance* and the *expected value* in the sense of probability theory.

The equation is a tautology; it results directly from some algebraic manipula-

[2]Here is the derivation: By definition, $\Delta x = x' - x$, and $x' = \sum_i w_i' x_i' / \sum_i w_i'$. As $w_i' = f_i w_i$, $x' = \sum_i w_i f_i x_i' / fw = \mathrm{E}(fx')/f$. Hence $f\Delta x = \mathrm{E}(fx') - fx$. This is the left-hand side of the equation.

By definition and elementary equivalences, $\mathrm{Cov}(f, x) = \mathrm{E}(fx) - \mathrm{E}(f)\mathrm{E}(x) = \mathrm{E}(fx) - fx$, and $\mathrm{E}(f\Delta x) = \mathrm{E}(fx' - fx) = \mathrm{E}(fx') - E(fx)$. So the right-hand side of the equation sums up to $\mathrm{E}(fx') - fx$ as well.

tion of the assumptions. Its importance lies in the conceptual clarity it provides. The left-hand side holds the total change in the average value of x between parent and offspring generation, multiplied by overall fitness. This overall change is split into two components on the right-hand side. The first term, $\mathrm{Cov}(f, x)$, covers the contribution of between-group *selection* to the change in x. If x strongly covaries with fitness f, selection will favor an increase of x over time. Conversely, if high values of x are associated with low fitness and vice versa, selection leads the average value of x to shrink.

This is not the full story though. The second term, $\mathrm{E}(f\Delta x)$, captures the change of x between parents and offspring *within groups*. If the average value of x within a group i is unchanged between parents and offspring, $\Delta x_i = 0$. If this holds for all groups, x is replicated faithfully. Provided that the external circumstances do not change, the second term becomes 0. However, if replication is not fully faithful or the environment changes, the term may be non-negligible. So one way to interpret the Price equation is to say that it separates evolutionary change into the effect of natural selection and the effect of unfaithful replication and a changing environment.

It is important to point out though that this distinction between selection and within-group change depends on the assumed grouping of the parent population. Since this is imposed by the modeler rather than being empirically determined, this distinction is an analytical tool, not something which is objectively given.

To bring this point home, consider again the example in Figure 1. Average fitness f is 1.25 and the change in the average proportion of gray objects is $\Delta x = 0.15$. So regardless of the grouping, the left-hand side of the Price equation is:

$$f\Delta x = 1.25 \cdot 0.15 = 0.1875$$

For the right-hand side of the equation, the grouping structure makes a difference. In the middle panel, the populations are grouped according to the parents' shape. The character of interest x, changes from 0.5 to $0.\overline{6}$ between parents and offspring for the square-shaped group, so it is not faithfully replicated. Therefore the second term is non-negligible. Numerically, we have

$$\begin{aligned} \mathrm{Cov}(f, x) &= 0.0625 \\ \mathrm{E}(fx) &= 0.125 \end{aligned}$$

In the left panel, objects are grouped according to parents' color. Here the proportion of gray objects remains constant between parents and offspring for both groups, so the second term becomes 0. Carrying out the calculation gives

$$\begin{aligned} \mathrm{Cov}(f,x) &= 0.1875 \\ \mathrm{E}(fx) &= 0 \end{aligned}$$

So according to the first grouping, we find moderate between-group selection for grayness (of magnitude 0.0625) and unfaithful within-group replication favoring grayness. According to the second grouping, there is faithful replication and stronger between-group selection for grayness (of magnitude 0.1875). Both conceptualizations describe the same dynamics, though. In both cases, the sum of the two terms equals the left-hand side of the equation.

The explicit focus of the Price equation on the grouping structure makes it well-suited to study hierarchical selection, e.g., the relative strength of between-individual and between-groups selection. Also, it can be used to capture the effects of directed mutations via the second term.

A major advantage of Price's approach is its generality. It leaves the modeler complete freedom to decide what kind of dependency between stages of a system is considered as parent-of relation, and how populations are structured into groups. The question what *is* a replicator in linguistics is meaningless in this context. It is up to the modeler to decide what is *considered as* unit of selection.

To return to the mathematical detail, in the limiting case where selection is iterated many times and the time interval between successive generations is so short that time can be approximated as continuous, the Price equation becomes the differential equation (see Price 1972a for the derivation)

$$\frac{d\mathrm{E}(x)}{dt} = \mathrm{Cov}(f,x) + \mathrm{E}(\frac{dx}{dt}). \tag{10.2}$$

3 Fisher's fundamental theorem and evolutionary change to the worse

In his landmark book *The Genetical Theory of Natural Selection* (originally published in 1930), Ronald Aylmer Fisher — one of the founders both of population genetics and of statistics — postulated what he called the *fundamental theorem of natural selection:*

> "The rate of increase in fitness of any organism at any time is equal to its genetic variance in fitness at that time." (Fisher 1999: 35)

If higher fitness is read as "better" and vice versa, this seems to suggest that there cannot be biological evolution to the worse. A moment's thought reveals, however, that this "theorem" cannot be quite right in its literal interpretation. If *variance in fitness* is taken in its obvious mathematical interpretation, this quantity cannot be negative. In fact, it has to be positive in any population that is not fully homogeneous with respect to fitness.[3] So according to the theorem, the *rate of increase in fitness* must be non-negative, and in fact positive in almost all cases. Once a population has a fitness > 1, fitness must remain > 1, and this entails that such a population will keep growing indefinitely. This is of course inconsistent with the observation that populations never grow forever.

In Price (1972b) it is spelled out how Fisher's theorem is to be understood, and a simple proof is given. It can easily be shown to be corollary of the Price equation.

Consider the continuous-time version of the Price equation given in Equation (10.2). The quantity x can be any quantitative character, including fitness. If one replaces x with f, one gets

$$\begin{aligned} \frac{d\mathrm{E}(f)}{dt} &= \mathrm{Cov}(f,f) + \mathrm{E}(\frac{df}{dt}) \\ &= \mathrm{Var}(f) + \mathrm{E}(\frac{df}{dt}) \end{aligned}$$

Recall that the first term on the right-hand side captures the change due to selection. So what this formulation says is that the part of change in fitness *that is due to selection* equals the variance in fitness. This variance is virtually always positive, but this may be offset by the second term, which tracks the within-group change in fitness from parents to offspring. This term may be negative for two reasons. First, replication may be unfaithful, and this change — perhaps due to a deleterious mutation — decreases fitness. Still, even if replication is fully faithful, the term may be negative. To see why, recall that the change in fitness is the difference in fitness between offspring and parents, and fitness is the expected number of offspring. Even if the offspring is an exact copy of its parent, it fitness may be lower because *the environment may have changed.* Similar to generals that proverbially always fight the last war, evolution favors change from parents to offspring generation that would benefit the offspring if they would live in the parents' environment, but it may or may not benefit them in their actual environ-

[3] By the term *organism*, Fisher must refer to populations of organisms, since an individual organism cannot have variance in fitness.

ment. Fisher (1999: 41) called this effect the "deterioration of the environment".

To return to the issue whether there may be evolutionary change to the worse, the answer is: Yes, populations may change to the worse in evolution if the deleterious effects of unfaithful replication and of the deterioration of the environment are stronger than the effect of natural selection.

A well-known example of deterioration of the environment is the prisoner's dilemma. Recall that in this kind of game, there are two types of players, *cooperators* C and *defectors* D. The utility matrix for the game is

	C	D
C	2,2	0,3
D	3,0	1,1

where the first number in each cell is the utility of the row player and the second one of the column player. The maximal overall utility that can be achieved is 4 if both players are C, and it is lowest with 2 if both play D. Still, it is rational to play D because D always incurs a higher utility than C, no matter which strategy the opponent plays.

This pessimistic prediction carries over under an evolutionary interpretation of the game where utility is interpreted as fitness. Suppose we have a large population consisting entirely of C players. Then there is a mutation, leading to a single D-player. This mutant will have a fitness of 3 while the rest of the population has fitness of ≤ 2. Therefore D will spread over the generations, and the overall population will approach a pure D state. So the average fitness of the population starts at 2 and converges to 1. Still, if one of the D-players were placed in the original environment of a pure C-population, its fitness would be 3. The decrease in average fitness is a result of the changing population composition.

4 Deterioration of the linguistic environment

The various notions of linguistic replication mentioned above — replication of I-languages, E-languages, grammatical rules, constructions, words, morphemes etc. — can all be accommodated within the Pricean framework. Consider the generative notion according to which linguistic replication primarily proceeds via first language acquisition of syntactic parameters (cf., e.g., Lightfoot 1999). In the simplified case where each infant acquires language from exactly one teacher, each acquired parameter value can be considered the offspring of the teacher's corresponding value. In a more realistic scenario, a learner has more than one teacher though, and there is a probabilistic relation from teacher's to learner's parameter values. This can be fitted into Price's framework if we replace x, f, and w by their expected values.

Similar considerations apply to usage-oriented notions of linguistic replication. Following Bybee (2006), exemplars, i.e., memory traces, of linguistic experiences can be seen as forming the populations selection operates on. As with syntactic parameters, there is no unique map from offspring to parent, so formally, the underlying probability space over exemplars would be the populations in the formal sense.

Taking the latter perspective, the fitness of an exemplar would then amount to the expected number of later exemplars that it spawns. In other words, an exemplar is accessed in the production of an utterance by the speaker, and this utterance is stored as a new exemplar by the listener(s) and perhaps by the speaker herself. While the number of listeners is a non-linguistic random variable that can be averaged out when considering the expected fitness of an exemplar *type*, the crucial fitness-inducing features are (a) the frequency of situations where the speaker wants to make an utterance where the exemplar provides a suitable precedence, (b) the ease of access from memory (as compared to other suitable exemplars), and (c) the likelihood that the resulting utterance is stored as an exemplar in the listener's memory. It is easy to recognize the well-known notions of speaker economy in (b) and hearer economy in (c).

The overall fitness of a population of exemplars within a speech community, however, is no linguistically meaningful quantity, as it depends on the number of community members and their verbosity, not on language internal features. In this sense, a language — conceived as the totality of linguistic exemplars stored in the minds of the language's users — becomes fitter if the total amount of usage of the language increases (and vice versa). This can happen because the language community expands or because people increase their linguistic activity. In this sense, language change to the worse, i.e., decrease in linguistic fitness, occurs if and only if a language's usage shrinks, for whatever reason. This, however, has arguably little to do with the language's properties as such, and is therefore not a helpful answer to the overarching question of this volume.[4]

To formulate it in another way, if extralinguistic and sociolinguistic factors are averaged over, languages do not change to the better or to the worse as long

[4]One reviewer remarked that in situations of direct language competition in multilingual contexts, selection between languages takes place, and factors like learnability or expressivity might have in impact on the strength of selection between languages. This is a relevant aspect that will not be pursued futher here.

as they serve the language users' communicative needs. However, we may ask whether certain slots within the language system can change to the worse, in the sense of losing fitness.

This is exactly what is happening in the initial stages of grammaticalization, as conceived by Haspelmath (1999). He assumes the following schematic structure of this process:

> "a. A speaker says YB_LZ where s/he could have said YA_FZ […]. (X_L = lexical element; X_F=functional element).
> b. Other speakers follow him/her and say YB_LZ, too […].
> c. B_L increases in frequency in the community's speech, because B's new meaning is more basic to discourse […].
> d. Because of its high frequency, B becomes more predictable.
> e. Because of its predictability, B is pronounced in a reduced manner by many speakers […].
> f. Because of its high frequency, B (which is now B_F) is increasingly automated/routinized in the speaker's mind […]; automated processing entails features such as merger with adjacent elements; obligatory use in certain contexts; fixed position; etc.; […].
> g. Through habituation, the meaning contribution of B is no longer perceived as pragmatically salient."
> (Haspelmath 1999: 1055)

This process is set in motion due to a conversational maxim stated in Keller (1994), which Haspelmath (1999) dubs the maxim of "extravagance": "Talk in such a way that you are noticed." (Keller 1994: 101)

During stage b., the innovative item B achieves a high fitness because few existing exemplars give rise to many copies thereof. However, during stages c. and d., B's fitness decreases because a speaker choosing B has more exemplars to draw from, and B is not very extravagant anymore. During this phase, B is *getting worse*. Haspelmath aptly compares this process with economic inflation, where an oversupply of money leads to its devaluation.

Note that this effect applies whether or not B is phonetically reduced and/or semantically bleached during this process. What has changed from phase a. to phase c. is the surrounding population of linguistic exemplars, not the linguistic type. B's reduction in fitness is an instance of deterioration of the environment in the sense described in the previous section.

5 Directed mutations

Price's framework does not require replication to be faithful. (Recall, e.g., that in the example in Figure 1, the third row changes its shape from square to round.) Changes due to unfaithful replication are also covered by the second term of the right-hand side of the equation, just like deterioration of the environment. If copying errors reduce fitness, this may also lead to a decrease in fitness.

Let me illustrate this point with a schematic example[5], which is illustrated in Figure 2. Suppose we have two types of individuals, A and B, in a population.

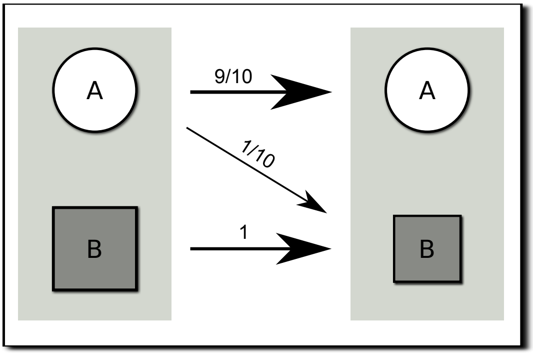

Figure 2: Schematic example of fitness loss due to directed mutations

A has fitness 1 and B has fitness $4/5$. B always reproduces faithfully, but there is a $1/10$ chance that the offspring of an A-individual is a mutant and has type B. Suppose the population consists of $2/3$ type A and $1/3$ type B. Then the variance in fitness is $2/225$. The expected change in fitness for type A is $-1/50$ (since there is a 1 in 10 chance that the offspring has type B and therefore fitness $4/5$ rather than 1), while the expected change in fitness for type B is 0. So the expected change in fitness due to unfaithful mutation is $-1/75$. This amounts to a net change in population fitness of $-1/225$. (This system will eventually settle in an equilibrium where both types are equally abundant.)

A linguistic instance of this effect is phonetic reduction. Consider, e.g., the English word *fifteen*, pronounced /ˈfɪf.tiːn/. Analogously to *fourteen, sixteen, seventeen* etc., the regular word for 10+5 should be *fiveteen* (/ˈfaɪv.tiːn/). Arguably, the monophtongization of the vowel and subsequent consonant devoicing in /ˈfɪf.tiːn/, as compared to the regular formation /ˈfaɪv.tiːn/, are the result of pho-

[5]This is an instance of the *quasispecies* model from biomathematics; cf. (Eigen & Schuster 1979).

netic reduction. It is well-known that phonetic reduction is the more likely the more frequent a word is (see, e.g., Ernestus 2000). Krifka (2007) observes that round number words are ambiguous between a precise and a vague interpretation, while non-round numerals only have the precise interpretation.[6] Therefore it stands to reason that round number words such as *fifteen* words are more frequent in conversation than comparable non-round words like *fourteen* or *sixteen*. In fact, according to the Google Ngram Viewer[7], *fifteen* was consistently more frequent then either *fourteen* or *sixteen* in English language books between 1800 and 2000. The plot is given in Figure 3.

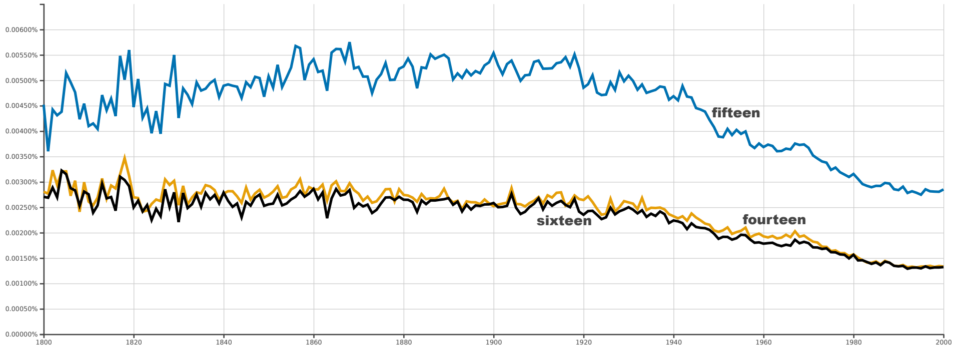

Figure 3: Google Ngram search for *fourteen* (orange), *fifteen* (blue) and *sixteen* (black).

The regular formation *fiveteen* is easier to acquire for language learners than the irregular *fifteen*, so it arguably has a higher fitness. However, hypoarticulation of *fiveteen* is apt to lead to altered replication; many exemplars of *fiveteen* spawn *fifteen*-offspring. This eventually led to the the entrenchment of the phonetically reduced form *fifteen*. So here we have a case where in a competition between a fitter and a less fit item, the latter wins out because there is systematic altered replication to its favor.

6 Random drift

A third scenario where the fitness of a population can decrease despite the force of selection is *random drift*. This effect becomes negligible as population size increases but can be substantial in small populations.

[6] I owe the example regarding *fifteen* to Manfred Krifka, p.c.

[7] http://books.google.com/ngrams, accessed on September 10, 2019.

Again I will give a simple example for illustration. Suppose a population consists of two types of individuals, types A and B, with fitness f_A and f_B respectively such that $f_A < f_B$. In this scenario, both sub-populations will grow indefinitely, even though the relative size of the B-subpopulation will shrink in comparison to the A-subpopulation. But now suppose f_A and f_B are random variables rather than being fixed. The exact number of offspring of an A-individual may depend on all sorts of random circumstances, and it is only known that its *expected value* is f_A (and likewise for B-individuals). If the total population size is finite and limited, there is a positive probability that a mixed population will evolve towards a pure B-population, even though A has a higher expected fitness.

A simple model of this principle is the *Moran process* (Moran 1958). It assumes a finite population of fixed size N. At each time step, one individual is picked at random from the population, and a copy of it is made. Then a random individual is picked (which could be the same as the first) and eliminated, and the copy of the first individual assumes its place. This is illustrated in Figure 4.

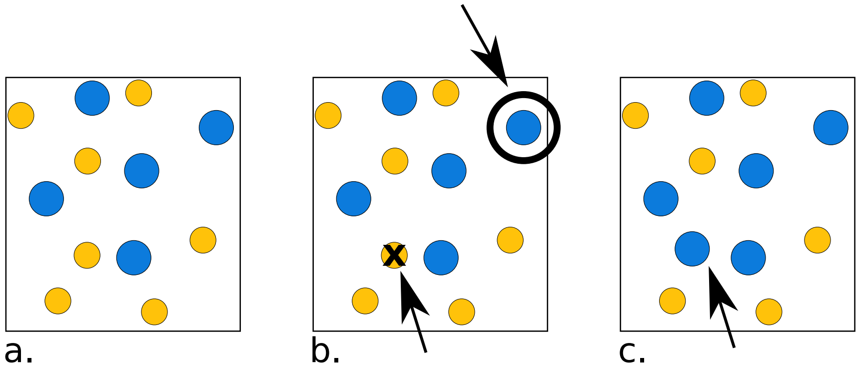

Figure 4: Moran process. In a finite population (a.), an individual is chosen randomly for replication and one for elimination (b.). The eliminated individual is replaced by a copy of the replicated one (c.).

The probability that given individual of type A is picked for replication is $p(A)$, and likewise for $p(B)$. Each individual is equally likely to be picked for elimination.

Now suppose a population of size N consists entirely of B-individuals, but one replication event introduces a mutation. This results in one B-individual being replaced by an A-individual. No further copying errors occur. According to Nowak (2006: 101), the probability that the entire population is eventually replaced by

A-individuals is given by the formula

$$P(B \to A) = \frac{r^{-1} - 1}{r^{-N} - 1}, \text{where}$$
$$r = \frac{p(A)}{p(B)}.$$

If $p(A) < p(B)$, this is the probability that the "better" type B is replaced by the "worse" type A. As shown in Figure 5, this probability can be non-negligible if both the population and the discrepancy between $p(A)$ and $p(B)$ is small.

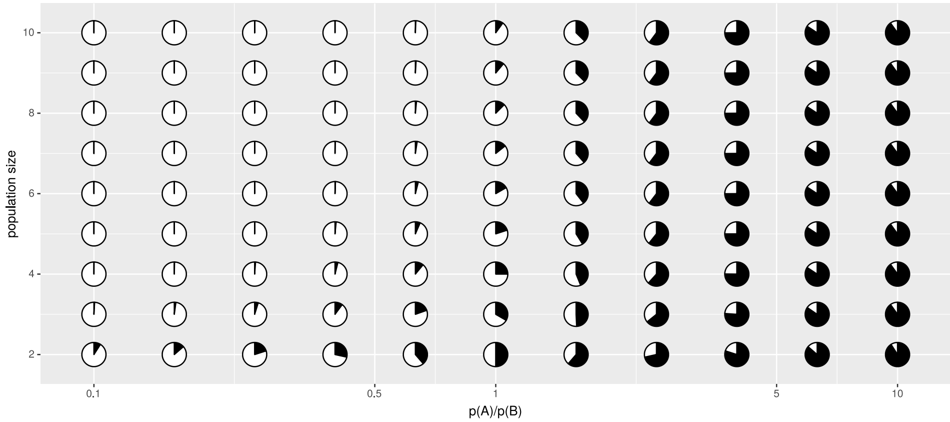

Figure 5: Probability of a finite population of incumbents B being successfully invaded and replaced by a mutant A

The figure also shows that even if $p(A) > p(B)$, i.e., if A is better than B, it is by no means certain that A will replace the worse type B.

Instances of language change where among two competing forms, the less natural/more marked variant occasionally wins out are not hard to come by. An example would be the general trend in Germanic languages to replace the strong (vowel alternation) by the weak (dental suffix) verbal inflection. Verbs that changed from strong to weak abound, e.g. English *shove* which derived from the the strong Old English *scufan*[8] or the German *kauen*, derived from the strong Old High German *kiuwan*.[9] However, there are a handful of examples of the opposite trend, verbs that were originally weak but switched to strong inflection,

[8] www.etymonline.com, accessed on April 23, 2019.
[9] www.dwds.de, accessed on April 23, 2019.

such as English *dive*[10] or German *schrecken*.[11] It seems plausible that the synchronously regular weak inflection is easier to acquire by children and second language learners and therefore has a higher fitness than the competing strong inflection (if both exist or can be morphologically constructed). Since the population of exemplars of a verb is finite, we expect switches from one inflectional paradigm to the other to be possible, and the switch from strong to weak inflection to be more probable. However, the switch from weak to strong inflection has a probability > 0, so it to be expected to occur occasionally.

7 Conclusion

This article probed the question whether languages can change to the worse from a conceptual, modeling point of view. I argued that this question has an illuminating analogy to the issue whether Darwinian evolution in biology can lead to the reduction of fitness. Following much recent work in historical and evolutionary linguistics, I assume that biological evolution and language change are two instances of an overarching principle of evolution via replication and selection. I furthermore argued that George Price's mathematical framework is well-suited to tackle conceptual questions like the one discussed here. My main conclusions are:

- A language as a whole cannot become better or worse, in the sense of increasing or decreasing in fitness, as long as it is fully functional as a vehicle for communication in its speech community.
- Parts of the language system can become worse in the sense that they are changed towards or replaced by alternatives that would be less fit than the original version under similar circumstances.

[10] According to www.etymonline.com, accessed on April 23, 2019:

> "**dive (v.)**
>
> c. 1200, diven, "descend or plunge headfirst into water," from a merger of Old English *dufan* "to dive, duck, sink" (intransitive, class II strong verb; past tense *deaf*, past participle *dofen*) and *dyfan* "to dip, submerge" (weak, transitive), from Proto-Germanic verb **dubijan*, from PIE **dheub-* "deep, hollow" (see deep (adj.)).
>
> In the merger of verbs the weak forms predominated and the strong inflections were obsolete by 1300. The past tense remained *dived* into 19c., but in that century dove emerged, perhaps on analogy of *drive/drove*. […]"

[11] www.dwds.de, accessed on April 23, 2019: "Das ursprünglich schwach flektierende, mit j-Suffix gebildete, intransitiv gebrauchte Verb ahd. *scricken* 'empor-, aufspringen, erschrecken' (um 800) […] entwickelt die Bedeutung 'in Schrecken geraten, erschrecken' aus […]."

- There are at least three general scenarios for how this can happen:
    1. *Deterioration of the environment*, e.g. inflationary use of originally extravagant forms,
    2. *directed mutations*, e.g. in phonetic reduction, and
    3. *random drift*, e.g. switch from weak to strong verbal inflection in Germanic languages.

Acknowledgements

I would like to thank the two reviewers of this chapter for helpful feedback. This research was supported by the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (Grant agreement No. 834050) and the German Research Foundation (DFG-FOR 2237), which is gratefully acknowledged.

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Chapter 11

How to use evolutionary game theory to study evolutionary aspects of grammar

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This article serves first and foremost as a short tutorial for a game-theoretic approach to study the evolutionary aspects of grammar. Such an approach is very useful to better understand the nature of language change, for at least two reasons: On the one hand, game-theoretic models of grammatical systems make it possible to quantify how useful a grammar is in terms of speaker/hearer economy, where such a quantification serves to compare different grammars regarding being better or worse. On the other hand, evolutionary game theory (EGT) provides tools for studying the evolutionary aspects of grammars, such as their stability as well as the transition probabilities among them. As I will show, EGT supplies useful methods to study aspects of language change that might drive a grammatical system for better or worse.

1 Introduction

Do some languages change for the better, and others for the worse? This question is probably hard, maybe impossible to answer. The main problem is due to the fact that it is as good as impossible to quantify languages in terms of being better or worse. Human languages are complex constructions with many grammatical subsystems that are hard to compare in their whole structure. Yet it might be worth a try to compare particular grammatical subsystems of languages.

How can we quantify two grammars g_1 and g_2 of a common domain in being better or worse than the other? There are certainly different factors that play a role, such as *learnability*, *regularity*, the *potential for ambiguity*, *mutual intelligibility*, et cetera. See Jäger (same volume) for a more thorough discussion about

Roland $M_t ext_c omposite_p atch$: *hlenbernd*. 2020. How to use evolutionary game theory to study evolutionary aspects of grammar. In Dankmar Enke, Larry Hyman, Johanna Nichols, Guido Seiler & Thilo Weber (eds.), *Language Change for the Worse*, 283–322. Berlin: Language Science Press. DOI: ??

such factors. In this study I want to focus on quantifying grammars with respect to two usage-based principles: *speaker economy* (SE) and *hearer economy* (HE). SE represents the speaker's interest to accomplish information transfer with minimal effort, whereas HE represents the hearer's goal to construe the information appropriately and as precisely as possible. Grammars that i) *maximize communicative success* and at the same time ii) *minimize speaker effort* can be viewed as being optimized for language users. Now, how can we concretely compare two grammars in terms of speaker and hearer economy? I will discuss this point in the final section, after I have introduced the tools that help to formalize the idea of grammatical systems being quantified in terms of SE and HE.

Note that SE and HE are considered to be more than possible means to quantify grammars. Early work in historical linguistics considered SE and HE as antinomic forces that are important driving factors in language change (cf. Paul 1888; Zipf 1949; Martinet 1962). The dichotomy of both forces results in language systems that are i) sufficiently efficient in usage and learning (SE), as well as ii) sufficiently expressive to make communication mostly successful (HE) (cf. Horn 1984).[1] Furthermore, both principles are directly reflected i) in the tension between articulatory economy and perceptual distinctiveness as studies by phoneticians and phonologists (cf. Lindblom 1983), as well as ii) in the optimality-theoretic dialectic of faithfulness and markedness (cf. Horn 2006).

To understand the driving factors[2] behind change in grammatical systems, I believe it is valuable to see language change in the light of evolution theory[3] (cf. Croft 2000; Rosenbach 2008) – as an entity of cultural evolution (cf. Dawkins 1976; Dennett 1995). Languages, or grammars, can be seen as self-replicating systems, which replicate through the act of communication, as well as through first language acquisition (intra VS. inter-generational transfer). Furthermore, with respect to the initial discussion, grammars that increase communicative success (HE) and minimize speaker effort (SE) are considered as being fitter than competing grammars that are less successful in that respect. As soon as replication

[1] Empirical evidence for SE and HE has been found through multiple sources, such as dialogue analyses (cf. Geluykens 2013) as well as communication experiments (cf. Rubin et al. 2015).

[2] Note that I deliberately exclude social factors – such as prestige, register, etc. – from the discussion, since these factors are (mostly) independent from the inherent quality of a grammar/linguistic entity itself and therefore cannot be captured by a general theory of usage-based language change that studies the inherent fitness of grammatical systems. Yet, it is undeniable that social factors are an important driving force in language change (cf. Labov 2001). In this respect, Roberts & Fedzechkina (2018) present a study that illustrates how social factors can produce language change for the worse with respect to speaker and hearer economy.

[3] This idea already goes back to Darwin himself (cf. Darwin 1871: Chapter 2).

is subject to variation and fitness-based selection, evolutionary processes will emerge. Such processes can be modeled and formally analyzed e.g. by applying tools and concepts from evolutionary game theory (EGT). This article is intended to serve as a short tutorial for how to study the evolutionary aspects of grammar by using EGT tools.

Why is the application of EGT helpful for studying grammatical change driven by usage-based factors?[4] First of all, a game-theoretic model for grammatical systems makes it possible to quantify how useful a grammar is in terms of speaker/hearer economy. And secondly, EGT already delivers many "off-the-shelf" methods and tools as well as results from this area that can be applied right away if the empirical domain to be modeled is formulated appropriately (cf. Jäger 2007).

The article is composed as follows: in Section 2, I will introduce two studies that use EGT tools to investigate the evolutionary aspects of different grammatical domains (Jäger 2007; Deo 2015). In Section 3, I will present a step-by-step tutorial for how to use game theory to model a grammatical system, wherein I frequently refer to the concrete models of the studies introduced in Section 2. In Section 4, I will introduce important tools and concepts from EGT that help to analyze game-theoretic models, such as *evolutionary stability* or *replicator dynamics*. In Section 5, I will return to the idea of language change for the better or for the worse, and discuss how EGT can help to shed light on the darkness of understanding how aspects of language use might drive grammatical change.

2 Grammatical Domains under Investigation

The grammatical domains under investigation are i) *case grammars for syntactic core roles*, and ii) *progressive grammars of the imperfective domain*. The reason for this choice is above all the fact that studies exist which contain very similar game-theoretic models for the investigation of these two domains: the *Case Game* (Jäger 2007), and the *Imperfective Game* (Deo 2015). With the goal of motivating game-theoretic tools for the investigation of the diachrony and stability of grammars, this situation allows me i) to introduce important concepts with reference to these two models, and at the same time ii) to reduce the linguistic motivations behind it to a minimum – since they can be found in the original studies. Yet, I will shortly introduce both.

[4]Note that the application of EGT does not require a commitment to a usage-based definition of fitness. For example, a number of fitness-based models are rooted in language acquisition (cf. Niyogi & Berwick 1997; Yang 2002).

2.1 Jäger's (2007) Case Study

The domain under investigation in Jäger (2007) concerns case-marking patterns that help to disambiguate syntactic core roles in transitive sentences. The core roles are the agent (*A*) and the object (*O*). Many languages have an *accusative system*: they use the same marker for the agent of transitive sentences and the only NP of intransitive sentences (nominative marker), while they mark the object of the transitive sentence in a different way, as accusative. Many other languages have an *ergative system*: they use the same marker for the object of transitive sentences and the only NP of intransitive sentences (as absolutive/nominative), while they mark the agent of the transitive sentence in a different way, as ergative. Furthermore, most accusative systems do not mark every object as accusative, just as most ergative systems do not mark every agent as ergative, but instead restrict this marker to NPs that form a subset of a particular hierarchy, such as definiteness or animacy hierarchy (cf. Silverstein 1976; Bossong 1985). For a more detailed discussion and some examples see e.g. Jäger (2007), pp 75-77.

The number of logically possible case marking patterns is huge, but only a relatively small number of them is very common in the languages of the world.[5] There are three such systems: *differential object marking* (DOM), *differential subject marking* (DSM), and a mixture of both (DSOM). All these systems have in common that they usually zero-mark the absolutive/nominative case. Furthermore, DOM systems are accusative systems that only accusative-mark the object if it is an NP-type from the upper part of a *prominence scale*[6]. For example, English belongs to this class, since it only marks the accusative of pronouns, whereby all other noun types remain unmarked when in the accusative case. Similarly, DSM systems are ergative systems that only ergative-mark the subject, if it is an NP-type from the lower part of a prominence scale, as e.g. found in several Caucasian languages. DSOM systems – also know as split ergative – use both strategies: they accusative-mark objects if the NP is from an upper part of a prominence scale and they ergative-mark subjects if the NP is from a lower part of a prominence scale. They are e.g. very common among Australian Aboriginal languages.

It turns out that these typologically very common patterns are exactly those that minimize speaker effort and ambiguity at the same time. This suggests that these case systems are primarily a result of functional adaptation in language

[5] See Section 4.3 in Jäger (2007) for a discussion about very common and also mostly unattested case systems. For further references, see e.g. Bossong (1985), Dixon (1994) or Blake (2001).

[6] A prominence scale is a more general concept that can be a definiteness hierarchy, animacy hierarchy, or a combination of both. See Jäger (2007), pp. 76-77.

use. By applying EGT tools, Jäger was able to show that the existing case marking systems are optimally adapted to patterns of language use in a game-theoretical sense. The formal part of his study – the Case Game – will be introduced in Section 3. There, I changed a number of his original definitions for reasons of generality and comparability with Deo's model. For example, I explicitly define a *context space* for the Case Game, which was only implicitly given in Jäger's definition. Yet, my definition of the Case Game replicates Jäger's original model in every detail in its functionality.

2.2 Deo's (2015) Study about the Progressive Aspect

In Deo (2015) the domain under investigation is the *Imperfective aspect* and its crosslinguistically attested distinct subreadings: *progressive* and *habitual*.[7] She connects those subreadings to an underlying metaphysical classification of two types of knowledge we possess: *phenomenal* (non-contingently) and *structural* (contingently) (Goldsmith & Woisetschlaeger 1982). In this respect, a progressive marker helps to discriminate phenomenal from structural meaning. However, languages can differentiate in many ways with respect to the manifestation and characteristics of the progressive marker: for example, in some languages the usage of the progressive marker is obligatory, while in other languages it is optional. In still other languages there is no explicit progressive marker at all. Let's take a look at some sample languages for examplification.

A categorical progressive (CP) system sharply differentiates between phenomenal and structural meaning of an action and is obligatory for marking the former meaning type. For example, English is a CP language. Its progressive marker is the *be* + *-ing*-construction. It is obligatory for distinguishing between a phenomenal meaning, such as 'You are smoking (right now)' and a structural meaning, such as 'You (use to) smoke (in general)'. Further sample languages for CP systems are Swahili, Irish or Hindi.

Other languages have a progressive marker that is optional, not categorical. Consider the following example sentences from Italian (Williams 2002):

(1)	*Che*	***stai***	*facendo?*	***Stai***	*ridendo?*
what	stay.PRS.1SG	doing	stay.PRS.1SG	laughing

'What are you doing? Are you laughing?'

[7] A third reading that Deo mentioned, the *continuous*, is restricted to stative verbs and is excluded from the model.

(2) *Che fai? Ridi?*
what do.PRS.1SG laugh.PRS.1SG
'What are you doing? Are you laughing?'

Example 1 illustrates the use of an optional progressive form within the postural verb construction (verb *stare*: to stay), while 2 is a present tense sentence in the imperfective aspect without any additional progressive form. Both 1 and 2 license a progressive interpretation (phenomenal meaning). Deo labels such languages as emergent progressive (EP), since historical evidence points to the fact that they are in the process of developing a full fledged categorical progressive, but have not reached it yet. For example, in earlier forms of English, such as Early Modern English, the progressive form was used as an optional marker, not a categorical one. Further sample languages for contemporary EP systems are Spanish, Dutch, and varieties of German.

Finally, there are languages with a zero progressive (ZP) system that do not have an explicit progressive marker at all. In such languages, a morphologically instantiated imperfective aspect inherits the communicative function of the progressive. The following examples from Russian delineate this distribution: The imperfective form *pisa-la* 'write' in 3 licenses a progressive interpretation, while the same form in 4 refers to a habitual/generic situation; in 5 the same imperfect form *zhi-la* 'live' licenses a continuous non-progressive reading without any overt material (Comrie 1976).

(3) *Olga* ***pisa-la*** *pis'ma kogda pojavilsja Vadim*
Olga.NOM.SG write.IMPF-PST.F letter.ACC.PL when appear.PERF.PST.M Vadim.NOM.SG
'Olga *was writing* letters when Vadim appeared.'

(4) *Olga* ***pisa-la*** *pis'mo materi po voskresenjam*
Olga.NOM.SG write.IMPF-PST.F letter.ACC.SG mother.DAT.SG on Sunday.DAT.PL
'Olga *used to write* a letter to her mother on Sundays.'

(5) *Olga* ***zhi-la*** *v Moskv-e*
Olga.NOM live.IMPF-PST.F in Moskva-LOC
'Olga *lived* in Moskow.'

Table 1: The historical progressive cycle and sample languages.

System	Sample languages
ZP: zero prog.	Middle English, Russian, Arabic, Bulgarian
EP: emergent prog.	Early Modern English, Italian, Spanish, Dutch
CP: categor. prog.	Present-Day English, Pre-Modern Turkish, Swahili
ZP*: zero prog.	Modern Turkish, Welsh, Yoruba

Languages with a ZP system exhibit no "explicit" progressive form, as there appears to be no differentiation within the imperfective domain; the imperfective form licenses progressive, habitual/generic and continiuous interpretations (phenomenal and structural meanings). Further sample languages for ZP systems are Bulgarian, Georgian or Modern Greek.

Cross-linguistic observations of semantic change suggest a universal tendency of a particular diachronic path: *the progressive-imperfective grammaticalization path* (cf. Bybee et al. 1994). This path forms a cycle that passes through three stages represented by the three exemplified progressive systems. The whole cycle can be described as the following sequence: ZP → EP → CP → ZP, whereby the three transitions (→) represent the grammaticalization processes (i) recruitment, (ii) categorization and (iii) generalization, respectively. Table 1 shows the different progressive systems in order of their appearance in the cyclic path, and the corresponding sample languages of which some illustrate historical evidence for the respective transitions. Note that ZP and ZP* are logically the same systems, but differ with respect to historical information: only for the latter is there evidence for an ancient CP stage (e.g. Pre-Modern and Modern Turkish).

Deo's research approach is similar to that of Jäger (2007). Both want to find explanations for cross-linguistic universal tendencies which cannot be explained by relatedness between languages but which are hypothetically a result of universal principles in language use. And both want to study these potential relationships with tools from EGT. An important difference is that Jäger's universal tendencies are with respect to language variation alone, whereas Deo additionally suggests a diachronic universal tendency, based not only on typological but also on historical data. Yet, for both enterprises, the concept of *evolutionary stability* plays an important role to better understand the universal character of the phenomena under investigation, as I will delineate in the following sections.

3 How to model Grammatical Systems

The main goal of the line of research of this study is to better understand the effect of language usage on change in grammar. To achieve this, I will make use of a particular game-theoretic model: the *signaling game* (Lewis 1969). What are the eligibility criteria for the choice of this model? Note that one aim of this line of research is to show how very general principles of language use can produce particular properties of grammatical structure. (cf. Jäger & van Rooij 2007). Additionally, as already mentioned in Section 1, SE and HE are very general principles of language usage that are assumed to be important factors that drive language change. And these principles can be formalized via signaling games, they themselves being basic assumptions for signaling games with costly signals (cf. Jäger 2008b).

A core property of a signaling game is the distinction between *meaning space* and *form space*. What a speaker wants to transfer to the hearer is something that is part of the meaning space (the information, the idea, or the concept), but what she can actually transfer at the surface is something that is part of the form space (signals, sounds, markers, words, sentences, etc.). The notion of the form space and meaning space of a signaling game can be understood very generally. It therefore has found application in diverse aspects of linguistic structure: It has been used to study associations between phonemes (meaning space) and phones (form space), as done by Jäger (2008a), who used the signaling game model to study particular universal tendencies of vowel systems. It has been used to study lexical semantics, such as the universal tendencies found in basic color terms (form space) and their color associations (meaning space), as studied by Jäger (2006). Finally, it has been used in our two case studies: (i) the associations between case markers (form space) and semantic core roles (meaning space) (Jäger 2007), and (ii) the associations between imperfective/progressive markers (form space) and the aspectual interpretation of a sentence (meaning space) (Deo 2015). In this study, I focus only on a particular part of linguistic systems, namely functional grammars. I believe that for this purpose a third space (next to meaning space and form space) is essential for modeling such systems: a *context space*. Such a space represents all additional cues that help the hearer for disambiguation (cf. van Rooij 2004).

In what follows I will present a step-by-step tutorial for how to model a signaling game that represents a grammatical domain, doing so by introducing the Case Game of Jäger (2007) and the Imperfective Game of Deo (2015). A schematic overview of the modeling process is presented at the end of this section in Figure

4. As a first step, I will introduce the fundamental aspects of such a game model: the meaning space, the form space, and the context space.

3.1 Step 1: Defining Meaning, Form and Context Space

A signaling game that models a grammatical domain contains three fundamental spaces. The first is a *meaning space* M: the domain of information that the speaker wants to transmit to the hearer. It is important to note that the entities of the meaning space – the different *meanings* – are information that is hidden to the hearer. The goal of both interlocutors is the successful information transmission of meanings. To achieve this, the speaker produces one of multiple *forms* which are entities of the *form space* F. Since human language is in many aspects context-dependent, there is a third space which provides additional cues: the *context space* C. The difference between this and the meaning space is that the entities of the context space – the different *contextual cues* – do not constitute private information to solely the speaker, but are accessible to both interlocutors. The ways of how speaker and hearer strategically navigate among these spaces to communicate will be formally defined in Section 3.3. First, I want to present how the three spaces are defined for the Case Game (Jäger 2007) and the Imperfective Game (Deo 2015).

3.1.1 Spaces of the Case Game

As already introduced in Section 2.1, Jäger's Case Game is designed to study the stability of case-marking systems for the actor identification of transitive sentences. To be more detailed: a transitive sentence contains two NPs, of which one is the agent A and one is the object O. The information as to which is which is private to the speaker. Since the NPs of the sentence must be ordered in a particular way, there are two possibilities as to how the speaker can construct the sentence: AO (agent before object) or OA (object before agent). Therefore the meaning space of the game is defined as follows: $M = \{m_{AO}, m_{OA}\}$.

Furthermore, Jäger considers three possible ways to mark an NP: with an accusative marker (a), with an ergative marker (e), and by zero marking (z). A transitive sentence can e.g. have the first NP ergative-marked, and the second NP accusative-marked, as represented by the form f_{ea}. Or, a sentence can have both NPs zero-marked, as represented by form f_{zz}. Furthermore, an ergative marker can solely be used to mark an agent (the subject), and an accusative marker can solely be used to mark an object. This excludes the possibility to mark both NPs with e or both with a, such as f_{ee} or f_{aa}. All in all, the logical space contains seven possible ways to mark a transitive sentence, given by the form space $F = \{f_{ea}, f_{ae}, f_{az}, f_{za}, f_{ez}, f_{ze}, f_{zz}\}$.

Apart from an NP being agent or object, in most languages of the world there is another factor that determines if an NP is case-marked or not: its position on a prominence scale, as already discussed in Section 2.1. Note that the prominence information of an NP is different information than its syntactic core role in a transitive sentence. The aim of Jäger's work is to study the way case markers encode the syntactic core roles, and not the prominence level. Therefore, prominence information is not part of the meaning space, but is given as contextual cues, accessible to both interlocutors. Since case systems with differential marking have a split point on the prominence scale, Jäger labels NP types above this split point as p (prominent), and NP types below this split point as n (non-prominent). With respect to this binary definition, the contextual cues give information about both NPs of a transitive sentence, namely if each of them is p or n. Therefore the contextual space C contains four different cues presenting combinations of the prominence status of the first and second NP: $C = \{c_{pp}, c_{pn}, c_{np}, c_{nn}\}$.

3.1.2 Spaces of the Imperfective Game

Deo's model – the *Imperfective Game* – is designed to study the diachrony of the progressive aspect inside the imperfective domain. As introduced in Section 2.2, the underlying submeanings in that domain distinguish between a phenomenal and structural interpretation. Ergo, the meaning space differentiates between a sentence's meaning being phenomenal m_p or structural m_s: $M = \{m_p, m_s\}$.

The form space of Deo's model contains two different forms that can be used to differentiate between the two mentioned meanings. Note that some languages do only have one grammatical form for the whole imperfective domain, thus a second grammatical form for disambiguation does not exist, or is at least very restricted. Let's call this form *imperfective form* f_i. Languages that have a second form to discriminate between phenomenal and structural meaning can do this in two different ways: as a progressive marker or as a habitual marker. To be neutral to either reading, let's label it as an *additional form* f_a. Therefore: $F = \{f_i, f_a\}$.

Note that Jäger made the contextual cues of the Case Game explicit: they are defined as the prominence level of a given NP. Deo, on the other hand, does not state explicitly the manifestation of the contextual cues, but suggests that there are two general cues c_p and c_s, which license rather a phenomenal reading m_p or the structural reading m_s, appropriately. Therefore: $C = \{c_p, c_s\}$.

3.2 Step 2: Defining Prior Probabilities and Costs Function

Given the spaces of the game, we want to be able to model the possibility that different meaning types appear with different probabilities in different contexts. For example, it can generally be assumed that an NP of a transitive sentence is more likely the agent, the more prominent it is (the higher it is on a prominence scale). Such probabilities can be defined by a *prior probability function* $P \in (\triangle(M))^C$ that defines the probability for a meaning m being used given contextual cue c.[8]

Furthermore, we want to pay respect to the fact that different grammars may be more or less costly in terms of SE. On the one hand, particular forms might be more or less costly to produce, while on the other hand, whole grammatical systems might involve more or fewer costs to be learned or used. Both cost types can be modeled by a *cost function*. The former type can be modeled as a *form-related cost function* $K_f : F \rightarrow \mathbb{R}$. Here each form is assigned with a particular cost value that the speaker has to pay by using it. The latter type can be modeled by a *strategy-related cost function* as $K_s : S \rightarrow \mathbb{R}$, whereby S is the set of speaker strategies (formally introduced in Section 3.3). Here the whole grammatical system that the speaker uses (the speaker strategy) is assigned with a cost value.

3.2.1 Priors and Costs of the Case Game

The prior probability function of the Case Game should give information about the probability of an NP geing an agent or object, given that it is prominent or not. Such probabilities can be derived from usage frequencies. For example, Jäger (2007) used frequency values from the CHRISTINE corpus of spoken English.[9] Note that English is a DOM system that makes the split between pronouns (prominent, accusative-marked), and non-pronouns (non-prominent, zero-marked). Therefore, Jäger computed the frequencies of the four sentence types [A/p, O/p] (prominent agent and object), [A/p, O/n] (agent prominent, object non-prominent), etc. from the corpus. His values are given in Table 2.

As apparent from the values, particular sentence types are much more frequent than others. This might be a particular feature of the English language and its split point. But Jäger compared it with further data from other languages

[8] Here and in the following I will use the $\triangle$-operator for defining probability functions. Note that $\triangle(M) : M \rightarrow \mathbb{R}$ denotes probability distributions over a random variable in M, in that for any $P \in \triangle(M)$ it holds that $\forall m \in M : 0 \leq P(m) \leq 1$ and $\sum_{m \in M} P(m) = 1$. Following this, $(\triangle(M))^C$ denotes probability distributions over M in dependence of a context $c \in C$.

[9] See http://www.grsampson.net/RChristine.html

Table 2: Corpus frequencies according to prominent (p) and non-prominent (n) NPs as agent (A) and object (O) in transitive sentences. These values are from the CHRISTINE corpus of spoken English, but taken as representatives for universal tendencies in language use.

	O/p	O/n
A/p	0.197	0.712
A/n	0.016	0.075

and other split points and concluded that the tendencies of the values are very similar. Therefore, Jäger took these corpus data as representatives for universal tendencies of such frequencies. On that supposition, Jäger was able to extract the prior probabilities from the data. For example, the probability that the agent is prominent and the object is non-prominent is 0.712. There are two possible context-meaning combinations where this is the case. For the pair (m_{AO}, c_{pn}), and (m_{OA}, c_{np}). Since Jäger didn't assume any bias according to the way both NP's are ordered, thus he assumed both orders to be equiprobable. Thus, by dividing the probability mass equally to these two options, we get the following probabilities: $P(m_{AO}|c_{pn}) = \frac{0.712}{2} = 0.356$, and $P(m_{OA}|c_{np}) = 0.356$.

In the same way we can extract all eight values for the prior probability function, resulting in the following values:

- $P(m_{AO}|c_{pp}) = 0.0985$, $P(m_{OA}|c_{pp}) = 0.0985$
- $P(m_{AO}|c_{pn}) = 0.356$, $P(m_{OA}|c_{np}) = 0.356$
- $P(m_{AO}|c_{np}) = 0.008$, $P(m_{OA}|c_{pn}) = 0.008$
- $P(m_{AO}|c_{nn}) = 0.0375$, $P(m_{OA}|c_{nn}) = 0.0375$

The definition of the cost function is much more straightforward. Jäger used a form-dependent cost function K_f and defined the production costs as the number of case markers used in a form. More concretely, the idea is that zero marking *z* has no costs, whereas the case markers *a* and *e* each have a cost value of 1. This leads to the following costs values for all seven forms:

- $K_f(f_{ea}) = K_f(f_{ae}) = 2$
- $K_f(f_{az}) = K_f(f_{za}) = K_f(f_{ez}) = K_f(f_{ze}) = 1$
- $K_f(f_{zz}) = 0$

3.2.2 Priors and Costs of the Imperfective Game

As already mentioned, Jäger made the contextual cues of the Case Game explicit by defining them as the prominence level of a given NP. This definition enabled him to calculate the prior probabilities via empirical data. Deo, on the other hand, did not state explicitly the manifestation of the contextual cues of the Imperfective Game, but suggested that there are two general cues: one that rather licenses a phenomenal reading c_p, and one that rather licenses a structural reading c_s. She expressed this relationship by an ad-hoc prior probability function that states that a meaning is much more probable given for a contextual cue that licenses it (with probability 0.9), than for the alternative contextual cue (probability 0.1). Formally, her prior probabilities were defined as follows:

- $P(m_p|c_p) = 0.9$, $P(m_s|c_s) = 0.9$
- $P(m_s|c_p) = 0.1$, $P(m_p|c_s) = 0.1$

While Jäger used a form-dependent cost function K_f, Deo used a strategy-dependent cost function K_s. She defined the costs of a grammar by the number of different forms the speaker is using: A grammar (strategy) that e.g. only uses form f_i to express the whole imperfective domain is cheaper than one that uses both forms f_i and f_a. The set of speaker strategies S will be formally introduced in the next subsection as functions from meaning space and context space to form space F. For now it is enough to define $\lambda(s)$ as the set of forms used in strategy s. Then Deo's cost values are defined as follows: $\forall s \in S : K_s(s) = |\lambda(s)|$.

3.3 Step 3: Strategy Space – Equilibria and Reduction

The behavior – in terms of language use – of speaker and hearer is given by a strategy. Speaker strategies $s \in S$ are defined as functions from meaning space and context space to form space $S : C \times M \to F$, while hearer strategies $h \in H$ are defined as functions from form space and context space to meaning space $H : C \times F \to M$. These functions represent the behavior of language production and language perception, respectively.

A combination of speaker and hearer strategy is called a *strategy pair* $(s, h) \in S \times H$ and represents a possible grammatical system. Thus, different strategy pairs of the same grammar game represent different grammars of the same grammatical domain.

To give a concrete example, let's take a look at two grammars of the Imperfective Game. Figure 1 shows one way of depicting a strategy pair. Left: given

$$c_s: \begin{tikzcd} m_s \arrow[r] & f_i \arrow[r] & m_s \\ m_p \arrow[r] & f_a \arrow[r] & m_p \end{tikzcd} \qquad c_p: \begin{tikzcd} m_s \arrow[r] & f_i \arrow[dr] & m_s \\ m_p \arrow[ur] & f_a \arrow[r] & m_p \end{tikzcd}$$

Figure 1: The two strategy pairs of an optional progressive grammar: for contextual cue c_s the strategy pair forms a signaling equilibrium, whereas for contextual cue c_p it forms a pooling equilibrium.

$$c_s: \begin{tikzcd} m_s \arrow[r] & f_i \arrow[r] & m_s \\ m_p \arrow[r] & f_a \arrow[r] & m_p \end{tikzcd} \qquad c_p: \begin{tikzcd} m_s \arrow[r] & f_i \arrow[r] & m_s \\ m_p \arrow[r] & f_a \arrow[r] & m_p \end{tikzcd}$$

Figure 2: The two strategy pairs of a categorical progressive grammar: the strategy pair forms the same signaling equilibrium for both contextual cues, therefore being context independent.

contextual cue c_s, the speaker uses form f_i for meaning m_s, and form f_a for meaning m_p, and the hearer construes f_i with m_s and f_a with m_p. Right: given contextual cue c_p, the speaker uses form f_i both for meaning m_s and m_p; and the hearer construes both forms with m_p. The whole system represents an emergent progressive system (see Section 2.2), where the speaker almost always uses the imperfective form f_i, except when the phenomenal meaning m_p is not supported by the context.

Another strategy for the Imperfective Game is given in Figure 2. Here the behavior differs from the former strategy only when context c_p is given (right). Here speaker and hearer behave exactly the same as they did for the context c_s. This strategy pair represents a categorical progressive grammar, such as in English, where one form is exclusively used for phenomenal meanings (in other words, a categorical progressive marker), whereas the other form is exclusively used for structural meanings. A very important difference between both systems is: the former is partially context-dependent, since interlocutors behave differently in different contexts, whereas the second one is context-independent. A categorical progressive system such as English needs much fewer contextual cues for expressing and understanding an ongoing event (phenomenal meaning), than for example an emergent progressive system, such as Spanish.

A very important concept for the study of signaling games is the *signaling equilibrium*: A one-to-one mapping between forms and meanings. In other words, signaling equilibria are strategy pairs for which the speaker uses a different form for each meaning, and the hearer behaves according to the exact mirror image.

Signaling equilibria have very important properties (cf. Jäger 2008b). Note that the left strategy pair in Figure 1 is a signaling equilibrium, as are both strategy pairs in Figure 2. On the other hand, the right strategy pair in Figure 1 is not a signaling equilibrium. It does not guarantee perfect information transmission, but at least it guarantees partial information transmission: interlocutors can communicate meaning m_p via form f_i. Such systems of partial transmission are also called *pooling equilibria*.

Note that the set of all possible strategies is called the *strategy space*, with S being the speaker's strategy space, and H being the hearer's strategy space. When we model a grammatical system via a signaling game, it is important to understand the dimensions of the strategy spaces for at least one reason: the models can readily produce *combinatorial explosions*. As we will see for the Case Game, the strategy space can be huge and often impossible to handle and analyze. Understanding the strategy space helps to find reasonable ways to reduce it to a number of strategies that can be dealt with.[10] In what follows I will discuss the strategy spaces of the Case Game and the Imperfective Game, and possible methods for *strategy space reduction*.

3.3.1 Strategy Space of the Case Game

The dimensions of the strategy space of a signaling game can be easily computed by the number of meanings $|M|$, the number of forms $|F|$, and the number of contextual cues $|C|$. Since a speaker strategy is defined as a function from the $C \times M$-space to the space F, it entails $|F|^{(|C| \cdot |M|)}$ different speaker strategies. Since the Case Game has $|F| = 7$ forms, $|M| = 2$ meanings, and $|C| = 4$ contextual cues, it entails $7^{(4 \cdot 2)}$ speaker strategies, which amounts to almost 6 million possibilities. Similarly, the number of hearer strategies is given by $|M|^{(|C| \cdot |F|)} = 2^{28}$, which amounts to almost 270 million possibilities! The number of strategy pairs is computed as a product of those two numbers, resulting in a number of 16 digits! It should be clear from these numbers that is would be impossible to work with the full strategy space $S \times H$ of the Case Game.

[10] "Reasonable ways" refer above all to the detection and deletion of strategies which are admittedly logically possible, but e.g, are invalid with the grammatical system, or are at least highly unlikely to emerge in the context of the given grammar game. Such strategies are supposed to be an alternative that a rational agent would never consider using in the first place. An example would be to use an ergative marker for the accusative case (or vice versa), as discussed in the next section. It is important to note that space reduction is not supposed to be a process conducted by language users, but a preselection made by the modeler to obtain only those strategies that are reasonable candidates to be considered by language users at all.

Jäger reduced the space of speaker strategies in multiple ways. First, he joined strategies that have the same case marking structure, but only differ in word order. For example, the usage of form f_{ez} for meaning m_{AO} and the usage of form f_{ze} for meaning m_{OA} both describe the same way of case marking, namely marking the agent with an ergative marker, and zero-marking the object. Furthermore, he also excluded strategies that would mark the agent as accusative and/or the object as ergative. Additionally, he used the concept of strict strategy domination (cf. Watson 2008) to eliminate so-called dominated strategies.[11] This treatment rules out strategies, which e.g. always mark both NPs, such as using f_{ea} for meaning m_{AO}, and using form f_{ae} for meaning m_{OA} among all contexts.

This whole process reduces the space of speaker strategies from almost six million to ten strategies! These strategies can be described as follows:

- $s_1 : \forall c \in C : (c, m_{AO}) \rightarrow f_{ez}$ (always *e*-mark the agent)
- $s_2 : \forall c \in C : (c, m_{AO}) \rightarrow f_{za}$ (always *a*-mark the object)
- $s_3 : (c_{nn}, m_{AO}) \rightarrow f_{zz}; (c_{pp}, m_{AO}) \rightarrow f_{ea}; (c_{pn}, m_{AO}) \rightarrow f_{ez}; (c_{np}, m_{AO}) \rightarrow f_{za}$ (always mark the prominent NP, never the non-prominent NP)
- $s_4 : (c_{nn}, m_{AO}) \rightarrow f_{ea}; (c_{pp}, m_{AO}) \rightarrow f_{zz}; (c_{pn}, m_{AO}) \rightarrow f_{za}; (c_{np}, m_{AO}) \rightarrow f_{ez}$ (always mark the non-prominent NP, never the prominent NP)
- $s_5 : (c_{nn}, m_{AO}) \rightarrow f_{ez}; (c_{pp}, m_{AO}) \rightarrow f_{za}; (c_{pn}, m_{AO}) \rightarrow f_{zz}; (c_{np}, m_{AO}) \rightarrow f_{ea}$ (*e*-mark the non-prominent agent; *a*-mark the prominent object)
- $s_6 : (c_{nn}, m_{AO}) \rightarrow f_{zz}; (c_{pp}, m_{AO}) \rightarrow f_{ez}; (c_{pn}, m_{AO}) \rightarrow f_{ez}; (c_{np}, m_{AO}) \rightarrow f_{zz}$ (*e*-mark the prominent agent)
- $s_7 : (c_{nn}, m_{AO}) \rightarrow f_{ez}; (c_{pp}, m_{AO}) \rightarrow f_{zz}; (c_{pn}, m_{AO}) \rightarrow f_{zz}; (c_{np}, m_{AO}) \rightarrow f_{ez}$ (*e*-mark the non-prominent agent)
- $s_8 : (c_{nn}, m_{AO}) \rightarrow f_{zz}; (c_{pp}, m_{AO}) \rightarrow f_{za}; (c_{pn}, m_{AO}) \rightarrow f_{zz}; (c_{np}, m_{AO}) \rightarrow f_{za}$ (*a*-mark the prominent object)
- $s_9 : (c_{nn}, m_{AO}) \rightarrow f_{za}; (c_{pp}, m_{AO}) \rightarrow f_{zz}; (c_{pn}, m_{AO}) \rightarrow f_{za}; (c_{np}, m_{AO}) \rightarrow f_{zz}$ (*a*-mark the non-prominent object)

[11] I will not go into greater detail with respect to the ways in which strategies can be reduced, since it would exceed this study's purpose. Yet, this case should make sense for the problem of combinatorial explosions and hint at the fact that there are elaborate ways to reduce the strategy space.

$$\forall c \in C : \quad \begin{array}{l} (c, f_{ea}) \searrow \\ (c, f_{za}) \longrightarrow m_{AO} \\ (c, f_{ez}) \nearrow \\ (c, f_{zz}) \longrightarrow ??? \\ (c, f_{ae}) \searrow \\ (c, f_{az}) \longrightarrow m_{OA} \\ (c, f_{ze}) \nearrow \end{array}$$

- $h_1 : \forall c \in C : (c, f_{zz}) \rightarrow m_{AO}$ (first NP is agent, or subject before object)
- $h_2 : (c_{nn}, f_{zz}) \rightarrow m_{AO}; (c_{pp}, f_{zz}) \rightarrow m_{AO}; (c_{pn}, f_{zz}) \rightarrow m_{AO}; (c_{np}, f_{zz}) \rightarrow m_{OA}$ (more prominent NP is agent)
- $h_3 : (c_{nn}, f_{zz}) \rightarrow m_{AO}; (c_{pp}, f_{zz}) \rightarrow m_{AO}; (c_{pn}, f_{zz}) \rightarrow m_{OA}; (c_{np}, f_{zz}) \rightarrow m_{AO}$ (more prominent NP is object)
- $h_4 : \forall c \in C : (c, f_{zz}) \rightarrow m_{OA}$ (first NP is object, or object before subject)

Figure 3: *Left*: the ultimate hearer strategy is completely context-independent and works as long as at least one NP is case marked, but it does not have an answer when the hearer receives f_{zz}. *Right*: the four substrategies that use either word order information (h_1, h_4) or prominence information (h_2, h_3) to discriminate between meanings.

- $s_{10} : \forall c \in C : (c, m_{AO}) \rightarrow f_{zz}$ (no case marking)

The space of hearer strategies can also be drastically reduced. First, note that whenever a hearer receives a form that is not f_{zz}, he can easily detect agent and object. If one of both NPs is *e*-marked, it must be the agent, whereas if one of both NPs is *a*-marked, it must be the object. Therefore, the hearer can use the ultimate strategy: if one NP is *e*-marked, construe it as agent and the other NP as object; if one NP is *a*-marked, construe it as object, and the other NP as agent. This strategy works for all forms, except for f_{zz}, as displayed in Figure 3 (left).

To handle the f_{zz}-situation, Jäger introduced four substrategies that deal with this case in different ways: (i) h_1: the first NP is agent, (ii) h_2: the more prominent NP is agent, (iii) h_3: the more prominent NP is object, and (iv) h_4: the first NP is object, as shown in Figure 3 (right). Note that h_1 and h_4 use word order to discriminate between meanings, whereas h_2 and h_3 use prominence information. Note also that h_2 and h_3 additionally use word order (agent before object), when both NPs have the same prominence level. In that way, Jäger reduced the space of almost 270 million hearer strategies to finally four! Therefore, the resulting strategy spaces of the Case Game contain 10 speaker and 4 hearer strategies. In the next subsection I will show that the Progressive Game does not entail such a combinatorial explosion.

3.3.2 Strategy Space of the Imperfective Game

Since the Imperfective Game has $|F| = 2$ forms, $|M| = 2$ meanings, and $|C| = 2$ contextual cues, it entails $2^{(2\cdot 2)} = 16$ speaker strategies, as well as $2^{(2\cdot 2)} = 16$ hearer strategies. The number of strategy pairs is therefore $16 \cdot 16 = 256$. Note that unlike Jäger's game, Deo's game amounts to a total number of strategies that can be dealt with computationally.[12] Nevertheless, Deo also reduced the strategy space by focusing on those strategies that are assumed to represent the different stages of the grammars of the progressive-imperfective grammaticalization path (see Section 2.2). The four relevant speaker strategies are as follows:

- $s_I : \forall c \in C, \forall m \in M : (c, m) \rightarrow f_i$ (always use the imperfective marker)
- $s_O : (c_p, m_p) \rightarrow f_i; (c_p, m_s) \rightarrow f_i; (c_s, m_p) \rightarrow f_a; (c_s, m_s) \rightarrow f_i$ (use the additional marker f_a optional for m_p in case when it is not supported by the contextual cue, else use f_i)
- $s_C : \forall c \in C : (c, m_s) \rightarrow f_i, (c, m_p) \rightarrow f_a$ (use both markers categorically, with f_i for m_s and f_a for m_p)
- $s_A : \forall c \in C, \forall m \in M : (c, m) \rightarrow f_a$ (always use the additional marker)

Furthermore, the three relevant hearer strategies are as follows:

- $h_X : \forall c_i \in C, \forall f \in F : (c_i, f) \rightarrow m_i$ (construe context-dependent, choose the meaning that fits the context)
- $h_O : (c_p, f_i) \rightarrow m_p; (c_p, f_a) \rightarrow m_p; (c_s, f_i) \rightarrow m_s; (c_s, f_a) \rightarrow m_p$ (construe meaning according to the context, except when additional marker f_a is used in a non-supported context: hearer pendant to s_O)
- $h_C : \forall c \in C : (c, f_i) \rightarrow m_s, (c, f_a) \rightarrow m_p$ (construe both markers categorically, with m_s for f_i and m_p for f_a)

Now, the four stages can be represented by the following strategy pairs:

- zero-progressive (ZP) using solely f_i: (s_I, h_X)
- emergent-progressive (EP): (s_O, h_O)
- categorical-progressive (CP): (s_C, h_C)
- zero progressive (ZP*) using solely f_a: (s_A, h_X)

[12] See Mühlenbernd & Enke (2017) for a computational study that incorporates the whole strategy space of Deo's Imperfective Game.

3.4 Step 4: Utility Functions and the EU Table

One fundamental aspect of game-theoretic models is the definition of a utility function. The utility function maps strategic behavior to a numerical value which represents the preferences of the players. In a signaling game both players – speaker and hearer – prefer successful communication over non-successful communication, therefore an outcome of the former kind must for both result in a higher payoff than one of the latter. The success of communicating a particular meaning $m \in M$, whereby the speaker uses strategy s and the hearer uses strategy h, can be defined by the following δ_m-function:

$$\delta_m(s,h) = \begin{cases} 1 & \text{iff } h(s(m)) = m \\ 0 & \text{otherwise} \end{cases}$$

δ_m simply returns 1 when the hearer construes the meaning the speaker wants to communicate, and 0 if not. Note that this is the original definition by Jäger (2007). But in his model he did not explicitly define a context space, but integrated it as part of the meaning space. By integrating the contextual space, communicative success can be defined by a $\delta_{c,m}$-function in the following way:

$$\delta_{c,m}(s,h) = \begin{cases} 1 & \text{iff } h(c, s(c,m)) = m \\ 0 & \text{otherwise} \end{cases}$$

Note that the $\delta_{c,m}$-function determines whether a particular pair of speaker strategy s and hearer strategy h is successful (1) or not (0), given the very particular situation that the meaning is m and the context is c. To estimate a comprehensive utility value for a sender strategy s and a hearer strategy h, both have to be defined over the whole meaning space and over the whole context space. Such a utility is called *expected utility EU* and is defined as the average communicative success over all contexts $c \in C$ and meanings $m \in M$, by taking prior probability $P(m|c)$ into consideration. Therefore the *hearer expected utility* EU_h for using strategy h against strategy s is defined as follows:

$$EU_h(s,h) = \sum_{c \in C} \sum_{m \in M} P(m|c) \cdot \delta_{c,m}(s,h)$$

The *speaker expected utility* EU_s is defined in the same way by additionally incorporating the costs $\mathcal{K}$ that the speaker has to pay with respect to her strategy:

$$EU_s(s,h) = \sum_{c \in C} \sum_{m \in M} P(m|c) \cdot (\delta_{c,m}(s,h) - k \cdot \mathcal{K})$$

Here $\mathcal{K}$ is a placeholder for either a form-dependent cost function $K_f(s(c,m))$ that pays respect to the costs of each form $f = s(c,m)$ that is used in the speaker strategy s, or for a strategy-dependent cost function $K_s(s)$ that pays respect to the costs of the speaker strategy s itself. Furthermore, the parameter k is an additional factor, with $0 \leq k \leq 1$, which specifies the speaker's priorities: if k is low, communicative success is more important than minimal effort, and vice versa. In the Case Game, k represents how costly case morphology is. For example, one can say that case marking is more useful in languages with free word order than in those with fixed word order. Therefore it is relatively more costly to have case marking in the latter case, where it is less needed for disambiguation (see Jäger 2007: page 85, for a more detailed discussion). All in all, the higher k is, the more additional options a language has to disambiguate between meanings, and the less needed and therefore more costly grammatical marking is.

Given these functions, we can compute the *expected utility* (EU) table, which represents the expected utility value of both players for each combination of speaker and hearer strategy. In the following I will present the EU tables of the Case Game and of the Imperfective Game.

3.4.1 EU Tables of the Case Game

Grammar games as defined here entail an infinite number of EU tables. Each depends on the k-value of the speaker utility function EU_s, since this parameter changes the utility values of the speaker. Table 3 shows the EU tables for a relatively low k-value of 0.1 (left) and a median one of 0.45 (right). Note that these tables solely contain the expected utility values of the speaker (EU_s), but – as Jäger (2007) argued – since the relative utilities between speaker and hearer expected utility do not differ for the hearer, it suffices to consider only the expected utilities of the speaker without changing the qualitative results of evolutionary analysis.

Importantly, these EU tables are the object of investigation when we want to study the stability of grammars. I will be more concrete in Section 4 when I introduce EGT tools for analyzing such EU tables. Then I will also introduce the fundamental concept of an *evolutionarily stable strategy* (ESS). As a simple heuristic, for asymmetric EU tables (such as those of Table 2), evolutionary stable strategies can easily be located by finding utility values that are the unique maximum in their row and column. In Table 3 the strategy pairs that form ESSs are marked in bold. Here, the strategy pair (s_5, h_2) is an ESS when k is relatively low (left table). Note that this strategy pair represents a DSOM grammar, which is a combination of differential subject and object marking and very common

Table 3: EU tables (only EU_s values) of the Case Game with $k = 0.1$ (left) and $k = 0.45$ (right). The bold numbers are the utility values of strategy pairs that are evolutionarily stable strategies.

	h_1	h_2	h_3	h_4
s_1	0.9	0.9	0.9	0.9
s_2	0.9	0.9	0.9	0.9
s_3	0.85	0.85	0.85	0.85
s_4	0.81	0.81	0.81	0.81
s_5	0.61	**0.97**	0.26	0.61
s_6	0.86	0.86	0.87	0.86
s_7	0.54	0.89	0.54	0.54
s_8	0.59	0.94	0.59	0.59
s_9	0.81	0.81	0.82	0.81
s_{10}	0.5	0.85	0.15	0.5

$k = 0.1$

	h_1	h_2	h_3	h_4
s_1	0.55	0.55	0.55	0.55
s_2	0.55	0.55	0.55	0.55
s_3	0.458	0.458	0.458	0.458
s_4	0.507	0.507	0.507	0.507
s_5	0.507	0.863	0.151	0.507
s_6	0.545	0.538	**0.553**	0.545
s_7	0.505	0.861	0.148	0.505
s_8	0.510	**0.867**	0.154	0.51
s_9	0.539	0.531	0.547	0.539
s_{10}	0.5	0.849	0.152	0.5

$k = 0.45$

Table 4: EU tables (only EU_s values) of the Imperfective Game with $k = 0.1$ (left) and $k = 0.45$ (right). The bold numbers are the utility values of strategy pairs that are evolutionary stable strategies.

	h_X	h_O	h_C
s_I	0.9	0.9	0.5
s_O	0.8	0.85	0.45
s_C	0.8	0.85	**0.9**
s_A	0.9	0.5	0.5

$k = 0.1$

	h_X	h_O	h_C
s_I	0.9	0.9	0.5
s_O	0.45	0.5	0.1
s_C	0.45	0.5	**0.55**
s_A	0.9	0.5	0.5

$k = 0.45$

in Australian languages (c.f. Dixon 1994). Furthermore, when k is higher (right table), then, e.g., the strategy pair (s_8, h_2) is an ESS, which represents a DOM grammar, such as English.

3.4.2 EU Tables of the Imperfective Game

The Imperfective Game also produces multiple EU tables in dependence of the k-value. Table 4 shows the table for $k = .1$ (left) and $k = .45$ (right). Note that solely depicting the speaker utility is sufficient to study the characteristics – for the same reason as for the Case Game. As highlighted, the only ESS in both tables is the strategy pair (s_C, h_C): the categorical progressive system. This is also the only signaling equilibrium of the reduced strategy space (cf. Figure 2).

To make a more elaborate analysis of grammar games, we can use concepts and tools from EGT which will be introduced in the next section. But just to wrap up at this point: the goal of the modeling is to define a signaling game that represents a particular grammatical domain. From the model we can calculate EU tables, which are the objects of investigation for EGT analyses. A schematic sketch of the modeling process is depicted in Figure 4.

4 Evolutionary Game Theory: Concepts and Tools

Languages or grammars can be seen as self-replicating systems, which are subject to variation and selection. Linguistic selection is most certainly guided by factors that are functional, cognitive and social as well. While *Epistemic Game Theory* focuses on the cognitive processes of agents, we will look at the other side of the coin using *Evolutionary Game Theory* (EGT). EGT mainly abstracts from the individual agent and her specific cognitive processes guiding decisions, and considers the dynamics of populations instead. This step of abstraction is in some aspects very valuable, since due to its low complexity it enables a mathematical analysis of the population dynamics of the game-model to be performed; on the other hand it does not allow for e.g. incorporating agent-based aspects in a very fine-grained way, such as in the case of many social or cognitive factors. Yet EGT is very useful for studying the role of functional factors in the cultural evolution of grammars.

EGT was originally developed by theoretical biologists (Maynard Smith & Price 1973; Maynard Smith 1982) to formalize neo-Darwinian concepts of evolution. The idea is that the interactions between different members of a population can be modeled in a game-theoretic sense. Here, the population members are represented by strategies of a game, and a strategy's average payoff represents its fitness. Evolutionary dynamics ensure that a higher fitness generally entails a higher chance of reproduction. More recisely, evolutionary dynamics determine the change of the population's configuration – the *population state*, that is, the proportions of all strategies in the population – in the following way: the greater/less the relative fitness of a strategy, the more its proportion increases/decreases. This can, for example, lead to situations where one single strategy conquers the whole population, whereas all competitors die out.

Note that I will introduce EGT concepts that are designed for 2-player games, since I believe that most instances of language use and communication are 2-person situations between a speaker and a hearer (as also represented by the standard definition of a signaling game). However, these concepts can also be

Step 1: Definition of Meaning, Form and Context Space

	Case Game	Imperfective Game
meaning space	agent/object	struct./phen. reading
form space	acc./erg./zero marker	imperf./additional marker
context space	prominence inf.	cue for struct./phen. reading

Step 2: Defining Prior Probabilities and Cost Function

	Case Game	Imperfective Game
source for prior $P(m\|c)$	corpus data	ad-hoc values
type of cost function	form-related	strategy-related
cost function factors in:	number of markers	number of forms used in strategy

Step 3: Strategy Space Reduction

	Case Game	Imperfective Game
speaker strategy reduction	$\sim$ 6 million $\rightarrow$ 10	16 $\rightarrow$ 4
hearer strategy reduction	$\sim$ 270 million $\rightarrow$ 4	16 $\rightarrow$ 3

Step 4: EU Table Computation

	Case Game	Imperfective Game
EU table (k = .1)	see Table 3 (left)	see Table 4 (left)
EU table (k = .45)	see Table 3 (right)	see Table 4 (right)

Figure 4: Schematic representation of the modeling process. Step 1: Define the relevant spaces of the grammatical domain. Bring to mind what is core information for the coding system under investigation to set up form and meaning space. Then think of particular domain(s) that provide contextual cues, such as prominence information, (cf. Case Game) or set up ad-hoc contexts (cf. Imperfective Game). Step 2: Define the relationship between context and meaning in form of a prior probability function, that might be determined by empirical data (Case Game) or as ad-hoc values (Imperfective Game). Then define a cost function that pays respect to the complexity of the grammar, which can be form-related (Case Game) or strategy-related (Imperfective Game). Step 3: Compute the number of speaker and hearer strategies and under certain conditions – such as combinatorical explosions (cf. Case Game) – reduce the space in reasonable ways. Step 4: Given the set of (reduced) strategies, compute the EU tables via speaker and hearer expected utility function EU_s and EU_h, respectively.

generalized to n-player situations (cf. Hofbauer & Sigmund 2003; van Veelen 2011). Furthermore, the evolutionary dynamics I will introduce are designed for *infinite* population scenarios with a *homogeneous* structure where every member interacts with every other member with the same frequency. This is of course an unrealistic assumption when it comes to human societies that are finite and interact in social network structures, but it simplifies the formal analysis immensely. Nonetheless, there exists plenty of literature that studies evolutionary dynamics in finite and *heterogeneous* populations, from classical game-theoretic scenarios (cf. Nowak & May 1992; Taylor et al. 2004; Lieberman et al. 2005) to signaling games (cf. Skyrms 2010; Huttegger & Zollman 2011; Mühlenbernd & Franke 2014; Mühlenbernd 2017) and more language-specific mechanisms of cultural evolution (cf. Baxter et al. 2006; Fagyal et al. 2010; Blythe 2012).

4.1 Tool 1: How to Compute Symmetric Games

Note that the EU tables of the Case Game and the Imperfective Game (Table 3 and 4) are non-symmetric: the row strategies differ from the column strategies, since the former are speaker strategies and the latter are hearer strategies. Such an *asymmetric game* is generally represented by a 2-population model in terms of EGT (one population represents speaker strategies, the other, hearer strategies). It is often useful to analyze *symmetric games* (as 1-population models). When we deduce symmetric games from asymmetric signaling games, we do not consider speaker strategies $s \in S$ and hearer strategies $h \in H$ as single options any more, but as strategy pairs $(s, h) \in S \times H$ instead. An entry of such a symmetric game table is given by the expected utility value $EU_p((s_i, h_i), (s_j, h_j))$, defined as how well a strategy pair (s_i, h_i) works with another strategy pair (s_j, h_j):

$$EU_p((s_i, h_i), (s_j, h_j))) = \frac{EU_s(s_i, h_j) + EU_h(s_j, h_i)}{2}$$

Note that for a given asymmetric game with dimension $n \times m$, the corresponding symmetric game has the dimension $(n \cdot m) \times (n \cdot m)$. For example, the EU table of the Case Game has dimension 10×4, and its symmetric pendant amounts to a 40×40 game table. Accordingly, the dimensions of the game table of the Imperfective Game changes from 4×3 to 12×12. To present an example, in her analysis Deo (2015) used a subgame[13] of the symmetric game table of the Imperfective Game by solely paying attention to those strategy pairs that constitute the dif-

[13] A subgame can be computed by selecting a subset of the original strategy set(s) and the respective utility values.

Table 5: Symmetric EU table of strategy pairs for the Imperfective Game (only row player's EU_p values) with $k = 0.2$, restricted to four strategy pairs. The bold number marks the only ESS of the game.

	(s_I, h_X)	(s_O, h_O)	(s_C, h_C)	(s_A, h_X)
(s_I, h_X)	0.9	0.9	0.7	0.9
(s_O, h_O)	0.8	0.85	0.65	0.6
(s_C, h_C)	0.6	0.65	**0.9**	0.6
(s_A, h_X)	0.9	0.7	0.7	0.9

$k = 0.2$

ferent stages of the progressive-imperfective grammaticalization path. The EU table of the subgame is given in Table 5. Note that, for a symmetric utility table, it is sufficient to depict solely the row player's utilities, since the column player's utilities are the same as those of the row player when mirrored at the northwest-to-southeast-diagonal.

In the next section I will use subgames of those symmetric game tables to better picture an important concept in EGT: the *replicator dynamics*.

4.2 Tool 2: The Replicator Dynamics

The replicator dynamics in its general specification is a dynamics that models replication in populations, one example being biological reproduction. It is defined for an infinite population, where its members are programmed for a certain strategy and interact under totally random pairings. The *fitness* of a strategy is defined by its accumulated utility value over the interactions, and the average number of a member's offspring is proportional to the fitness of her strategy. For the formal definition of the replicator dynamics, I will here restrict myself to symmetric games (see c.f. Hofbauer & Sigmund 1988: for asymmetric games). Beforehand I have to introduce some further notions.

A *population state* represents the proportions of the population's members using particular strategies. More precisely, let $x_i \in \mathbb{R}$ be the proportion of a population using strategy $g_i \in G$.[14] Now, a population state for n strategies can be presented as a vector $\mathbf{x} \in \mathbb{R}^n$, with $\forall x_i$ in $\mathbf{x}$: $0 \leq x_i \leq 1$, and $\sum_{i=1}^{n} x_i = 1$. Given a population state $\mathbf{x}$, the *fitness* f_i of strategy g_i is defined as $f_i(\mathbf{x}) = \sum_{j=1}^{n} x_j EU(x_i, x_j)$, whereby EU is the game's (expected) utility function. The fitness represents the

[14] I use here and any time afterwards the label g for a strategy in general (and G for the set of strategies, appropriately). Note that in the case of a grammar game, g can stand for a speaker strategy s, a hearer strategy h, or a pair of both, depending on the type of the game table.

average score of a strategy against all other strategies in the population with respect to population state $\mathbf{x}$. The *average fitness* ϕ of the whole population can now be defined as $\phi(\mathbf{x}) = \sum_{i=1}^{n} x_i f_i(\mathbf{x})$, which represents the average over all strategies' fitness values with respect to population state $\mathbf{x}$.

The replicator dynamics defines how these population states change over time: the proportion of the population playing a strategy g_i in the next generation depends on i) its proportion x_i of the current generation and ii) its success in the form of overall utility f_i in comparison to the population's average utility ϕ. By considering that time intervals between generations are arbitrarily small and that the population size goes towards infinity, the development of the relative frequency of the different strategies within the population converges towards a deterministic dynamics – the *replicator dynamics* (Taylor & Jonker 1978). The change of a strategy's proportion x_i over an arbitrarily small time interval t is defined by the following differential equation[15]:

$$\frac{dx_i}{dt} = x_i[f_i(\mathbf{x}) - \phi(\mathbf{x})]$$

Note that there are only two cases in which a strategy g_i does not change it's proportion x_i over time: i) the strategy's fitness is as good as the populations average: $f_i(\mathbf{x}) = \phi(\mathbf{x})$, or ii) the strategy is extinct: $x_i = 0$. If not extinct, a strategy proportion x_i increases if and only if its fitness is better than average: $f_i(\mathbf{x}) > \phi(\mathbf{x})$, and decreases if and only if its fitness is worse than average: $f_i(\mathbf{x}) < \phi(\mathbf{x})$.

As initially mentioned, the replicator dynamics was originally used to capture biological evolution. There are some later studies that reasonably apply the replicator dynamics in a cultural context (c.f. Björnstedt & Weibull 1996; Harms 2004). For example, Björnstedt & Weibull (1996) showed that the replicator dynamics describes a learning process governed by imitation. From this point of view, the replicator dynamics seems to be a good approximation for modeling processes of cultural evolution, such as language change. See for example Jäger (2007: pp. 92) for a more thorough discussion.

The replicator dynamics helps us to picture the evolutionary dynamics of a game, or, more precisely, the change in the proportions of strategies inside a population over time. For example, the evolutionary dynamics of a symmetric game with three strategies can be depicted through a so-called simplex. To present an example here, let's pay attention to a subgame of Deo's symmetric game Table 5, that contains solely the strategy pairs (s_I, h_X), (s_O, h_O), and (s_C, h_C) as given in Table 6. The temporal dynamics under replicator dynamics for this subgame is

[15] For the concrete derivation of the equation I recommend Jäger (2004), Section 2.2.

Table 6: EU table of strategy pairs for the Imperfective Game (subgame of Table 5). The bold numbers are the utility values of strategy pairs that form evolutionarily stable states for this subgame.

	(s_I, h_X)	(s_O, h_O)	(s_C, h_C)
(s_I, h_X)	**0.9**	0.9	0.7
(s_O, h_O)	0.8	0.85	0.65
(s_C, h_C)	0.6	0.65	**0.9**

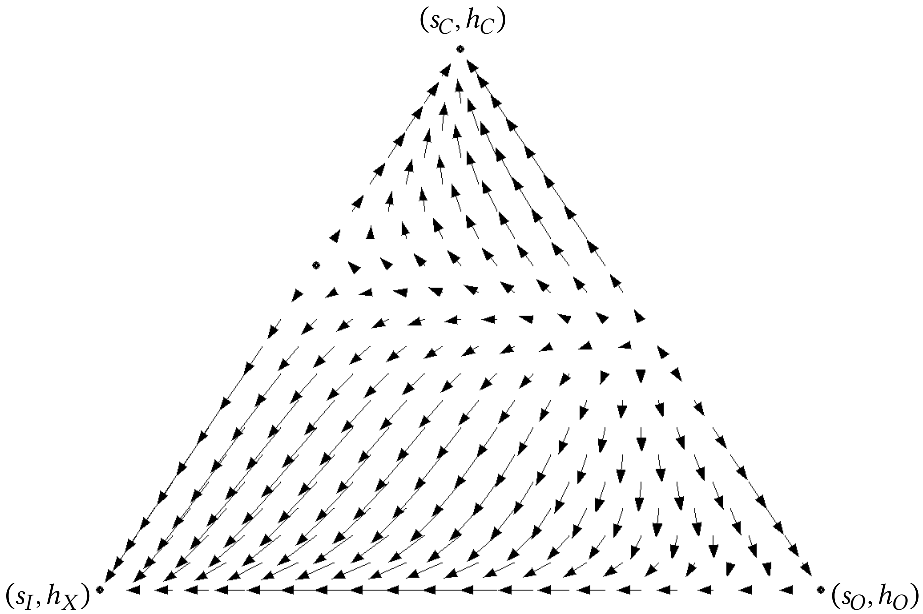

Figure 5: Temporal dynamics of the Imperfective Game as presented in Table 6 under replicator dynamics. While the categorical system (s_C, h_C) is an evolutionarily stable strategy and has an invasion barrier against any other strategy, the optional system (s_O, h_O) is not evolutionarily stable. It has an invasion barrier against the categorical system (s_C, h_C), but not against the single form system (s_I, h_X).

represented in Figure 5.[16] This simplex represents the vector field of population states, and the three corners are states where the whole population uses only one strategy (top: (s_C, h_C), bottom left: (s_I, h_X), bottom right: (s_O, h_O)). All other points of the vector field represent mixed population states. For example, the

[16]I recommend a number of tools for producing dynamic figures on a simplex for any symmetric 3×3 game, such as **egtplot** or **EvoDyn-3s** (see Table 7).

middle point of the simplex represents the state where each strategy's proportion is exactly $\frac{1}{3}$. The arrows in the simplex are sample gradients that represent the directions of change, whereby the length of an arrow shows the velocity of change. By following the arrows one can derive trajectories of change.

Note that the replicator dynamics does not allow for *unfaithful reproduction*: errors in horizontal (intra-generational) or vertical (cross-generational) transmission. On the other hand, unfaithful reproduction is an essential aspect in language change and evolution. When it comes to language use, it happens frequently that members of a language community create new linguistic variants that replace old ones, motivated by social as well as functional aspects (cf. Croft 2000). When it comes to language acquisition, children learn the language of their parents, and this learning is often subject to mistakes (cf. Nowak et al. 2001). I refer to Rosenbach (2008) for a more thorough discussion and a wide literature review about aspects of replication in language change.

In biological terms, types of unfaithful reproduction are subsumed under the notion of mutation. A generalization of the replicator dynamics that allows for mutation is e.g. given by the *replicator-mutator equation* (cf. Page & Nowak 2002). This equation is in many aspects more realistic when it comes to studying the evolution of grammar. I refer to Nowak et al. (2001) and Deo (2015) for the definition of the replicator-mutator dynamics and its application to language change. To describe it briefly, the replicator-mutator equation additionally contains a mutation matrix Q, whereby its entries Q_{ij} define the mutation probability from a strategy g_i to a strategy g_j. In other words, it describes particular biases for unfaithful reproduction.

4.3 Tool 3: Detecting Evolutionarily Stable Strategies

The central concept in EGT is the *evolutionarily stable strategy* (ESS) (c.f. Maynard Smith & Price 1973; Maynard Smith 1982). For a symmetric 2-player game with strategy set G and utility function $U : G^2 \to \mathbb{R}$, a strategy $g_i \in G$ is an *evolutionarily stable strategy*, if and only if the following two conditions hold:

1. $U(g_i, g_i) \geq U(g_j, g_i)$ for all $g_j \neq g_i$
2. if $U(g_i, g_i) = U(g_j, g_i)$ for some $g_j \neq g_i$, then $U(g_i, g_j) > U(g_j, g_j)$

Why should we be interested in evolutionarily stable strategies? As the name suggests, it is the stability aspect of an ESS: if a strategy g_i is evolutionarily stable, then a population that uses g_i is resistant against a small proportion of mutants that use any other strategy $g_j \neq g_i$. More concretely, if such mutants appear, and if their number is below a particular threshold, then the evolutionary selection mechanism will move the population back to a population state of solely g_i users. In other words, an ESS has an *invasion barrier* against mutants.

Let's take a closer look at the definition of an ESS to see how it works. The first condition can be divided into two possible cases: (A) $U(g_i, g_i) > U(g_j, g_i)$ or (B) $U(g_i, g_i) = U(g_j, g_i)$. In case (A) a strategy g_i is an ESS if it scores better against itself than any other strategy g_j scores against g_i. It is obvious that g_j cannot invade the population of g_i users under evolutionary dynamics such as replicator dynamics for the following reason: since the majority of the population uses g_i and g_j scores worse against this majority than g_i itself, g_j has a lower fitness than g_i and therefore will be replaced by g_i over time. In case (B) we have $U(g_i, g_i) = U(g_j, g_i)$ which brings us to the second condition of the definition. Note that since g_j scores as well against the g_i majority as g_i itself, both strategies can theoretically have the same fitness and coexist. But due to the second condition's requirement of $U(g_i, g_j) > U(g_j, g_j)$, g_i scores better against g_j mutants and therefore will have a higher fitness and replace them over time.

Even without understanding the definition of evolutionary stability in all its details and consequences, it is still important to understand the properties of an ESS, most importantly its invasion barrier. Furthermore, it is quite straightforward to detect ESSs from a utility table. Here we can differentiate between symmetric and asymmetric utility tables. For symmetric tables we have to check for each entry of the main diagonal (from north-west to south-east) if it is the maximum in its column or not. If it is not a maximum at all, then it is not an ESS (example: strategy pair (s_O, h_O) of Table 5). If it is a unique maximum, it is then an ESS (example: strategy pair (s_C, h_C) of Table 5). If it is a maximum but not a unique one, then it is only ESS if the other strategies that score maximally in the same column have a lower utility value against themselves (example: strategy pairs (s_I, h_X) and (s_A, h_X) of Table 5 are both non-unique maxima in their columns, but neither are ESSs, since none of them has a fitness advantage over the other). For asymmetric tables we have to check every entry (not only the main diagonal), and only if an entry is the unique maximum in its row and column, then it is an ESS (example: strategy pairs (s_8, h_2) and (s_6, h_3) of Table 3 (right)).

Due to its property of having an invasion barrier, it is also possible to detect an ESS from a temporal dynamics representation. For example, let's take a look at the game's trajectories over the population states depicted in Figure 5. The top point of the simplex represents the population state where the whole population uses strategy pair (s_C, h_C). Note that any small mutation would lead the population state a little bit below the top point. And from any of these points below, the evolutionary trajectory shifts the population back to the top point. In other words, (s_C, h_C) has an invasion barrier against any other strategy pair, it is an ESS. The same holds for the most bottom left point of the simplex, thus also (s_I, h_X) has an invasion barrier against any other strategy pair since it is an ESS. On the other hand, (s_O, h_O) is not an ESS: a population that solely uses strategy pair (s_O, h_O) (the most bottom-right point of the simplex) does not have an invasion barrier against (s_I, h_X), since for any minute mutation to the left the evolutionary trajectory drives the population away from (s_O, h_O).

A very important refinement of an ESS is the *stochastically stable strategy* (cf. Young 1998). The idea is as follows: let's assume that we have an evolutionary dynamics that is non-deterministic due to *noisy mutation*: the mutation rate changes randomly. If we wait long enough, every ESS will finally be invaded by mutants, no matter how high the invasion barrier is. Thus, for all ESSs $g_i, g_j \in G$, there is a non-zero probability p_{ij} that the system switches from g_i to g_j, as well as a non-zero probability p_{ji} for the reverse switch. For two ESSs g_i, g_j, if $p_{ji} > p_{ij}$, then g_i is the only stochastically stable strategy and it follows that the system is expected to stay longer in state g_i than in state g_j.

Let's make this clear by taking a look again at the Imperfective subgame in Table 6. Here we have two ESS, but only one of them is stochastically stable. In a simulation test with the replicator dynamics and noisy mutation (maximal noise: 0.2) over 20 million simulation steps, it turned out that the population spent 93.9% of the time in state (s_I, h_X). This is a clear indicator for the fact that only (s_I, h_X) is stochastically stable, not (s_C, h_C). Another indicator for (s_I, h_X) being the only stochastically stable strategy can be found in Figure 5, where (s_I, h_X) has a larger basin of attraction/mutation barrier, although this is not per se a sufficient criterion for a strategy being stochastically stable.

4.4 How to Apply EGT Tools

How can we concretely apply the EGT tools once we have managed to deduce an EU Table as the last step of the tutorial in Section 3 (cf. Figure 4, step 4)? First of all, it is quite straightforward to detect ESS, as delineated in detail in Section 4.3. Note that for all EU tables of this article, the ESSs are highlighted with bold font (Tables 3, 4, 5, and 6). In the case of multiple ESSs in one game, we might be interested in the stochastically stable strategies. Note that this is not that easy to detect. As already mentioned, we can conduct simulation experiments that help to detect stochastically stable strategies, and, while there are analytically ways to detect them, the mathematics behind it is quite sophisticated (see e.g. Jäger

Table 7: Different tools that help to compute and/or visualize evolutionary aspects of game tables, given as programs to embed into the NetLogo framework (http://netlogoweb.org), or as packages for diverse programming languages. Respective links in Table 8.

Name	lang./frame	tools	game types
ABED-1pop	NetLogo	history plot	symmetric, n×n
ABED-2pop	NetLogo	history plot	asymmetric, n×n
egtplot	python	simplex plot	symmetric, 3×3
EvoDyn-3s	Mathematica	simplex plot	symmetric, 3×3
EvolutionaryGames	R	RD, ESS, ...	symmetric, 2×2-4×4

Table 8: The links for the tools of Table 7.

Name	link
ABED-1pop	https://luis-r-izquierdo.github.io/abed-1pop
ABED-2pop	https://luis-r-izquierdo.github.io/abed-2pop
egtplot	https://github.com/mirzaevinom/egtplot
EvoDyn-3s	https://github.com/luis-r-izquierdo/EvoDyn-3s
EvolutionaryGames	cran.rstudio.com/web/packages/EvolutionaryGames

(2007), p. 99).

Secondly, we would like to visualize the evolutionary dynamics: the trajectories among population states. Here we need at least some basic knowledge in programming to use a number of different packages that help to produce e.g. simplex representations, such as given in Figure 5. Without a claim for completeness, I recommend a number of different tools as given in Table 7 with the corresponding links in Table 8.

Finally, I would like to give a short report of how EGT tools were applied in Jäger (2007) and Deo (2015), and what the basic results were. Jäger tested the asymmetric Case Game for the parameter k ranging from 0 to 1. He found that there are only four stochastically stable strategies: DSOM (strategy pair (s_5, h_2)) for low k-values, DSM (strategy pair (s_7, h_2)) and DOM (strategy pair (s_8, h_2)) for middle k-values, and no case marking (strategy pair (s_{10}, h_2)) for high k-values. Furthermore, the evolutionary stability of DSM and DOM did depend – next to k – on a second parameter p that defines the split point on the prominence scale. All in all, his study showed that the stochastically stable strategies in his model analysis represent exactly those case grammars that are predominantly found in languages of the world (see Jäger (2007), Section 2, for a more thorough discussion).

Deo (2015) tested the behavior of the symmetric Imperfective Game (parameter $k = .01$) under evolutionary dynamics. She applied the replicator-mutator equation, where the central element is the mutation matrix Q, which is set with regard to the acquisition properties of language learners due to linguistic considerations (see Deo (2015), pp. 38-44 for more details). Her result showed that the progressive cycle – starting from stage ZP using solely form f_i (strategy pair (s_I, h_X)) over stage EP (strategy pair (s_O, h_O)) over stage CP (strategy pair (s_C, h_C)), and finally ending in stage ZP that uses solely the form f_a (strategy pair (s_A, h_X)) – can be reconstructed, whereby the strategy pairs of both intermediate stages never totally invade the population (see Deo (2015), Figure 4).

5 EGT and Language Change For The Worse

Language change for the worse with respect to a particular grammatical subsystem of a language can be defined as a process in which a grammar g_1 changes to another grammar g_2, whereby g_1 is better than g_2. As already addressed in Section 1, to make a claim about such a process, it is necessary to have a measure that allows us to make a quantitative comparison of different grammars; and as I pointed out in the last sections, such a measure can be defined with respect to very general usage-based principles: speaker economy and hearer economy.

When we model a grammatical system in a way that is presented in Sections 3 – via a signaling game – then a grammar g is i) defined as a speaker/hearer strategy pair $g = (s, h)$, and ii) quantified via the utility functions $EU_s(s, h)$ and $EU_h(s, h)$, as well. Utilities are defined with respect to the principles mentioned: i) speaker economy (minimize costs), realized by adding a cost value $(k \cdot \mathcal{K})$ to the definition of speaker utility, and ii) hearer economy (maximize clarity), realized by the $\delta_{c,m}$-function as part of both speaker and hearer utility.

Now, when we want to compare two grammars with respect to speaker and hearer economy, we can straightforwardly say: a grammar g_1 is better than a grammarg_2, if g_1 is at least as good as g_2 with respect to one economy, and better with respect to the other. Formally, when we define $SE(g) = -k \cdot \mathcal{K}$ as a value for the speaker economy of grammar g, and $HE(g) = \delta_{c,m}(g)$ as a value for the hearer economy of grammar g, then grammar g_1 is better than grammar g_2, if at least one of the following two conditions hold:

1. $SE(g_1) \geq SE(g_2)$ and $HE(g_1) > HE(g_2)$
2. $SE(g_1) > SE(g_2)$ and $HE(g_1) \geq HE(g_2)$.

Let's give an example for two such grammars with regard to Jäger's Case Game. Take for example the speaker strategy $s_2 : \forall c \in C : (c, m_{AO}) \rightarrow f_{az}$: always *a*-mark the object. And then take the hypothetical strategy $s' : \forall c \in C : (c, m_{AO}) \rightarrow f_{ae}$: always *e*-mark the subject and *a*-mark the object. Both strategies are equally good with respect to hearer economy, since they both enable always successful communication, thus $\forall h \in H : HE((s_2, h)) = HE((s', h))$. But s_2 uses less case markings than s', and thus is better with respect to speaker economy: $\forall h \in H : SE((s_2, h)) > SE((s', h))$. Therefore, one can say that (s_2, h) is a better grammar than (s', h) with respect to SE/HE. Note that case grammars such as (s', h) indeed do not exist, whereas (s_2, h) grammars represent full accusative systems and can infrequently be found in the languages of the world.

But how can we treat cases for which none of the two conditions is fulfilled, when e.g. g_1 is better than g_2 with respect to SE, but g_2 is better than g_1 with respect to HE? An obvious idea would be to compare the sum of the utility values of these two grammars: Therefore, a grammar g_1 is better than a grammar g_2, if $EU_s(g_1) + EU_h(g_1) > EU_s(g_2) + EU_h(g_2)$. But note that with this definition we are dependent on the factor k that regulates the relative weight between speaker and hearer economy in EU_s. To make this point clear, let's have another look at the Case Game. Take for example the strategy pair (s_5, h_2) (a DSOM grammar/split ergative) and the strategy pair (s_8, h_2) (a DOM grammar). The former is better in terms of HE, since it guarantees more frequent communicative success, whereas the latter is better in terms of SE, since it uses less case marking. And as can be observed from Table 3, for $k = 0.1$ the strategy pair (s_5, h_2) has a higher utility value than (s_8, h_2): $0.97 > 0.94$. For $k = 0.45$ it is exactly the other way around: $0.863 < 0.867$. Which grammar is better cannot be ultimately decided, as this depends on additional factors, which are subsumed by parameter k in our model. Also, the fact that both case systems are very frequent in the languages of the world weakens the presumption that one of those grammars might have an inherent advantage over the other.

From an evolutionary point of view, a measure for a grammar being better or worse is given by its *fitness*: its potential to reproduce. Note that according to many evolutionary dynamics, such as the replicator dynamics, the fitness f_i of a grammar g_i is not a value uniquely attributed to it, but is highly dependent on the population state $\mathbf{x}$. In other words, fitness itself depends not only on inherent properties of a grammar, but also on its environment of competing grammars. This can lead to the following situation. Let's assume we have a population state $\mathbf{x}$ with two grammars: g_1 with fitness $f_1(\mathbf{x})$, and g_2 with fitness $f_2(\mathbf{x})$, whereby $f_1(\mathbf{x}) > f_2(\mathbf{x})$. Let's furthermore assume that g_1 spreads over time and drives the competing grammar g_2 to extinction. Furthermore, the fitness of g_1 changes finally to $f_1(\mathbf{x}')$, whereby $f_1(\mathbf{x}') < f_1(\mathbf{x})$. Now we can argue that the population-wide grammar changed for the better, since the one with a higher fitness replaced the one with a lower fitness. But we can also argue that the grammar g_1 changed for the worse, since its fitness value decreased over time.

Probably a more promising concept for quantifying a grammar is its evolutionary stability. A grammar that forms an ESS is assumed to be better than one that does not. But how do we quantify multiple ESSs as part of the same fitness landscape? Take for example Table 3 (right) of the Case Game. While strategy pair (s_8, h_2) (DOM grammar) is both an ESS and the global optimum of the fitness landscape, strategy pair (s_6, h_3) (inverse DSM grammar) is an ESS, but only a local optimum. To find the strategy that is better in terms of stability, we can use a refinement of an ESS: the stochastically stable strategy. In the example given only (s_8, h_2) is stochastically stable and is found much more frequently in the languages of the world than its counterpart (s_6, h_3).

Let's agree on the idea that we quantify different grammars in terms of evolutionary stability. Admittedly, we know that evolutionary dynamics, such as the replicator dynamics, do not guarantee processes of change that end up in the global optimum. But they generally never enable a language to change for the worse. By neglecting mutation, each step in time leads to an increase in the strategy with the higher fitness, and the trajectories lead generally from a less to more stable state. Let's take a look at the Imperfective Game, for instance. As can be observed from Tables 4 and 5, the system (s_I, h_X) is better than (s_O, h_O) in terms of utility and fitness. Furthermore, the former is an ESS of Table 6, while the latter is not. As can be seen in Figure 5, (s_O, h_O) is attracted by (s_I, h_X) through the replicator dynamics. In other words, there is a strong evolutionary drive to change from non-ESS (s_O, h_O) to ESS (s_I, h_X).

But note: this result is contrary to empirical observations. The progressive-imperfective grammaticalization path, as discussed in Section 2.2, predicts a change exactly the other way around, namely from (s_I, h_X) (zero-progressive) to (s_O, h_O) (emergent-progressive). How can we explain this discrepancy between empirical data and the predictions of the evolutionary model?[17] One explanation might be: there are further factors that are not necessarily in line with SE/HE, so that such evolutionarily unexpected transitions are possible. For example, Mühlen-

[17] In her model analysis, Deo (2015) enables this transition via mutation. But Yanovich (2017) showed that it relies on very particular mutation values and cannot be obtained for a large range of value combinations. In other words, with the model given, the transition from (s_I, h_X) to (s_O, h_O) is indeed an event very unlikely to happen under evolutionary dynamics.

bernd & Enke (2017), by using Deo's model in an agent-based setup, were able to show that the progressive cycle can be reconstructed if we take additional often phenomenon-specific conjectures into consideration, such as i) the partial absence of contextual cues, or ii) an input asymmetry in first language acquisition.[18] The second factor in particular points to another important principle for the fitness of a grammar: learnability in language acquisition (cf. Niyogi & Berwick 1997; Yang 2002). I believe that the search for such forces/factors is an important task to better understand the nature of grammatical change and that game-theoretic and computational approaches are valuable tools to test their effects.

Now let's assume that we know all the relevant factors that drive the change of a particular grammatical system, and that we want to quantify the grammar in terms of those factors. I believe that even then we cannot exclude the fact that the grammar might change for the worse. And this is for the following reason: change for the worse in one subsystem can emerge as a side-effect of change for the better in another subsystem of the same language. To give an example, the processes of sound simplification can make the phonological system of a language more economic and more learnable while still maintaining the same amount of expressivity. In other words, the phonological subsystem is getting better (in terms of SE/HE). But such a change might for example produce syncretisms in the case system, which would increase the ambiguity of the grammar – thus decreasing HE – while keeping SE constant. Here the morphological/syntactical system is getting worse (in terms of SE/HE). Ergo, one change for the better involves at the same time another change for the worse. Admittedly, such effects are hard to test with the modeling techniques I presented here, since defining a grammar game that operates on different subsystems of a language would probably become extremely complex and therefore hard to deal with (cf. Section 3.3: combinatorial explosion).

To conclude, I assume that a very important factor in language change is a dyad of two usage-based principles: speaker economy and hearer economy. Therefore, it should be possible to apply the tools and concepts introduced herein for reconstructing further phenomena of grammatical change. But the expectation to explain all grammatical change with these principles should be taken with a grain of salt. Many other factors can also play an important role. First of all, there might be very phenomenon-specific usage-based factors that must be taken into consideration to get a more complete picture. Secondly, the factor of learnabil-

[18] Input asymmetry of progressive vs. non-progressive forms during childhood is supported by empirical data from corpora of parental speech (cf. Li et al. 2001).

ity can play a very important role for the shape of a grammar, as e.g. illustrated through the bottleneck phenomenon (cf. Kirby 2002). As already mentioned, first language acquisition can have an essential impact on the change of grammatical systems. Thirdly, many extra-linguistic – especially social – factors are known to be driving factors in language change (cf. Croft 2000; Labov 2001). Last but not least, a number of studies argue that many aspects of language change might be neutral and do not require any intrinsic driving force (cf. Blythe 2012; Stadler et al. 2016; Newberry et al. 2017; Kauhanen 2017). But note: given all these different possible factors, if we are still able to reconstruct phenomena in language variation and change using the models and tools that were introduced here, we show that SE and HE can be assumed to play a pivotal role for its existence. And on top of that, it gives us an instrument for evaluating changes from one grammatical system to the other to be indeed for the better or for the worse.

Abbreviations

SE: Speaker Economy; **HE**: Hearer Economy; **DOM**: Differential Object Marking; **DSM**: Differential Subject Marking; **DSOM**: Differential Subject/Object Marking; **ZP**: Zero Progressive; **EP**: Emergent Progressive; **CP**: Categorical Progressive; **EU**: Expected Utility; **EGT**: Evolutionary Game Theory; **ESS**: Evolutionarily Stable Strategy;

Acknowledgements

The author has received funding from the European Union's Horizon 2020 research and innovation 604 programme under grant agreement no. 732942, as well as from the Polish National Agency for Academic Exchange (NAWA) under grant agreement PPN/ULM/2019/1/00222.

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Chapter 12

Languages as public goods and language change as a tragedy of the commons

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This paper makes three claims: first, that constructions in languages can be largely analyzed as public goods; second, that in cases where this is not true, they are Common Pool Resources; and third, that in communication, there are systematic and intrinsic conflicts between speaker and hearer, such that in some cases, those conflicts will lead to a tragedy of the commons.

It will be argued that at least some instances of language change can be seen as cases where short-term speaker interests impose costs on short-term hearer interests, and that in the long run, they also go against the best interests of speakers.

1 Introduction: Public vs private goods

Samuelson (1954) introduced an important conceptual distinction by separating two types of goods: private goods vs public goods. Public goods have two essential properties distinguishing them from private goods: if one person uses or consumes a public good, this does not diminish the possibility of consumption by other people (which is called the property of "nonrivalness of consumption", or "subtractability"); the second property is that it is either difficult, prohibitively costly, or outright impossible to exclude other people from using them (which is called "exclusion"). This has lead economists to further refine this distinction into the four-way classification of goods as illustrated in table 1,[1] where we will focalize for the moment on the opposition between public and private goods.

[1] A brief note to table 1: In the age of high-speed internet, (permanently networked) personal computers are probably not as excludable as they used to be, or as we would like them to be…

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Gerhard Schaden. 2020. Languages as public goods and language change as a tragedy of the commons. In Dankmar Enke, Larry Hyman, Johanna Nichols, Guido Seiler & Thilo Weber (eds.), *Language Change for the Worse*, 323–348. Berlin: Language Science Press. DOI: ??

Table 1: 4 types of goods, following Hess & Ostrom (2007:9)

		SUBTRACTABILITY	
		Low	High
EXCLUSION	Difficult	**Public Goods** Useful knowledge Sunsets	**Common-Pool Resources** Libraries Irrigation Systems
	Easy	**Toll or Club Goods** Journal subscriptions Day-care centers	**Private Goods** Personal computers Doughnuts

A prototypical private good –like a popsicle –is subtractable and excludable. If I eat the popsicle, this prevents anybody else from eating it. And in most circumstances, it is not prohibitively costly to exclude other people from eating it (either because I eat it, or because I store it in an inaccessible place).

1.1 Languages as (collections of) public goods

It appears at first sight that all ingredients of natural languages are public goods.[2] Clearly, if I use a phoneme (like /s/), this does not prevent other language users from producing it as well. And there is no way for me to monopolize the use of a phoneme. The same thing is true for other linguistic expressions: words, morphemes, constituents, propositions. Languages are basically huge collections of public goods, and their usefulness derives from the fact that they are public goods. Language, as a conventional signaling system, has by definition no place for completely private signs or phonemes.

(Units of) Languages are not the only public goods. Similar cases include software, audio- and video-files etc. If I use some program or file, it can be copied without problem, and given to other people, without diminishing in any way my personal use. This fact has given rise to all kinds of copy-left licenses. However, it is also a source of problems: given the costs of producing software, music or films, and the ease with which their use can be transferred without diminishing the use of the transferrer, there is no reason why a selfish agent would pay for it. But if nobody pays for such content anymore, this creates a problem for the creators of such content, who cannot afford to create new content anymore.

[2] As we will see below in section 1.2, certain linguistic expressions do seem to be common pool resources rather than public goods. I will come back to the issue of subtractability in 1.3 below.

Therefore, given rational agents, the content is predicted to disappear in the long run. This problem is known as the "tragedy of the commons" (see Hardin 1968). What I will try to show in this paper is that –given that units of languages are public goods –they are probably not immune to such tragedies, and that at least some instances of language change can be classified in this way.

As far as I am aware, there has not been much investigation into the idea that change within one language change might be an instance of a tragedy of the commons,[3] although there is literature in language preservation, dealing with the transition of a community from one language to another.[4] So, the question is: would we expect something like this to happen in language? And whatever the answer may be to this question, why? As far as I can see, the field of linguistics is stacked against such a position, because it seems to suggest that somehow, a language would have decayed from an anterior, better state. Furthermore, it seems to contradict the idea that all languages can satisfy the same expressive needs. Finally, mainstream pragmatic theories (witness, e.g. Clark 1996) stress collaboration following an interpretation of Grice (1975), which is antithetical to the idea of change as deterioration driven by short-term, selfish instincts.

And there are also important empirical reasons that one adduce: as far as I am aware, there has been no catastrophic breakdown of a signaling system – contrary to attested breakdowns of physical resources –, and I certainly would not expect that speakers discard a language for having become too unwieldly to be spoken, and adopt another one. Finally, languages (like other memeplexes, see Blackmore (1999)) seem to lack the crucial property of subtractability that physical resources have: it cannot be exhausted, and contrary to other cultural resources, there is no special creativity involved in creating utterances.[5] Thus, there are good reasons to doubt that a tragedy of the commons could be an issue for a linguistic resource.

In the remainder of this introduction, I will show highlight why the tragedy of the commons is of importance to linguistics. I will start by considering what kind of conditions stabilize systems against tragedies of the commons. Then, I will

[3] But see Nikitina (2018), although the tragedy of the commons is treated from a very different perspective.

[4] This has been pointed out to me by one of the anonymous reviewers; see, e.g., Beckerman & Valentine (1996); Eggington (2010).

[5] I am speaking here of the kind of creativity that one might be willing to reward with a protection by copyright, like our societies have decided to do for patents, works of art, or software. I assume that even in our age of patent- and copyright-trolls, nobody would seriously consider a protection for a specific grammatical construction, such that McDonald's would obtain a copyright on the progressive, or Nike on *do*-support in English.

show that at least some linguistic expressions are indeed subtractable. Finally, I will go on to show how even linguistic entities that are not subtractable may still be susceptible to selfish exploitation by speakers.

1.2 Governing the linguistic commons

The tragedy of the commons is notable for the fact that rational behavior (as defined in the usual, game-theoretic way) leads to bad outcomes for all. In many instances, indeed, such bad outcomes have come to pass (e.g., global warming, pollution, deforestation, or the collapse of fisheries). However, there all also many instances of commons that have been managed in a sustainable way, and therefore, avoided to turn into tragedies. Ostrom (1990) has studied cases of successful vs unsuccessful cases of making Common Pool Resources use sustainable. Ostrom (1990: 90–102) identified the following "design principles" for long-enduring institutions able to successfully govern common pool resources (for material goods):[6]

- Clearly defined boundaries should be in place;
- Rules in use are well matched to local needs and conditions;
- Individuals affected by these rules can usually participate in modifying the rules;
- The right of community members to devise their own rules is respected by external authorities;
- A system for self-monitoring members' behavior has been established;
- A graduated system of sanctions is available;
- Community members have access to low-cost conflict-resolution mechanisms;
- Nested enterprises –that is, appropriation, provision, monitoring and sanctioning, conflict resolution, and other governance activities –are organized in a nested structure with multiple layers of activities

The question is whether these principles do apply at all to language (or linguistic constructions). At first sight, the answer seems to be negative. First of all, monitoring language is not that easy, since many people seem hardly to be aware of a large part of their linguistic production. There is also no low-cost conflict-resolution mechanism in place for the "correct" use of a linguistic resource –and probably, there is no way of deciding on the "correct" way of use of a linguistic

[6] The shortened formulation of these design principles is taken from Hess & Ostrom (2007a: 7).

resource (or more generally, a resource based on convention) at all. In any case, language academies (where they do exist) do not seem to be able to fulfill such a role. Furthermore, it is not that clear in all instances (even for trained linguists) where the exact boundary of a linguistic construction should be drawn. Finally, and most importantly, these design principles have been observed for Common Pool Resources, and not public goods. As discussed above, the difference of these two kind of resources is subtractability: a public good is not subtractable (and the use of one person does not impede other persons from using them). However, the fact that something is non subtractable does not guarantee immunity against Tragedies of the commons, as was illustrated by (media or software) piracy. I will come back to this issue in section 1.4. However, as will be seen in section 1.3, at least some linguistic items are subtractable.

If we ignore for a moment the narrower issue of linguistic expressions as public goods vs common pool resources, Ostrom's criteria also give us an idea in which cases linguistic commons cannot be enforced (or only with much difficulty). First, the observance of some convention can only be enforced if its non-observance can easily be detected. Second, if there are no sanctions, or if access to sanctions is prohibitively costly, even detection will be of no use. Third, if encroachment or appropriation of the commons is not resisted by outsiders of the group defending some particular use, there also will be little chance of resisting a use. In the case studies presented in section 3, difficulty of detection will be the most salient point. However, the difficulty of section or resistance towards outsiders will be of importance what follows in section 1.3.

1.3 Subtractable linguistic entities

The use of commons does not happen in a void; in our intensely social species, it always happens within social groups. Therefore, it is worth stressing that the use of commons is always defined by Ostrom (1990) as the use of some resource *by some community* –and this social aspect may introduce subtractability.

A linguistic resource (like a word) may be used by other speech communities (i.e., speakers of other languages), but at first sight, this does not seem to be problematic: because of the absence of subtractability, loans need not have any impact on the source language. For instance, it is a source of amusement to French native speakers that in German, hairdressers are called "*Frisör*" (which is a loan from French, and means literally 'one who makes locks'), but this does not subtract anything from the possibility of using *friseur* or *coiffeur* (which is the normal French correspondent of hairdresser) in French. Generally, the fact that speakers of some language *A* take some lexical element from some language *B* does not seem to interfere with usage in language *B*. Speakers of different languages do not interact frequently enough (in the general case, and in their respective mother tongues) for such a loan to have any perceivable effect on the source language. In order to see cases where a linguistic commons is defended as the exclusive property of one community (and sensibly so), we probably need to look at linguistic resources specific (or defended as being specific) to socio-linguistic communities within a larger language community.

The basic issue is that, while it is most often true that the use of a linguistic expression by some person cannot prevent its use by some other person, the use of a linguistic expression by some persons in *some specific sense* can nevertheless impact its use *in some (possibly different) sense* by other persons, and may influence that usage to a degree that speakers of one group no longer see it fit to serve its purpose. Let us take a (fictive) example to illustrate this behavior: assume that linguists somehow come to acquire a word for everything that is linguistically cool, namely "ʃwɛt", and that this word is commonly used in English conversation among linguists, and also, in online discussion, for instance on LanguageLog. Things that are ʃwɛt are ergative languages, Burushaski, retroflex consonants, quirky voice, etc. Now assume that Justin Bieber, a regular reader of LanguageLog, starts to use ʃwɛt in his tweets, and that his fan-base starts using this expression to qualify things that appear cool to them (certainly Justin Bieber himself, but also the lyrics of Justin Bieber songs, Justin Bieber posters, etc.). Since there are more Justin Bieber fans than linguists, there would be no way that ʃwɛt could retain its association with linguistics[7] in the larger population, and the use of ʃwɛt would mark its utterer as a fan of Justin Bieber –with all its associations. Most likely, linguists would end up abandoning its use. In this context, ʃwɛt could function as a badge for membership in a small community as long as its use was –in the mind of the members of that community –strongly associated with group membership. So, especially if an expression is used to encode group membership or social distinction or differentiation, one of its main appeals may be the fact that it is not used by salient out-group members.[8]

Now, are there any cases of the successful defense of a positively connoted meaning of a word by some group in the face of out-group adversity? One possible case comes from the N-word. As cursory listening to Afro-American rap artists will show, it is highly frequent in some socio-linguistic communities of

[7] And also, its association in linguists' minds with more futile concepts like cultural sophistication, excellent taste, …

[8] This is not specific to linguistic expressions; the same is true for other cultural artifacts, as can often be seen in the commercialization of (formerly "underground") sub-cultures.

Afro-Americans in the United States, and does not have any derogatory meaning attached *in that specific context*. At the same time, it is also used by white supremacists, in which case it has a strongly derogatory meaning, and is also historically tainted by its use by slave-owners. As of the writing of this paper, the use of the N-word by others than African-Americans is completely beyond the pale in polite company, and even its mention (in citations, with scare-quotes) is at least frowned upon.

To what extent can this be seen as a successful defense of a commons? It concerns the use of a linguistic resource (a word), whose use is polluted by at least a part of the out-group (i.e., white supremacists). Nowadays, the wish of the Afro-American community not to be addressed at or referred to in this demeaning way is respected by external authorities (not all, but the taboo on the N-word has a wide political, social and media backing). There is a graduated system of sanctions, reaching from a slap on the wrist on social media or booing in a concert for Caucasian students singing rap songs containing the N-word, to the temporary or permanent loss of political functions or jobs.[9] Social media provide for a low-cost means of gaining redress; social shunning or exclusion can work on multiple levels (family and friends, work, etc.), and the use of a word is something that can be easily monitored and documented.

What I take these examples to show is that the use of a linguistic form with some meaning by one group can have an impact on the use of that same linguistic form (but with a possibly different meaning) by some other group. Therefore, at least some linguistic expressions are subtractable, and thus, common pool resources rather than public goods. And while the linguistic commons can sometimes be successfully defended, there are also cases where the association with an unsavory group leads to an abandonment of the resource.

1.4 Tragedies of the commons with non-subtractable public goods

The main point I will defend in the remainder of the article is that some instances of grammatical change can be seen as tragedies of the commons. This does not seem obvious at first, because grammatical items (like articles, tense morphemes, etc.) do not seem to be subtractable. However, as already explained in section 1.1

[9]For the smaller sanctions, see http://theconversation.com/white-people-should-never-rap-the-n-word-a-linguist-breaks-it-down-84673, retrieved on 26/05/2018; for an instance of the latter, see, e.g., https://en.wikipedia.org/wiki/Anne_Marie_Morris, retrieved on 25/05/2018, or https://www.theroot.com/new-york-times-hires-fires-reporter-for-using-the-n-wo-1822995189, retrieved on 6/6/2018. What is interesting about these cases is that it is not that clear that overt racism was the driving force behind the utterance of the N-word.

above, tragedies of the commons are not necessarily limited to common pool resources, and can also concern public goods, like (records of) music, or (electronic) texts, or useful knowledge more in general.

The argument in cases of knowledge commons generally concerns the production aspect. Writing a novel takes a lot of time and effort, and an author (or musician) should ideally earn some money with it. If there is no reward for the effort (because sales are preempted by massive free online copying), a rational agent should not engage in the creation of novels (or music). Therefore, we would end up with no new art. Similarly, if anybody could freely sell any new medical molecule or processor design, rational corporations would stop doing research and development, and we would end up without new drugs and faster computers. The net effect would be the end of innovation, and therefore, stagnating culture.

The question is whether this could concern linguistic entities. At first sight, the obvious answer seems to be negative. As far as I know, nobody is doing research on the structures of English, with the aim that speakers of that language could tell their husband or spouse in 40% less time what they have been doing during the day, in order to free them for more productive tasks. So, in that sense, there is no innovation that could be stifled. However, I will argue in section 2 that tragedies of the commons in linguistics are linked to production, although in a slightly different way.

The remainder of this paper is structured as follows: in section 2, I will lay out the basic hypothesis, namely that speakers and hearers have opposing preferences in communication, and that these may be the origin of a tragedy of the commons. In section 3, I will look at two different diachronic changes that illustrate these opposing preferences in action, and how in the long run, these lead to less favorable outcomes for everybody. Section 4 concludes the paper.

2 The conflicting interests of speakers and hearers in communication

The two main points the remainder of this paper will try to make are the following: first, there are factors where selfish instincts of the speaker will lead to a situation that is worse for the hearer, and that, as a consequence, this can lead in the long run to a situation that is worse for the speaker, as well; and second, that a rational speaker has an incentive to transfer communication costs toward the hearer.

2.1 Motivating the idea

The idea of an intrinsic conflict between speaker and hearer in communication may be highly counterintuitive. An objection can be stated as follows: Aren't we all speakers and hearers all the time? Why should we do as speakers something that would hurt us as hearers? This would obviously be stupid, so why would anybody do this? If this argument looks convincing to you, consider the following, which has *exactly* the same structure. Aren't we all tax payers and do we not all receive the benefits of our taxes (infrastructure, etc.)? Why would we do anything as tax payers that would hurt us as the receivers of benefits? Clearly, evading taxes would be extremely stupid, and we should not expect anybody to engage in such an obviously hare-brained endeavor.

Now, we know that some people do engage in evading taxes, and tax fraud is a problem in many, if not all, countries. The point to be made here is not only that incentives may vary (some people receive vastly more money than they pay, and vice-versa); even if someone pays very little, and receives huge amounts, there would still be an incentive not to pay taxes at all. So, individually, evading taxes does make sense –and if only one person does it, the consequences on a country's budget will be so small as to be negligible. The problem, of course, is that everybody has an incentive to evade taxes, and if nobody pays taxes anymore, there will be no benefits to be distributed. In what follows, I will argue that exactly the same pattern as in tax fraud –an incentive for an individual, which is detrimental for the collective, and in the end, also the individual –also holds in linguistic communication. The literature on evolutionary biology assumes that biological organisms are designed by evolution to be utility-maximizers –an assumption even shared by authors working explicitly on the evolution of altruism (see, e.g., Bourke 2011) –, and I will assume that this behavior is too deeply engrained not to be operative in language use.

So, what are the conflicting interests of a speaker and a hearer? Communication involves a hearer figuring out what a speaker had in mind by sending a given message, and it is a process which involves costs for both speaker and hearer. Let us spell this out in a preliminary fashion in (1). The information transmitted by a speech act can be taken to the explicitly coded meaning, plus any additional elements inferred by a hearer. In any case, a speaker can assume –and will depend on the fact –that the hearer will infer at least some additional content. Explicit coding is associated with costs for the speaker, whereas inference is associated with costs for the hearer. All things being equal, a rational speaker should therefore prefer inference to coding, whereas a rational hearer should prefer coding to inference.

(1) *cost of communication = cost of coding + cost of inference*[10]

In extreme cases –and everything else being equal –the speaker would prefer not to have to speak at all, whereas the hearer would prefer to rely on inference as little as possible. In order to make things a little less abstract, let me give an example. Assume that a speaker wants to communicate (2a), and to do so, chooses (2b), rather than (2c-d).

(2) a. $\exists x[man(x) \wedge see(m, x) \wedge drunk(x) \wedge can\_hardly\_walk(x)]$
    b. *Michael saw a man. He was drunk, and could hardly walk.*
    c. *Michael saw a man who was drunk and who could hardly walk.*
    d. *Michael saw a man. That man was drunk, and could hardly walk.*

(2b) is a perfectly legitimate –and probably common –way of expressing the content of (2a), and it is likely to have communicative success. Notice, however, that (2b) is underspecified with respect to a crucial part of information that is specified in the other alternatives: the identity of the drunk person who could hardly walk anymore. As (2b) stands, it might be *Michael* or *a man*. At the same time, (2b) is slightly less complicated to code than (2c-d) –it is shorter, and has no subordinate clauses. By using the third-person pronoun *he* in such a context, a speaker leaves a piece of information that could be explicitely coded to be inferred by the hearer. Therefore, the speaker transfers effort to the hearer.

I would like to stress that what I have been exposing here is not a new idea, although as far as I know, the specifics are new. There is a common –and, as far as I know, well accepted idea –that language is shaped (among others) by two conflicting forces: *economy* vs *clarity*, on the background of social *conformity* (see, e.g., Keller (1994); Haspelmath (1999), or already Paul (1995: 313ff.)). The twist I would like to suggest is that these are conflicting interests of a speaker (*economy*) and a hearer (*clarity*) when playing a signaling game (and hence, *conformity*).

Let me rehearse again why individually, it makes sense for a speaker to reduce the coding effort.

[10]This formulation assumes that the proper act of decoding has a negligible cost with respect to additional inference costs that go beyond pure linguistic decoding. In order to illustrate the difference, consider the following: upon hearing "*the president has small hands*", the hearer has to decode that there exists in the utterance context a unique individual who is president, and who has small hands. This, however, is not sufficient to derive truth-conditions for the sentence, since the hearer has to figure out with additional inferences which individual the speaker was referring to by saying "the president" in this particular context.

2.2 Modeling the optimization problem

An act of communication is generally modeled as a signaling game. In a signaling game, the speaker observes some state *s*, to which the hearer has no access. Given this state, the speaker then chooses a signal, which he transmits to the hearer (in other words: the speaker strategy maps a state to a signal). The hearer receives the signal, and based on this, must chose some action *a*. If the chosen action is appropriate given *s*, both hearer and speaker receive some payoff; if *a* is inappropriate given *s*, both receive nothing. Generally, signaling games are treated as being cost-free. But we are interested in the specific case of costs associated with communication, and ignore the coordination part (apart from the effort required).[11]

The optimization problem can be stated as follows. For the speaker S, it involves choosing a level of effort $\gamma \geq \varepsilon_S$ such that $\gamma + \delta \geq t$ (where ε_S represents the minimally necessary effort on the speaker, δ is the level of effort chosen by the Hearer H, and t is the threshold below which communication fails, and above which it will succeed). Similarly, the optimization problem for H can be stated as choosing $\delta \geq \varepsilon_H$ such that $\gamma + \delta \geq t$. I assume that both ε_S and ε_H need to be positive and greater than 0. The idea is that when a hearer does not pay attention, communication will fail no matter what the speaker may do; similarly, I assume that if the speaker does not make an effort to emit some message, we have left the proper domain of signaling games. As a corrolary, this also means that $\gamma < t$ and $\delta < t$.

We can now define the pay-off functions of the two participants:

(3) a. $p_S(u, \gamma, \delta) = \mathit{benefit}(u) - \mathit{cost}(\gamma)$
    b. $p_H(u, \gamma, \delta) = \mathit{benefit}(u) - \mathit{cost}(\delta)$

(3) assumes thus that the benefit of an utterance is the same for speaker and hearer, but that they may incur differing costs, which has to be subtracted from the (possible) benefit they receive from successful communication.

As can be easily seen in figure 1, the payoff for each participant is maximized for the lowest admissible level of effort possible, and decreases as the level of effort rises. In both cases in figure 1, the diagrams show a sharp cliff where successful message transmission borders on non-successful passing of the message.

[11] Communication cost and how to share it is important also in domains slightly removed from natural language. For instance, the internet has moved from a state where most rendering was done on the server-side to a position where much rendering is done on the client-side (that is, by JavaScript in a web-browser).

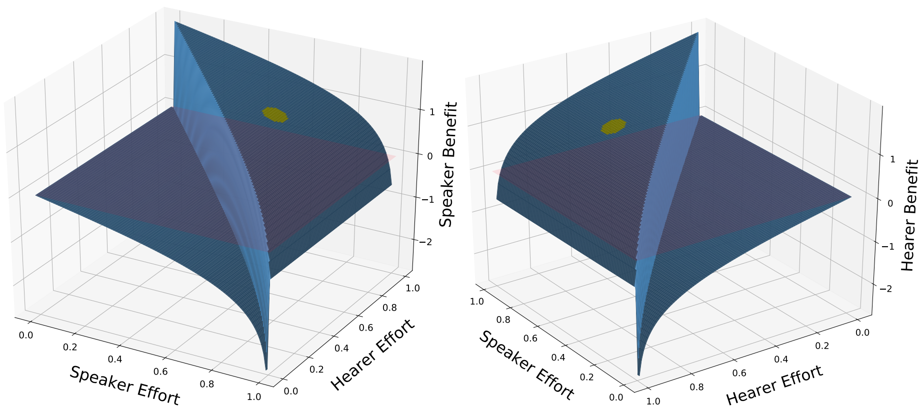

Figure 1: Profiles of Speaker (left) and Hearer (right) Benefits. In yellow: area of socially expected levels of effort in coding and inference.

But even when the message is successfully transmitted, the cost may become so high that it would have been better not to attempt to transmit the message. As has often been noted, natural language is a communication system characterized by a high degree of redundancy. One way of conceiving of this is to assume that there is a (social) norm which keeps away a message from the cliff, and that there is something like an expected level of coding (and inference) in the population – which has been pictured in figure 1 by the yellow area.

We can assume that there are sanctions for speakers not conforming to the socially expected level of coding effort. However, this area should probably not be conceived of as a single point that could be easily targeted, but has to cover some acceptable variation. And within this acceptable range of variation, we should expect a rational speaker to minimize effort. Once again, if there is a single speaker doing this within a sufficiently large population, one would not expect this to have any consequences. However, the incentives exist for all speakers, and if all speakers start to minimize their effort, and if the socially expected level of effort is dependent on production at least to some degree, over time, the socially expected area of coding will approach the cliff, and eventually, go over it. Once this has happened, the coding strategy is no longer viable, and has to be replaced.

But let us now look at two concrete cases where rational incentives for the speaker either to minimize coding or to increase the inference load of the hearer have led in the long run to a less optimal outcome for everybody.

3 Two case studies

In this section, I will present two cases that I argue constitute tragedies of the commons. In the first case, concerning the loss of syllable-final *-s* in Western Romance, it is the reduction of the articulatory coding effort that led to complications in the system (and thus, in the end, to more articulatory effort); in the second case, concerning the aoristic drift of the present perfect, it is a tentative to bring the hearer to additional inferences that leads to the loss of a (comparatively) shorter form, and the loss of the coding of a meaning difference.

3.1 The loss of syllable-final *-S* in Western Romance

In contemporary French, there still subsists a plural marking on nouns and adjectives with *-s* in the orthographical norm, as is illustrated in (4b), as contrasted with (4a). However, this plural marking on the noun is absent from spoken varieties, as is illustrated in (4d), and in contrast to (4c), where the only remaining difference in number marking is on the determiner.[12]

(4) a. *Le petit chat miaule.*
The small cat meow.3SG.PRES
The small cat is going meow.

b. *Les petit-s chat-s miaul-ent.*
The.PL small-PL cat-PL meow-3PL.PRES
The small cats are going meow.

c. lə pti ʃa mjol
The.SG small cat meow

d. le pti ʃa mjol
The.PL small cat meow

While I will specifically be concerned with the aspect of plural-marking (see, e.g., Massot (2008) on this issue), it is important to notice that this is a general

[12]The only context where this -s may still surface is in contexts of *liaison*, and it can surface only in cases where the word following the plural mark begins with a vowel — and even there, it is not systematic (for a detailed descriptions, see Massot (2008)). Furthermore, there are a few nouns with irregular plurals (for instance, *bocal*, *bocaux*, glass container), where there is a difference in pronunciation. However, it has been convincingly argued by Massot (2008) that plural-marking on the noun is no longer a productive grammatical strategy in what he calls “demotic” varieties of modern French.

process that applies to all instances of syllable-final *s*.[13] To witness, consider the following French words, with their cognates in other Romance languages and English:

(5) a. forɛ *(forêt): cf. Italian* foresta *or English* forest
 b. etydjɑ̃ *(étudiant): cf. Spanish* estudiante
 c. pat *or* pɑt *(pâtes): cf. Italian* pasta

The loss of syllable-final -*s* is largely complete in contemporary French. Some instances were already under way in the 11th century (see Brunot & Bruneau (1933: 53f.) or Picoche & Marchello Nizia (2008: 196ff.)), and the process was by and large finished in the 16th century (see Brunot & Bruneau 1933: 70f.). But interestingly, it appears in various intermediate states in different dialects of Spanish: in the most conservative dialects of Northern Peninsular Spanish, coda weakening has not begun at all; in other varieties, e.g., slightly more Southern Peninsular Spanish varieties (e.g., Toledo) or in Lima (Peru), the *s* is weakened and aspiration is incipient, but *s* still is the dominant allophone. Then, there are varieties in which *h* is the dominant allophone (e.g, in the Spanish of *Las Palmas* and in the varieties of more formal speech (*habla culta*) of Havanna). Finally, there exist some varieties (especially in the Caribbean region, and still more so in the popular speech of Santiago in the Dominican Republic, where 95% of all instances of syllable-final *s* are not realized at all, not even by aspiration), where complete elision is the dominant realization.[14] Generally, the pathway goes from a clear fricative *s* towards an aspiration (*h*), which may then disappear (see, e.g. Ferguson 1990), and one can make a pathway from the most conservative to the most innovative variants as follows:

(6) a. *No weakening: Northern Spanish varieties*
 b. *Slight weakening: Spanish varieties in Central Spain, Lima*
 c. *Aspiration dominant: Spanish varieties on Canary Islands*
 d. *Elision dominant: Caribbean Spanish*
 e. *Full elision: Contemporary standard French*[15]

[13] This, in turn, is an instance of an even more general phenomenon of the loss of consonants in coda-position. However, most of the time, this has no major impact on the grammatical system of a language.

[14] Data taken from Samper Padilla (2001), especially table 1, and complemented with Kapović (2017: 250).

In any case, it is important to notice that this process only affects syllable-final *s*, but not syllable-initial s.[16] It has been pointed out by phoneticians like Solé (2010: 249) that syllable-initial and syllable-final consonants do not coincide exactly in a number of articulatory parameters. Furthermore, fricatives obey strict constraints with respect to position, aerodynamics and timing (see Solé 2010: 291f., and references therein), and as a consequence, they are easily degraded if these requirements are not met. A reduction in the articulatory gesture of is one of the standard explanations of s-aspiration in syllable final positions: aspiration results from the loss of the oral articulation of the fricative, while the glottal gesture is maintained (see Solé 2010: 293). Furthermore, coda consonants tend to be shorter than onset consonants (see Solé 2010: 293). The results in the study by Solé (2010: 301) are consistent with a hypothesis according to which the syllable-final fricative is produced with a reduced oral gesture.[17]

Once this reduced oral gesture has become standard, elision can be seen as the result of a further weakening of this resulting partial gesture. However, even though it may take articulatory effort, it is not intrinsically impossible to maintain syllable-final fricatives, as is shown by Northern Spanish varieties, where the *s* in a coda is not weakened. So, it appears that the weakening (or complete loss) of *s* in coda positions is a case where speakers have to invest less effort in articulation, and thus, something that alleviates coding.

The question is now: does this entail an augmentation in the inference-efforts required from a hearer, and assuming that it does, what could be an adverse effect of this that would (linguistic) life more difficult for everyone, speakers included?

There is an obvious answer to it, which is to say that any loss of sounds makes cases of homonymy more likely, and that the disambiguation of homonymy is one more inferential task required from the hearer. Generally, it seems that the mere existence of homonymy is a case that makes life easier for speakers (since there are more short signifiers available), while making communication more dif-

[15] It is true once again that, through external sandhi (namely *liaison*), syllable final *-s* may still appear in a few contexts (that is, if the *-s* is not only syllable-final, but also word-final, and if the following word starts with a vowel). However, word-internally, the process seems to have reached its end-point in French, and very often, an orthographical circumflex on the vowel is the last trace of the former presence of an *-s*. For instance, there is no context in which the *-s* in the examples in 5 would be pronounced.

[16] There are cases, however, where syllable-initial fricatives are concerned, see Spanish *fermoso* (beautiful) > *hermoso* (which is pronounced nowadays without any aspiration). In a more distant domain, but with respect to sibilants, the common Indo-Iranian initial *s* before vowel became reduced to *h* in Avestan, see, e.g., Williams Jackson (1892: 43): Sanskrit *saptá* vs Avestan *hapta* (‘seven’), or Sanskrit *sômam* vs Avastan *haoməm* (‘soma’, ritual drink).

[17] Solé’s experimental subjects where 2 native speakers (1 male, 1 female) of American English.

ficult for hearers. A language designed for loss-less communication and without cost for coding or transmission should not have instances of homonymy.

However, I will argue that there could be more profound, and far-reaching consequences than simple lexical ambiguity. In order to evaluate this, let us return to plural marking in French and Spanish. Contrary to English, number-marking in Spanish (and written French) is in principle (that is: in stages not showing elision) present on determiners, adjectives and nouns alike, as is illustrated in (7).

(7) a. *La oveja bonita duerme.*
The.SG sheep cute sleeps
The cute sheep sleeps.

b. *La-s oveja-s bonita-s duerme-n*
the-PL sheep-PL cute-PL sleep-PL
The cute sheep sleep.

Therefore, plural marking is in part redundant; however, the loss of syllable-final *s* would leave as sole plural mark the agreement on the verb −which may not be perceptually very salient, and which would be of no use for any other positions but the subject. So, the worst case scenario could be the complete loss of nominal plural marking in Spanish, which could possibly entail that a hearer would need to rely on contextual clues in order to know whether one or several entities are under discussion. Now, this needs to be refined.

Notice, first, that this is only valid for feminine nouns, since there would be a difference in the definite determiner of masculine nouns, even after the loss of syllable-final *s*, as is illustrated in (8): a pronunciation *lo* would necessarily be a plural in this context. [18]

(8) a. *El gato bonito duerme*
The cat cute sleeps
The cute cat sleeps

b. *Los gato-s bonito-s duerme-n*
the.PL cat-PL cute-PL sleep-PL

Second, definite DPs by definition refer to entities in the common ground. Therefore, even in case of feminine nouns, there should not be any additional inference-load heaped on the hearer with respect to the current situation.

[18] This is how plural marking works in spoken French, where the plural definite determiner [le] is different from both feminine [la] and masculine [lə].

However, this will be of no help for feminine indefinite DPs, where the entities are not yet in the common ground. Consider the following:

(9) a. # *Veo oveja*
see.1SG.PRES sheep

b. *Veo una oveja*
see.1SG.PRES a sheep.

c. *Veo oveja-s*
see.1SG.PRES sheep-PL

d. *Veo una-s oveja-s*
see.1SG.PRES a-PL sheep-PL

In current Spanish, (9a) is not acceptable under a standard count interpretation. Now, assume that coda-s disappears globally in Spanish. If a hearer heard (9b), there would be no way of knowing if the speaker intended actually (9b), or rather (9d). On the other hand, since article-less versions of singular count nouns are not standard, a hearer might interpret those as being plural. However, once again, feminine and masculine nouns do not pattern alike:

(10) a. # *Veo gato.*
see.1SG.PRES cat.

b. *Veo un gato.*
see.1SG.PRES a cat

c. *Veo gato-s*
see.1SG.PRES cat-PL

d. *Veo uno-s gato-s*
see.1SG.PRES a-PL cat-PL

So, with masculine nouns, the article would allow to explicitly mark a plural, whereas the bare noun would rely on inference in order to determine number. Now, all this is speculation. We know however, what were the long-term consequences in French in a situation where nominal plural marking by an *-s* suffix became impossible due to the disappearance of the suffix' signifier. According to Woledge (1956: 30) (and similarly, Carlier (2001)), the loss of syllable final *-s* condemned at the same time the bare plural and the plural of the indefinite *uns*, and in order to disambiguate, a construction based on the partitive, namely *des* took over.[19] In the end, contemporary French developed thus with *des* a plural indefi-

[19] Woledge (1956: 30) dates the '*sudden death*' of the old plural indefinite to the 16th century, which corresponds to the end of the process of loss of coda *-s*.

nite article, bare plural arguments disappeared from the language, and nominal plural marking moved generally from the noun to the determiner.[20]

(11) a. * *J' ai vu moutons.*
I have seen sheep.

b. *J' ai vu des moutons.*
I have seen IND.PL sheep.

To conclude this section, the loss of syllable-final *s* is a case which is a priori favorable to the speaker, since it reduces coding effort. However, given that the grammatical marker of nominal plurals in Western Romance happens to be an *s*-suffix, its loss has important side effects on the system of the language, which have been argued to have led in French to the rise of an indefinite plural article (see, e.g., Woledge 1956; Carlier 2001; 2013), and thus, to an increase in coding effort in the long run.

3.2 The aoristic drift of the present perfect

Another phenomenon where it has been actually been argued before (see Schaden 2012; 2013) that it might constitute an instance of a tragedy of the commons is the so-called aoristic drift of the present perfect. This term refers to the widespread phenomenon of present perfects becoming more past-tense like in time, and thereby marginalizing or ousting the traditional (simple) past form. This case is less straightforward than the loss of syllable-final /s/ in Western Romance, which is clearly caused by a diminishing coding effort, but it can be seen as in instance where the (rational) speaker's effort to obtain more hearer-inferences leads in the long run to the loss of a short form (the simple past tense) and its replacement by a form that is less economic.

The basic phenomenon is the following: in many languages, there are two different forms which can refer to an event in the past, without an intervening point of reference, namely a present perfect tense (see 12a) and a simple past tense (see 12b).

(12) a. *I have found my glasses.*

b. *I found my glasses.*

The general consensus in the literature is that a present perfect expresses *current relevance* – which a simple past does not. How current relevance is to be

[20] This is once again the position fully articulated by Massot (2008), but which is already hinted at by Woledge (1956).

precisely characterized is less consensual, but the idea is that there has to be some link of the event to the moment of utterance. For (12a), this may amount to the fact that now I know where my glasses are, or that I see well –given that I am wearing my glasses, or that I could use my glasses, if I needed to, etc.

It is also well established (see, e.g., Meillet 1909–1982; Bybee et al. 1994) that present perfects are diachronically highly unstable. Very often, the present perfect invades domains that were restricted to simple past tenses, namely combinations with past denoting expressions like *yesterday*, or uses in narrative sequences. Instances of such uses can be seen in the French examples in (13), which would both be ungrammatical in contemporary English, and require the simple past tense, as is illustrated in the translations.

(13) a. *J' ai retrouvé mes lunettes hier.*
I have found my glasses yesterday.
'I found my glasses yesterday'

b. *Il est entré, s' est assis et a commencé à manger.*
He is entered, SE is seated and has begun to eat.
'He entered, sat down and started to eat.'

In contemporary standard (spoken) French, where the process of the aoristic drift has been completed, the simple past tense is no longer used. More generally, the grammaticalization paths of present perfect are illustrated in figure 2. The French present perfect tense would be a general perfective past tense; its English equivalent fits plainly the anterior-category.

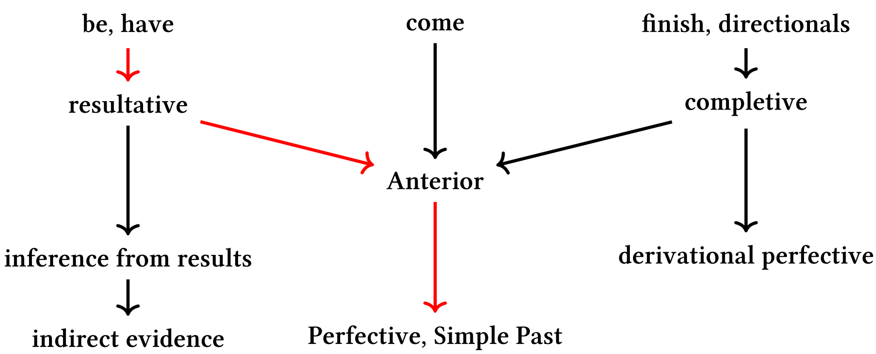

Figure 2: Grammaticalization paths for perfects –in red, the path followed by the French *passé composé* (following Bybee et al. 1994: 102).

The aoristic drift of the present perfect fits uneasily with the standard "optimization" approach to linguistic change because by standard metrics, the replacement form is longer and less economic (more syllables, more words), and also, because a semantic opposition (current relevance vs no current relevance) can no longer be expressed by two different tense-forms. Yet crosslinguistically, the aoristic drift of the present perfect is a frequent process.

Let us now have a look at the grammatical phenomenon responsible for the current relevance effect in present perfects. There is some consensus in the formalist literature of various kinds that there is some *perfect state* associated to the event which is responsible for this effect (see, e.g., Rothstein 2008; Nishiyama & Koenig 2010; Portner 2003), and furthermore, that the perfect state cannot be solely determined by the lexical properties of the underlying event-predicate. The idea is thus that, by using a perfect, a speaker instructs a hearer to infer a suitable perfect state, consistent with the utterance situation and derivable –by pragmatic means –from the event predicate and the situational context. Thus, there is intrinsically some inferential work required from the hearer upon interpreting such a form. Yet, the precise formulation of how to infer such perfect states has proven elusive, since inferring some state coming after the event is not a very restrictive condition (on this issue, see, e.g., Schaden (2009); Nishiyama & Koenig (2010)).

On the other hand, general principles of relevance will probably also require in most cases the inference of some relevance for the event expressed by a simple past tense –which however is generally assumed not to contain any semantic requirement of encoding some relevance state.[21]

The basic idea in Schaden (2012) –which is based on earlier work by Dahl (2001) –is that the strength of current relevance of an event can be linked to the frequency of present perfects and simple pasts, respectively.[22] If present perfects

[21]Simplifying a lot, this boils down to the following, assuming P to be the verbal predicate, and S the moment of speech (where aspectual issues are ignored):

(i) a. past: $\exists i \exists e[i \prec S \wedge P(e), \tau(e) \subseteq i]$
b. present perfect: $\exists i \exists i' \exists e \exists s[S \subseteq i \wedge i' \prec i \wedge P(e) \wedge \tau(e) \subseteq i' \wedge Q(s) \wedge i \subseteq \tau(s)]$

In the formula for the present perfect, i' corresponds to a Reichenbachian point of reference, and Q is the relevance state following the event, which has to be inferred contextually by the hearer. Notice, that in both cases, an event is located before the point of utterance, but that the present perfect is more informative than the simple past.

[22]For formal implementations of the notion of relevance and its different strengths, see Merin (1999) or Parikh (2009); for a (considerably simplified) application of Merin's work to current relevance, see Schaden (2013).

are rare, the current relevance inferred for the event will be high –and, as a corrolary, simple past tenses will not trigger any inference that the event will have low current relevance.[23] On the contrary, if present perfects are frequent, the current relevance inferred for the event will be lower, –and as a corrolary, simple past tenses will trigger an inference that the event will have low current relevance. Now, if a speaker wants to boost the current relevance of his utterances, he is bound to use more present perfects with respect to the general frequency in the population. This is a higher amount of inference in the hearer, and the speaker pays for it by a higher cost of production or coding.

Here now comes the tragedy of the commons aspect: as long is there is only one speaker in a sufficiently big population trying to boost the current relevance of his past utterances in this way, this will have a negligible impact on the meaning of the form. However, if everybody does this, the general frequency of present perfects to simple pasts in the population will rise, and hearers are bound to adjust for this phenomenon by reducing the strength of current relevance they infer for present perfects. At some moment, a markedness reversal will occur: it is no longer the use of a (by then: high frequency) present perfect which will trigger an inference toward strong current relevance of the event, but the use of the (by then: low frequency) simple past will trigger an inference towards weak current relevance of the simple past tense. [24]

So, here it is not the tentative of minimizing the speaker's effort that leads to the extinction of a form, but rather, the tentative of the speaker to maximize the inference strength of a hearer. The result, however, is similar: a more economic form disappears (here: the simple past), and is substituted by a form that is less economic. In the end of the process, the meaning differentiation around current relevance breaks down, and speakers end up having to provide more coding ef-

[23]The work by Schaden (2012) assumes standard grammaticalization theory, and tries to give a formal account of the unidirectionality of the change. There are however doubts whether such an approach is correct. As pointed out by Nilsson (2016), there are simple past uses in German that have current relevance semantics –which is in contradiction with this approach. Nilsson considers two possible explanations for this pattern: first, it might be a case of a reversal of grammaticalization (similar to what happens in some dialects of American Spanish), or there might be some aspectual pattern to it (since stativity seems to be a determining criterion for the use of the simple past) that has not been taken into account by Schaden, but might complement the analysis.

[24]This idea assumes that the frequency (or expectedness) of a construction is to be taken into account in drawing inferences. If the expected form is semantically richer (involving some potentially extremely vague relevance state), an unexpected form lacking the relevance state will trigger the inference that there is no inference present, while the expected form will not trigger any further inferences. For the full argument, see Schaden (2009).

fort because of the cumulative effect of generations of selfish utility-maximizers before them.

4 Conclusion and perspectives

In this paper, I have defended three main claims: first, that linguistic entities (namely phonemes and constructions) can be seen as prototypical public goods. Second, in some circumstances and for some linguistic entities, the socially differentiating use of these expressions makes them subtractable, and thus, Common Pool Resources. In both cases, linguistic entities are potentially exposed to overexploitation of the resource by selfish human agents, that is, to tragedies of the commons. Third, I claimed that, if communication is by and large a cooperative endeavor, one must not lose sight of the fact that it is associated with costs in all participants, and that speakers and hearers have intrinsically opposed preferences in a communication situation: a rational speaker should transfer as much effort as possible to the hearer (here identified as *inference*), whereas a rational hearer should be interested in a maximum effort of the speaker (here identified as *coding*), in the limits of what is possible given the requirement of successful communication.

I also briefly reviewed strategies of maintaining linguistic commons, and circumstances under which they are more or less likely to succeed, based on the pioneering work by Ostrom (1990).

Finally, I discussed two cases that instantiate in different ways tragedies of the commons, namely the loss of syllable-final *s* in Western Romance languages, and the aoristic drift of present perfects, arguing that these constitute cases where short-term advantages of the speaker lead to a long-term complication for everybody.

This article is part of a wider effort to take advantage of results in economics and evolutionary biology, and to try to unify the description of linguistic behavior with other types of social behavior. Like the entire book, it has a rather pessimistic outlook, which contrasts starkly with most of the literature in the shiny happy world of linguistics: in some sense, language can deteriorate; change is not necessarily optimization, individual optimization can lead to collective breakdown, and we cannot take unconditional cooperation for granted. This, of course, raises the question of why we are able to use such a cheap semiotic system at all, how it could arise (see, e.g., Sterelny 2012: on this issue), and how it can be maintained in a more or less stable state. Clearly, the reasons of why and how a language does not change are at least as mysterious as why and how it changes.

Conceiving of linguistic entities as public goods opens up in principle a wide range of problems which have not been touched upon at all in this article: are there phenomena that could be described as *enclosure*, that is, privatization of the resource against its current users? What differences (if any) are there between *knowledge commons* (see Hess & Ostrom 2007b) and linguistic commons? All this must be left to future work.

Acknowledgements

I would like to thank Sylvain Billiard and Maxime Derex for their very helpful discussions and input on the idea of conflicting interests of speakers and hearers. Roland Noske and Cédric Patin helped me with the part on the loss of syllable-final *-s*. I am also indebted to Ignacio Rejas (and my old Nokia cellphone), without whom this paper would never have been written. Many thanks are also due to Roland Mühlenbernd and Dankmar Engke for providing me with an opportunity to dive into this issue. Two anonymous reviewers provided me with valuable feedback on how to improve the paper. None of the above should be assumed to agree with anything in this article; all errors and omissions are mine alone.

The diagrams in figure 1 have been plotted with Python (Python Software Foundation, https://www.python.org/), using the *matplotlib* library (see Hunter 2007).

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Language Change for the Worse

Many theories hold that language change, at least on a local level, is driven by a need for improvement. The present volume explores to what extent this assumption holds true or whether there is a particular type of language change we dub *language change for the worse*, i.e., changes with a worsening effect that cannot be explained away as side-effect of improvement in some other area of the linguistic system. The chapters of the volume, written by leading junior and senior scholars, combine expertise in diachronic and historical linguistics, typology, and formal modelling. They focus on different aspects of grammar (phonology, morphosyntax, semantics) in a variety of language families (Germanic, Romance, Austronesian, Bantu, Jê-Kaingang, Wu, Greek, Albanian, Altaic, Indo-Arian, and languages of the Caucasus). The volume contributes to ongoing theoretical debates and discussions between linguists with different meta-theoretical orientations.