

Lineage-based linguistics

William Croft
University of New Mexico

The phenomena that linguists study—a language community, its language, and the sounds (or signs), words and constructions of the language—are all historical (spatiotemporally bounded) entities, that is, individuals in the philosophical sense. More specifically, they are populations as defined in biology: a historical (bounded) set of individuals that are linked together via shared lineages that are the result of replication. In linguistic terms, replication is the (re)production in language use by speakers/signers of instances of previously used linguistic structures. This lineage-based approach contrasts with the hypothesis of linguistic units and language as kinds, namely entities defined by their inherent properties. Although the objects of study of linguistics are populations, kind concepts are also relevant for both language description and language comparison.

1. Introduction

The idea to be articulated and defended here is that grammatical categories can be defined as lineages of linguemes—usages of linguistic units—used to communicate similar experiences. In looser terms, I will argue that grammatical categories are basically social histories of the use of grammatical forms in a speech community. This idea is quite different from the traditional definition of grammatical categories and constructions. It can be seen as an extension of the usage-based model from its origin in cognitive linguistics to an evolutionary model of language communities, languages, and grammatical structures. I will trace out this idea here, and argue that it can address a number of problems in the study of grammar.

The usage-based model is the hypothesis that linguistic knowledge reflects language use fairly directly, representing not just form and meaning but also usage phenomena such as token frequency (e.g. Bybee 1985; Langacker 1988, 2000). That is, usage-based models were basically cognitive, focused on mental representation. All cognitive usage-based models also propose that linguistic units are organized into a network (for a detailed explication, see Diessel 2019). Dynamic processes associated with the storage of grammatical representations, including entrenchment, productivity, retrieval, and formal changes such as phonetic erosion of forms and analogical reformation, have been shown to be sensitive to usage phenomena such as token frequency and social context of use (see also Schmid 2020).

The well-established role of token frequency leads logically to the question of how token frequency is to be represented in the mind. In EXEMPLAR models, each token is represented directly (see Pierrehumbert 2003; Bybee 2010; Ambridge 2020a). The direct representation of exemplars accommodates the fact that productions of linguistic units are highly variable. Exemplar models allow for the representation of that variability directly as a network of instances mapped onto phonetic or conceptual space.

The shift from usage-influenced representations to exemplar-based representations, including polysemy representations of meanings, raises fundamental issues of categorization in language, which in turn leads us to the lineage-based model described in the following sections.

2. Essential categories (kinds) and populations: an ontological distinction emerging from evolutionary theory

2.1. *Kinds and individuals*

The usage-based model has two salient features. The first is that it describes a cognitive phenomenon, namely knowledge of linguistic categories by a language user. This is true even though that knowledge is proposed to be closer to language use in a social or interactional sense: utterances produced and comprehended by interlocutors in social interactions. This is a fairly standard cognitive science view of knowledge of language as mental representations. There are other approaches to cognition, such as (existential) phenomenology and embodied cognition, which eschew mental representations and reject Cartesian mind-body dualism. In these approaches, cognition is the ability to develop the skill to be perceptually open to and actively engage with affordances in the natural and cultural world that we are born into (Croft 2024:213-14). We will return to the relation between cognition and language in §3.3.

The second feature of the usage-based model is that the organization of that information—its division into categories, and the relationships between those categories, is defined by similarity or possibly identity of the mentally stored exemplars. For both phonetic and grammatical exemplars and lexical/constructional polysemy, the unity of the category is built around similarity. The phonetic realizations of a phonological category are similar to each other, but generally cannot be reduced to a classical category. The meanings or senses of a grammatical category—word or construction—are similar to each other, but generally cannot be reduced to a classical category. Even so, the finer-grained categories of individual uses, or in phonological categories, points in phonetic space—what is sometimes called the ‘etic grid’, a term from American structuralism (Levinson et al. 2003:487; see also Haspelmath 2018:88)—are assumed to be classical categories, where identity rather than similarity is the appropriate relation between tokens. Even similarity between meanings and forms presupposes the ability to assign specific properties or values to a token, i.e. a location in a conceptual space—semantic, phonetic or otherwise.

This is not the only way that exemplars of use can be organized. In fact, there is a fundamental way in which this is not the way that linguistic categories should be organized. Instead, linguistic categories are better analyzed as populations, as defined in evolutionary biology. The theoretical concept of a population in evolutionary biology is introduced in §2.2, and contrasted with the older and better-known concept of a kind, also known as essentialism. The concept of a population is applied to different entities in linguistics in §2.3: languages, language communities, and then linguistic categories.

In evolutionary biology, the term ‘essentialist’ or ‘essentialism’ describes a classical category (Mayr 1982:256; Hull 1976, 1988:215-16). An essentialist category is defined by a set of generally inherent properties of the members of a category, such that anything that has that set of properties belongs to the category, and anything that doesn’t have all and only those properties doesn’t belong to the category. For example, turquoise is a mineral that is a hydrous phosphate of copper and aluminum, with the chemical formula $\text{CuAl}_6(\text{PO}_4)_4(\text{OH})_8 \cdot 4\text{H}_2\text{O}$.¹ Anything, anywhere, anytime satisfying that description is turquoise, and anything, anywhere, any time not satisfying that description is not turquoise. Something that is defined in an essential manner is

¹ <https://en.wikipedia.org/wiki/Turquoise>, accessed 20 March 2025.

also called a TYPE, or a natural kind (see for example Haspelmath 2018, though his definition is ‘natural kind’ is actually narrower—see §4.1).

Kinds can be distinguished from individuals. Individuals are spatiotemporally bounded, HISTORICAL entities: they exist only in a particular place and time. For example, the individuality of a particular quartz crystal is its unique spatiotemporal existence: it was formed at a point in time, it exists in some location for some period of time, and it will pass out of existence when it is destroyed. In other words, individuals are historical entities. However, by virtue of their essentialist properties, individuals like a quartz crystal are INSTANCES of a kind that is spatiotemporally unbounded.

A spatiotemporally bounded set of historical entities, i.e. individuals, is also a historical entity, i.e. an individual. This is a POPULATION, in the biological sense (Ghiselin 1974; Hull 1976; Mayr 1982:272-75). By contrast, a kind as a theoretical concept, that is, an ontological category, is not a population. A kind is defined by inherent properties of its members (and in contrast, those of its non-members). Although in cosmic terms, turquoise must have arisen at some point after the Big Bang, and will come to an end if and when the universe comes to an end, the category ‘turquoise’ is not defined by its beginning and end.

The relation between a kind and an individual which is an instance of the kind is described as a relation between a type and a TOKEN. A population, on the other hand, is finite, and it is defined in part by its spatiotemporal boundedness. It is also defined by the relation that individuals in the population have with each other (and not with individuals outside the population). The nature of this relation will be described in the following sections. Finally, the relation between a population and its members is not the same as the relation between a kind/type and its instance/token. The relation between a population and its individuals is between a whole and its PARTS (Hull 1976).

The main aim of this paper is to show that populations as well as kinds play a major role in linguistic analysis, in particular in grammatical description and analysis, linguistic typology and historical linguistics. In the remainder of this section, I describe populations in biology and in language. In section 3, I describe how populations are defined in terms of replication lineages, and the consequences that has for grammatical description and analysis. In sections 4-5, I describe how kinds and populations are both needed in language description and language comparison (typological and historical), and how population thinking is even relevant to an issue in language revitalization.

2.2. Populations, illustrated in biology

There is more to the definition of a population. I will describe it here with respect to how it is instantiated in evolutionary biology. Population thinking is one of the major insights of the neo-Darwinian synthesis (Mayr 1982:272; see Mayr 1982, chapter 6 for a brief history). Population thinking resolves serious problems with the essentialist theory of a biological species by abandoning the essentialist theory. A species such as a red-tailed hawk was defined in the essentialist theory in terms of inherent properties of the bird: its shape, size, physiology and so on. However, the essentialist definition suffers from a number of problems. There are sibling species: two species that have similar inherent properties but do not interbreed (Hull 1988:104). There are also polytypic species: a species that has a high degree of variation but whose members nevertheless interbreed. Many if not most species have a high degree of variation among inherent properties, making an essentialist definition impossible. Finally, species change

over time, and their “inherent” properties that supposedly define them disappear. The “essential” traits of species therefore cannot define the species.

Population thinking takes a completely different approach to categorization from essentialist thinking. Populations are defined not by inherent properties of the individuals but instead by a relational property, a relation that holds the individuals in the population together. The relational property that defines a biological population is reproduction (cf. Hull 1988:470). In the population theory of biological species, a species is defined as a reproductively isolated population. Members of a species interbreed among themselves (although of course it is not necessary that every member breeds with every other member). Also, they do not interbreed with members of other species, for whatever reason: it is physiologically impossible, their ranges are fully separated, one species breeds in the spring and the other in the fall, and so on. And reproduction is how new individuals in the population are created. The more general description of this process is REPLICATION (see §3). Replication is how individuals are bound together in a population.

Biological populations are not entirely discrete. There are hybrid species, especially among plants. There are also chains of populations, where there is some interbreeding between neighboring populations but not between geographically distant populations. These are problematic cases in defining species in population terms. But the “problems” are phenomena that directly follow from the population definition of species. Sometimes reproductive isolation is not complete. Speciation happens: that is, populations split. But the speciation process, the loss of interbreeding, is a gradual process. Populations may also converge, as in hybridization. Hybridization is also a gradual process.

A species qua population is a historical, spatiotemporally bounded individual: ‘Just as the name “Gargantua” denotes a particular organism from conception to death, “*Gorilla gorilla*” denotes a particular segment of the phylogenetic tree’ (Hull 1988:215). Populations may be a grouping of individual entities, but they are very different type of grouping from an essentialist category. Since a species is itself an individual, a species name is a proper name, not the name of a type (Ghiselin 1974).

Populations are bounded spatiotemporally. They can be individuated by branching and extinction. When a population splits, that is, two or more parts of the population become reproductively isolated, the result are two or more new populations. The original population is bounded, that is, it has ended temporally. The initial temporal boundary of the original population is when it became reproductively isolated itself. The initial temporal boundary of the new populations is at the time of the split that terminates the parent population. Their final temporal boundary is when they split again, or if the population goes extinct. This is the sense in which a biological species is a particular segment of the phylogenetic tree of life.

2.3 Populations in language

Population thinking can be applied to language, or more precisely, the language community (Croft 2000:13-20). The language community is a communicatively (relatively) isolated population of speakers (Croft 2000:17-19). All of the familiar “problems” of defining languages are found in defining species, and can be addressed in the population theory of a language (Croft 2000:13-20). The “problems” are mostly due to the gradual process of speciation/language birth, and the incompleteness of reproductive/communicative isolation.

All languages vary to the point that one cannot identify a set of essential properties (rules, constructions, words) that holds for all users of the language. And languages change over time, even when they do not split up into daughter languages. A language community may split, as happened with Latin and its daughter Romance languages. Communicative isolation is incomplete in many instances, perhaps more so than between biological populations.

The emergence of new languages is gradual. In some cases it is due to the gradual process of the splitting of a language community, leading to sibling languages. The split is incipient in the case of Czech and Slovak, for example, or with Serbian, Bosnian and Croatian. In other cases it is due to the gradual integration of a nation state, leading to polytypic languages, that is, languages made up of distinct geographical varieties that have been unified under a new national identity but are still quite distinct, as with Modern Chinese and Modern Italian. That is, there is also convergence or even merger of language communities, just as there are with species; it leads to multilingualism, language contact phenomena such as *koinés* and creoles, and language shift with contributions from the lost language as with Norman French in English.

A further complexity that is found in human societies but not biological populations is that a society is not a homogeneous population; human individuals belong to multiple overlapping and nested language communities in a society, based on social domain and social categories (Clark 1998; Croft 2000:90-94, 166-73, 2009:403-4; Höder 2018:43-47): ‘There is no limit to the ways in which human beings league themselves together for self-identification, security, gain, amusement, worship, or any of the other purposes that are held in common; consequently there is no limit to the number and variety of speech communities that are to be found in society’ (Bolinger 1975:333).

In the evolutionary framework, a language such as Italian or Czech has a distinct identity to the extent that the users of the language form a distinct language community based on a relatively high degree of communicative isolation. But what is that language? A linguist captures that language in a reference grammar, that is, descriptive generalizations about the phonology, grammar and lexicon of the language. Such a grammar accommodates phenomena such as phonetic variability in the realization of phonemes, lexical and constructional polysemy, and variation in grammatical constructions. But what is the relation between a descriptive grammar and a language?

In formal language theory, a language is a set of sentences, and a grammar is a set of rules that generates those sentences, that is, specifies what sentences belong to the languages and what sentences do not. The grammar is then a sort of descriptive generalization of the language, although in fact there are few published descriptions of the grammars of a human language following the precepts of formal language theory.

Formal language theory is insightful, but it is essentialist. The set of sentences is infinite, and the rules describe inherent properties of the sentences. But it can serve as a starting point for the reformulation of language in population terms (Croft 2000:25-27).

In the evolutionary framework, a language is not an infinite set of sentences, but an actual, finite population of utterances actually produced by the language community—i.e., a corpus. Thus, the utterances that count as parts of a language are defined by the language community that produces them. It is actually more complex than that. As noted just above, language communities overlap and are defined by contexts of social interaction as well as the actual language users themselves. These phenomena raise complex issues in multilingualism and multilectalism which we cannot go into here. For now, we will make the gross simplification that

a language community is socially uniform and uses one language. Even so, this simplification is already a huge ontological shift away from the essentialism of formal language theory.

In the population approach, a description of the language does not consist of a fixed phonology, lexicon, or set of constructions of the sort implied by a formal grammar (in the formal language theory sense). Instead, sounds (or signs), words and constructions are finite populations of forms that are actually produced by language users, contained in the finite population of utterances that make up the language—again, a part-whole relation. Of course, grammatical descriptions of languages by descriptive linguists make generalizations over these finite populations of utterances and their parts, based on recorded and digital corpora, that is, samples of the finite population of utterances. These descriptions recognize variability and change in progress, as well as the social dimensions of language use and variation that we are leaving aside in this chapter.

These populations—language users in a language community, utterances in a language, and sounds/signs, words and constructions in those utterance—are finite. But the terminal boundary of these populations is in the future for languages that are still being used. Hence any description of a still-used language will be open-ended, and can at best capture the past and present of the language: “past performance may not be indicative of future behavior”.

In order to get a better idea of what sort of category a sound/sign, word, or construction is, it is necessary to look more closely at the structure of a population and the relational property that defines it, namely replication. This will also allow us to discuss the role of a language user’s knowledge about her language in a population theory of language and its structure.

3. Population structure: replication and lineages

3.1. Replicators and replication

In Croft (2000), I develop an evolutionary framework for explaining language change. More accurately, it is a framework for language, because in an evolutionary framework, variation and hence change is central to the nature of language. Here, I focus on replication and lineages and how they structure the population of utterances and the populations of the linguistic units, or LINGUEMES, that make up utterances.

The fundamental idea in Croft (2000) is that language change happens in language use. Language change is an instance of change by replication. Every time I talk or sign to you, I replicate sounds/signs, words and constructions that I or my interlocutors have previously used. That is, I am reusing sounds/signs, words and constructions that I am familiar with because I have heard them used before, or used them before myself.

Replication is a temporal process. Hence, a linguistic category, and a language user’s knowledge about that category, has a temporal dimension. Since replication happens every time we speak or sign, the temporal dimension of categories is at a small time scale, well within the lifetime of a single language user. Replication also extends beyond the lifetime of a single language user, since one can (and does) replicate sounds/signs, words and constructions from someone else’s utterance that they heard or saw, or was addressed to them. This is possible because language use is public, not internal: it occurs in conversation, as well as other types of discourse—not inside the head (*pace* Dawkins’ selfish meme model; see Croft 2013). The public nature of lingueme replication also means that linguists can observe and analyze the source and outcome of the replication process, although it is mediated in cognition (see §3.3).

Replication forms LINEAGES, that is, a replication of a replication of a replication...In the evolutionary framework, replication lineages provide the relations between tokens. Replication lineages are known in historical linguistics under other names: for example, a sound lineage is a sound change; a word lineage is an etymology; a construction lineage is a grammaticalization chain (Croft 2000:32-33).

All individuals in a population are related to each other, if only indirectly, via replication. Replication lineages branch when there are multiple replications from a single parent replicator. Replication lineages are interwoven when there are multiple parent replicators. In biological evolution, this happens in sexual reproduction: the child's genome is a recombination of parts of both parents' genomes. In language, this happens when an utterance recombines sounds/signs, words and constructions from multiple parent utterances. This is how novel utterances are produced, just as sexual reproduction creates novel combinations of biological traits. Of course, in the evolutionary model, unlike formal language theory, what matters are the novel utterances that actually are produced—which may not follow general patterns or rules that linguists infer from prior utterances.

Finally, replication involves INHERITANCE. That is, replication is mostly faithful: replicates possess most of the structure of the parent replicator. Equally important, alterations of structure in the process of replication can also be inherited, that is, changes in a replicator can be cumulative. This is a reason why populations cannot be fully captured by an essentialist definition: cumulation of changes in replication means that some individuals in the population will come to lack properties that other individuals have, and come to have properties that other individuals lack.

Variation in a population happens because replication is not always perfectly faithful. There are reasons for this, but the reasons may be different from one domain to another. The standard, albeit simplified, view in biology is that variation is generated by random mutation and by recombination (in sexually reproducing organisms). In language, there is fundamental indeterminacy in the communication process that gives rise to variation. For example, ambiguities in auditory perception and the challenge of perfect motor control means that the phonetic realization of each phoneme hits a slightly different point in the phonetic space, as demonstrated by instrumental phonetics (Ohala 1989:176; Pierrehumbert 2003:184; this was a motivation for the exemplar model).

The replication of symbolic units—words and constructions—is even more fraught (Croft 2010:11-12). Replication of symbolic units is an act of communication between speaker/signer and addressee. But the addressee cannot read the speaker/signer's mind: this is precisely why a public symbol or signal must be used for communication of fine-grained experiences to be successful. The speaker/signer has her own construal of the experience to be communicated. Her construal shapes the choice of words and constructions they make (and also the choice of sounds for speakers, since phonological variants often carry social meaning). However, the addressee of an utterance, like the speaker/signer, has his own alternative construals of the scene potentially available to him; nor can he be certain of the precise construal intended by the speaker/signer. The speaker/signer's choice of words and constructions are based on her prior exposure to and use of those words and constructions in other communicative acts, and are chosen by her to convey her intentions in the current situation. But the addressee's knowledge of the words/constructions is in turn based on his own past exposure to and use of them. And his past experience of use is different from the speaker/signer's. On top of the indeterminacy of the speaker/signer and addressee's knowledge about their language, no two experiences are identical.

Hence any choice of words and constructions by the speaker/signer will not precisely characterize the construal of the experience being communicated, since their prior uses were applied to different experiences. As a result, there is a fundamental indeterminacy in the construal of an experience and its interpretation in a communicative act. Both speaker/signer and addressee must fall back on their experience of the current situation itself as well as prior experiences (see also Croft 2000: 99–114, 2001: 115, 124–130).

3.2. *Interactors and selection: the role of speakers*

Once there is variation in replication, there can be change by replication. While change can take place by random processes (drift—note that the genetic sense of ‘drift’ is not the same as Sapir’s sense), the most interesting change processes occur via selection. The philosopher of science David Hull’s General Analysis of Selection (Hull 1988) generalizes the theory of evolution, so that it abstracts away from particular structures and mechanisms of selection in biology. Hull applies the General Analysis of Selection to conceptual change in science in his 1988 book (see §5.4). It is a relatively short step from there to apply it also to language change (Croft 2000).

Hull argues, along with many other evolutionary biologists, that ‘evolution through natural selection is (I repeat!) a two-step process’ (Mayr 1978, cited in Hull 1988:217). The first step is the generation of variation through replication, as just described. The second step is what Hull calls selection: ‘a process in which the differential extinction and proliferation of interactors *cause* the differential perpetuation of the relevant replicators’ (Hull 1988:409). Selection introduces two other functional roles in evolution, the interactor and the environment: ‘*interactor*—an entity that interacts as a cohesive whole with its environment in such a way that this interaction *causes* replication to be differential’ (ibid., 408). A cohesive whole interacts with its environment, and the result of that interaction—greater or lesser survival of different interactors—causes differential replication of the “relevant” replicators. The canonical selection process in neo-Darwinian evolutionary theory posits the organism as the interactor and the genes that the organism possesses and reproduces (if the organism survives and reproduces) as the relevant replicators.

Note that Hull’s theory is highly schematic, in order to allow it to be applied to change by replication in domains other than biological evolution. For example, it only states that there is a “relevance” relation between interactor and replicator. Hence the fact that an organism’s genes determine many of the phenotypic traits of the organism is not part of the General Analysis of Selection. Nor does it specify what the mechanisms of replication or selection are. Also, Hull suggests that different types of entities function as interactors in biological evolution, not just organisms (Hull 1988:409). Replicators require structure that can be passed on more or less intact in replication; Hull argues that the gene is the clearest replicator in biology, though he suggests that populations might have structure that persists in replication (ibid.).

There are multiple logically possible ways to instantiate the General Analysis of Selection in language. In Croft (2000), I argue that the most useful instantiation is to treat language users as interactors and tokens of linguistic structures in utterances—linguemes—as replicators (the Utterance Theory of Selection; Croft 2000:25-30). This allows us to represent linguistic categories (as well as language communities and languages) as populations in a lineage-based linguistics, and describe the language user’s role in a theory of language.

The speaker/signer replicates tokens of linguistic structure that she has been exposed to, either her own prior replications or replications produced by other language users. Her

knowledge about her language is a sample of the total population of utterances in the language community. Her contexts of use of language is also a subset of all of the social interactions that include language in the community.

3.3. *Linguistic replicators and linguistic lineages*

Replicators and replication play the most central role in lineage-based linguistics. Most but not all linguistic replicators are behaviors, that is, the production of signals (sounds, gestures, etc.) by interlocutors in communicative interactions. Individual language users and their knowledge about their language play a supporting but essential role. Language users choose what experience to verbalize and what signals to use in their verbalizations. Above all, speakers/signers produce the replicated signals. Addressees (including the speaker/signer hearing herself) interpret those signals, and their interpretation becomes part of their knowledge about their language. Signals—linguemes—cannot replicate by themselves; language users (re)produce linguemes. It is no different in biology: meiosis involves cells hosting chemical processes that bring about the replication of DNA, and those cells in turn exist by virtue of being functional parts of the organism.

Some linguistic replicators are not behaviors but artifacts. In particular, written language is an artifact that persists beyond the writing process that replicates linguemes onto the page (tablet, screen, etc.). Audio and video recordings also are linguistic replicators that are artifacts. Once the artifact is created, language users who were not present at the creation of the linguemes on the artifacts can read (hear, view) those linguemes and then replicate them. When artifacts occur in a lineage, there is a temporal and possibly also spatial break; we return to this phenomenon in §6.

Of course, we cannot, or have not yet found a way to, see the cognitive part of the actual process of replication in action. We only observe the result—the signal produced. The replicators are linguemes in utterances, that is, observable signals. As linguists, we observe the signals and judge that, say, this part of the signal is an instance of /u/ that replicates a prior instance of /u/, or that it is an instance of the English word *heart* and it replicates a prior instance of *heart*. But we may legitimately wonder, how is the just-produced /u/ or *heart* replicated by a language user from a prior instance? And which prior instance, or perhaps instances?

The exemplar-based model, and the psycholinguistic evidence supporting it (see references in §1), suggests that it is plausible to assume that speakers/signers are basing their current productions on knowledge of prior productions. Additional evidence that suggests that replication is the cognitive process in production is the phenomenon of priming, and the primacy and recency effects in psycholinguistics, all of which suggest that particular exemplars, not just some category abstracted from prior exposure to utterances, serve as the basis of speaker/signer production. Likewise, the phenomenon of accommodation also suggests that speakers/signers are using just used utterances of their interlocutors as the basis for their own utterance productions.

The simplest model of how language users replicate linguemes is that language users store all exemplars (subject to forgetting and other phenomena that might remove them). In producing an utterance, the language user replicates a particular exemplar in her store of each sound/sign, word and construction, and recombines them in the way that they occur in that utterance. This is a ‘single parent’ model of replication, that is, a single parent for each lingueme replicated in the utterance. The utterance as a whole has multiple ‘parents’, namely the parents of the different linguemes that constitute it.

Something close to this model has been implemented computationally (Baxter et al. 2009; see also Blythe and Croft 2012, 2021; Baxter and Croft 2016). The grammar of the language agent is a store of tokens of variants of a linguistic variable; the simplest case has two variants, α and β . The agent selects one of the tokens in the store to replicate in the current utterance. Many factors govern the choice of a token, including the frequency of tokens of that type, any valuation the language user has towards that variant, who produced the token and what the user's attitude is towards that agent. Once the token is replicated to produce a new token, it is added to the store of each interlocutor.

A more complex model would have multiple prior exemplars somehow contributing to the replication of a lingueme in an utterance. The lingueme would “mix” or “blend” structure from all of the prior exemplars that serve as its parents in the replication process. However, an alternative analysis would be that the partial structures inherited from the different parents are the actual replicators. For example, in sexual reproduction in biology, parts of the offspring's genome are inherited from both parents, but those structures (genes) are considered to be the replicators, and sexual reproduction is analyzed as recombination of those replicators. In other words, it is at least possible and perhaps desirable to reanalyze what the replicators are when there is a clear case of multiparent replication of replicators.

Still another theory is the embodied cognition/phenomenological analysis of human perception and interaction with the environment, including other people (see §2). In this theory, human behavior, including language, does not use internal representations, but instead is a cognitive/social skill, learned and mastered to a certain degree, like a physical skill is. It is embodied learning via a series of interactions by the agent with her interlocutors and her world. The outcome is still replication of signals. However, the way that a replicator's structure is replicated from one utterance to the next is not mediated by a mental representation of that replicator.

The nearest computational model to this theory is what Ambridge (2020b) calls a ‘BERT-type’ neural network model, i.e. ‘models that use huge numbers of units and hidden layers to abstractly re-represent exemplars [i.e. utterances and their linguemes] in the service of some task’ (Ambridge 2020b:655, fn. 3). Of course, such models have serious deficiencies, as Ambridge notes (Ambridge 2020b:643), such as lacking communicative goals or any understanding of the symbolic relation to real-world situations (meanings). In other words, it is at best a partial computational model of the embodied cognition theory (see also Dreyfus 2007).

Any of these models of human cognitive behavior results in the replication of linguemes in utterances, the central phenomenon to a lineage-based linguistics. However, it is difficult to impossible to determine the actual lineage of all exemplars that even a single speaker/signer produces. The parent replicator is determined internally to the speaker/signer, either via a mental representation of the exemplar or as a reflex of embodied cognition. Since replication involves mostly faithful reproduction of the structure of the parent replicator, we can reasonably assume that the parent of a lingueme in an utterance closely resembles the lingueme in form and function in context. We cannot go farther than that, at least not with current neurolinguistic techniques. However, this is not that different from the problem of identifying what sociolinguistic factor a speaker is using to replicate a variant (lingueme) in social interaction. Those factors are also internal to the speaker/signer. The computational models used by Baxter et al. cited above narrow the possibilities in certain circumstances. They could also be used to narrow the possible lineages that lead to the replication of particular linguemes in specific utterances.

3.4. Linguistic categories as populations

In order to explain the population definition of linguistic categories, we start with the definition of a single word, such as English *heart*. In an essentialist theory, English *heart* is a single individual abstract unit with a particular form and meaning, possibly multiple meanings, as in a dictionary entry. In the essentialist view, the word has its word class as an essential property, as asserted in introductory linguistics and syntax textbooks in various approaches, generative and otherwise (e.g., Carnie 2013:44; Fabb 2005:11; O’Grady et al. 1997:164; Finegan 2007:35).

In the population view, English *heart* is a population of uses of the word, replicated through the lifetimes of speakers of English and, thanks to the overlap of generations of speakers, through the history of the language. Thus, a word as a population has a historical (temporal) as well as a spatial dimension. Of course, for a single speaker, the most relevant uses are those in that speaker’s direct experience. But the uses that speaker is exposed to are replications of prior uses outside the speaker’s immediate spatiotemporal experience, and those prior uses influenced the uses that the speaker experiences. The uses of *heart* in the English speech community form a lineage, or rather a set of intertwining lineages of replications of prior uses. These lineage structures may not seem very relevant to the analysis of a common word such as *heart*: we mostly pronounce it the “same” way and give it the “same” meaning. The lineage of uses is more obviously central to the understanding of a theoretical term such as *adjective* or *language universal*. The word’s lineage is reflected in citations in the linguistic literature referring to prior uses of the term, tracing the history of its use and the evolution of its meaning.

The same appears to be true of sounds as populations. As noted in §2, in the exemplar model of phonology, a single phoneme is a cloud of exemplars mapped onto phonetic space. It is often the case, however, that the phonetic realizations of, say, different English vowel phonemes phonetically overlap. That is, the phonetic properties of the vowel in an utterance in themselves do not indicate to the hearer which vowel phoneme the vowel token belongs to. In some cases, the quality of a vowel is influenced by coarticulatory effects of neighboring phonemes. More generally, however, the phoneme category is defined by the word that the phoneme occurs in; this is why, for example, English dialectologists refer to a vowel by set of words that the vowel occurs in through history and dialect diversification, e.g. the TRAP vowel (see for example Gordon et al. 2004, chapter 6). In other words, the phoneme as a phonological category is partly defined by its grammatical context, namely the position in the phonological template of the word it occurs in (Vihman and Croft 2007:718-19). The phoneme population is defined as the relevant phonological part of replications of the set of words that contain that phoneme.²

The same applies to word classes vis-à-vis constructions, *mutatis mutandis*. Word classes are distributionally defined. They are therefore language-specific and construction-specific (Croft 2001, chapters 1-2). What makes *heart* an English Count Noun is not some inherent property but rather its occurrence in the relevant role in the morphological [COUNTNOUN-PL] construction. The [COUNTNOUN-PL] construction is a population of replications of form-meaning pairings, including replications of *hearts*. Hence the English Count Noun class is a population of elements occurring in the corresponding population of the [COUNTNOUN-PL] construction. The [COUNTNOUN-PL] construction is in turn a recombinant part of the subpopulation of English utterances that contain that construction. The same applies to syntactically-defined word classes.

² I am not aware of analogous research along these lines for signed languages, but I would hazard a guess that the same phenomena would be observed for signs.

The English Passive Subject, as in *She was fired by Musk*, is a population consisting of the phrases that occur in the relevant role in the population of the English Passive construction.

This population analysis of grammatical categories, from phonemes to constructions, resolves a contentious issue in language description and comparison, described in the next section.

4. Kinds and populations in comparison and description

I have presented an ontology of entities and categories of entities that pertain to linguistic phenomena. Kinds, also known as types or essentialist categories, are categories of entities that are defined by a set of properties whose definitions in turn are unbounded in space and time. These properties are typically inherent properties of entities, applicable to the entity as a whole (e.g. turquoise as a mineral) or to its parts and structure (e.g. the chemical composition of turquoise). Individuals, also known as historical entities, are spatially and temporally bounded. Individuals have structure; some categories of individuals of interest here are cohesive wholes. A population is made up of individuals, and is defined relationally, specifically by the relation of replication. A population as a whole is itself an individual: it is spatiotemporally bounded.

In the preceding sections, I have argued that many linguistic phenomena, including linguistic structures and categories are populations, not kinds, contrary to assumptions made in most linguistic theories. In this section, I will argue that a number of issues in language description and comparison can be resolved by carefully distinguishing which linguistic concepts are kinds and which are populations defined by lineages.

4.1. Comparative concepts vs. language specific categories

There has recently been considerable debate around the contrast between what Haspelmath (2010, 2018) calls ‘comparative concepts’ applied across languages in typological analysis, such as ‘adjective’, and language-specific categories, which Haspelmath calls ‘descriptive categories’, such as ‘English Adjective’. The positions range from assuming that there is no contrast between comparative concepts and language-specific categories, to the view that between the two there is an ‘ontological difference: comparative concepts are a different kind of entity than descriptive categories’ (Haspelmath 2018:84).

I have argued for the latter view, but not defined in quite the same way as Haspelmath, and not explicitly using the ontology presented here. Comparative concepts are kinds, while language-specific categories are populations. In the uniform view, both comparative concepts and language-specific categories are kinds.

Some issues arise in comparing the linguistic phenomena to nonlinguistic phenomena. Dahl discusses a philosophical contrast between ‘Universal’ and ‘Individual’ (Dahl 2016:427). He identifies the basic contrast as being between a Universal category defined independently of time and space (and named by a common noun) and an Individual entity, whose definition is bound to time and space (and named by a proper name). However, Dahl then discusses interpretations of the source of the defining properties (realist, conceptualist or nominalist). Haspelmath takes up this digression to argue that only ‘natural kinds’ are defined in realist terms (‘properties independent of our minds’, citing Dahl 2016:428), and therefore claims that comparative concepts are not kinds, or at least not what he calls ‘natural kinds’ (Haspelmath 2018:90). This is because, according to Haspelmath, comparative concepts are created by linguists; they aren’t

“there in nature” (the realist theory). Haspelmath goes on to say that this is what distinguishes natural kinds from comparative concepts: the latter are created by observers. He also suggests that nonlinguistic concepts like ‘mountain’ are comparative concepts, but not natural kinds.

I will return to this point in §4.3. The central point here is that what defines a kind is that the set of definitional properties apply independent of space and time, not where those properties came from—“reality” or “our minds”. Perhaps this is not a critical difference, because both comparative concepts, whether linguistic or non-linguistic, and “natural kinds” are kinds. This is usually described by saying that comparative concepts must refer to cross-linguistically valid properties that can be applied to all languages, not properties that can only be defined with respect to a single language (Croft 2003). Haspelmath also describes comparative concepts in this way (Haspelmath 2018:88-89).

Haspelmath also includes biological species as ‘natural kinds’ in his sense, because a species is ‘a category of animals that form a group regardless of any observers’ (Haspelmath 2018:90). But species are not kinds, according to population thinking in biological evolution. Dahl (2016:433) and Spike (2020:477-78) criticize Haspelmath for including biological species as ‘natural kinds’, because their definition is not obvious. But Dahl does not discuss population thinking; Spike mentions it as just one way of thinking of species, without further discussion. As we will see in §4.4, both Dahl and Spike are correct in stating that the definition of species is controversial in biology and philosophy. But I wish to clarify here what is going on in languages before turning to nonlinguistic phenomena.

4.2. Language comparison and description, kinds and populations

Haspelmath and others, myself included, have focused on comparative concepts used in typology and language-specific categories such as word classes or phonemes. I have argued here (and elsewhere, albeit in different terms) that comparative concepts are kinds and language-specific categories are populations. But it would be incorrect to say that language comparison is, or should, only be done using comparative concepts (kinds), and single language description is, or should, only be done using language-specific categories (populations).

There is an entire subdiscipline of linguistics devoted to comparison of languages as populations: (comparative-)historical linguistics. In comparative historical linguistics, languages are compared to identify cognate forms, and to trace lineages from a parent language to the various descendant languages: sound changes, etymologies and grammaticalization chains and other paths of syntactic or constructional changes. It is just typology that primarily is based on comparison using kinds: cross-linguistically valid properties of linguistic function and even of linguistic form. This is what the term ‘typology’ indicates: comparison of languages with respect to types (kinds). We can refer to these as HISTORICAL COMPARATIVE CONCEPTS and TYPOLOGICAL COMPARATIVE CONCEPTS respectively.

And historical linguistics and typology are not completely independent fields of study. Language sampling for typology takes into account language history by constructing a genealogically and geographically diverse sample, to minimize the likelihood of historical relatedness of the linguistic phenomena being compared, due to descent or contact. Diachronic typological universals are universals of language change that are manifested directly in language lineages, where we have evidence for them. Diachronic typology dates back to the emergence of modern linguistic typology (Greenberg 1964, 1969, 1979). Many typologists believe that many if not all synchronic typological universals of language are best explained by universals of

language change, i.e. diachronic typology. In typological comparison, a typologist employs both kinds (typological comparative concepts) and populations (language history and phylogeny, i.e. historical comparative concepts).

Conversely, language description involves describing, that is, categorizing, linguemes—tokens of language use—in terms of substantive properties of language form and function, that is, kinds. A description of the phonology of a language, among other things, roots the phoneme descriptions in terms of phonetic properties. A description of the morphosyntax of a language roots the word and construction descriptions in terms of semantic and discourse properties, which are kinds, as well as certain basic formal properties such as zero vs. overt coding, linear order and so on which are also kinds. We can describe kinds in language description as TYPE PROPERTIES or TYPE CATEGORIES.³

There are also properties that pertain to grammatical categories and constructions as populations. We can describe population-based properties of grammatical categories and constructions as HISTORICAL PROPERTIES or HISTORICAL CATEGORIES. For example, the fact that *afraid* is predicated in the English Copula construction (*He was afraid of the consequences*) is a historical property of *afraid*. The spatiotemporally bounded nature of this property can be seen from the fact that predication of *fear* is expressed in the basic English Predication construction (*He feared the consequences*). More generally, distributional properties are historical properties, as are constructions, linguemes in general, and utterances.

Properties of constructional function can also be historical properties. For example, the fact that the English Copula construction is used for property predication (*She is tall*), object predication (*She is a professor*), and location predication (*She is in her office*), that is, the polysemy of the English Copula construction, is a historical property of that construction. This is evident in that this pattern of polysemy is not found in all languages. In contrast, the fact that the English Copula construction includes overt coding of the predication function (in the copula) is a type property of the construction. Overt (vs. zero) coding of a function is a property applicable to a construction independent of its spatiotemporal, that is, historical, nature.

There is another important way in which language description involves the analysis of linguistic properties of kinds and populations, even in the perspective of a population-based analysis of linguistic categories. In the population-based model, categories of linguemes are grouped together by shared lineages. These lineages are produced in the process of replication. Replication involves inheritance: replication is mostly faithful, and replicates possess most of the structure of the parent replicator (see §4.1). This structure can be described as properties of the lingueme's form and function.

Yes, they can and do change over the course of replication, and any property of structure can change, so the population as a whole cannot be given an essentialist definition. But what is interesting of course are the changes in type properties that occur in replication. These “unfaithful” changes that happen in replication are indeed the same changes that typologists are looking for in diachronic universals (Croft 2010, 2016), for example the changes in form and function in grammaticalization, cycles of creation and replacement of articles, word order

³ Type properties are close to what Haspelmath (2018:86-8) calls ‘etic comparative concepts’. Haspelmath argues that these are not relevant to description of specific languages. But this is not true: any language description will and should describe the phonetic realization of phonemes and the range of functions of morphosyntactic forms. Haspelmath seems to be assuming a monosemy analysis of linguistic forms, with a single type property covering all and only the meanings of a word or construction, or all the phonetic values of a phoneme. But this is overwhelmingly not the case for phonemes or constructions.

changes and so on. And these type properties play a major role in causing language changes to be the way they are, that is, when an altered replicator acquires certain meanings or functions, they are often set on a path of change that recurs across languages.

4.3. The importance of distinguishing kinds and populations in linguistics

The theoretically interesting issue is: what language phenomena are best analyzed as populations, and what phenomena are best analyzed in terms of kinds? And: what properties of a linguistic category or construction are historical properties, and what properties are type properties? From this basic ontological perspective, it appears to me that the most controversial issue is whether grammatical categories in specific languages should be analyzed as kinds or populations. The proposal here (and in Croft 2000 and subsequent publications, such as Croft 2021, 2023) is to treat language-specific grammatical categories as populations. The population analysis of linguistic categories is a plausible extension of the usage-based, exemplar-based model of language. It is also a natural extension of the Radical Construction Grammar analysis of language-specific categories as derivative of the constructions that define them.

The more standard approach to specific language categories is to define them as kinds, more specifically, as instances or subtypes of the more general kinds that are taken to be comparative concepts. For words, their syntactic category is usually treated as an essentialist property of the word (see §4.3). This approach leads to problems for both the definition of specific language categories and of comparative concepts, that is, categories that can be applied across languages. These topics have been discussed more extensively elsewhere, so the summary here will be brief.

The problem for defining specific language categories as kinds—an essentialist definition—is that methodologically, it is generally agreed that the syntactic analysis proceeds by what American structuralist linguists called distributional analysis. Distributional analysis is the occurrence of linguistic elements, e.g. morphemes, words, or larger syntactic units, in a role (also called slot) of a construction, for example in the Subject role of the English Passive Construction. Anything that occurs in that role is a member of the Passive Subject category, and anything that doesn't, isn't.⁴ Yet this is patently language-specific: the English Passive Construction is a construction of English, and the phrases that occur in its Subject role are English phrases. Occurrence in the English Passive Construction is not an inherent property that could be used to define a 'passive subject' comparative concept across all languages.

The usual strategy to deal with this anomaly is to consider the distributional facts in particular languages as “diagnostics” for identifying the essentialist cross-linguistic category of passive subject, of which the English Passive Subject is an instance. But the diagnostics have to be different in different languages. This leads to disagreements on analysis: one linguist's diagnostic is another linguist's irrelevant grammatical distribution. If one believes the essentialist category exists in the language, then one finds a diagnostic that will indicate it; if one doesn't, then one doesn't find such a diagnostic. This is what I call methodological opportunism (Croft 2001), and Haspelmath (2018:101-2) calls diagnostic-fishing.

⁴ I am of course abstracting away from some important issues here, such as how the construction as a whole is interpreted depending on what occurs in the Subject role, differences in frequency of occurrence of different syntactic elements in the Subject role, and other usage-based phenomena that would necessarily affect the description of the English Passive Subject category. But my point is that even abstracting away from these issues still leaves serious problems in an essentialist analysis of a grammatical category such as “passive subject”.

The flip side of this problem is positing universal linguistic categories as comparative concepts. Linguistic categories are distributionally defined, hence language specific. Moreover, they are populations, not kinds. Nevertheless, there are ways to compare categories across languages, and even to do distributional analysis across languages, without engaging in methodological opportunism. Basically, one uses cross-linguistically valid properties, i.e. comparative concepts in Haspelmath's and my sense, to align both the construction determining the distribution and the units that fill the relevant role in the construction for the distribution.

For example, in Croft (1991, 2001) I fix the constructions determining the distribution for major parts of speech to be the propositional act constructions for reference, predication and modification constructions of a language. The propositional act function is a type property of the construction, defined in information-packaging terms. Most languages have multiple, different strategies for expressing reference, predication and modification. I distinguish these strategies in terms of language-independent morphosyntactic properties, such as structural coding (the number of morphemes expressing the function) and behavioral potential (the number of cross-cutting functional distinctions that are formally expressed in the construction). These are type properties of constructional form. These two type properties generally converge to indicate the typological markedness of the construction's strategy, a universal ultimately explained by token frequency (see Croft 2003). Then I identify the words in the language that fill the relevant role in each language-specific reference, predication and modification construction, and compare them to the corresponding words in the other languages via their meanings or more precisely, their translation equivalents—also a type property.

Of course, when this is done, the actual distributional mapping varies across the languages, and across the different propositional act constructions in a single language. It turns out that there is an empirically observed typologically universal relationship between the semantics of the words (i.e. translation equivalents) and the morphosyntactic typological markedness properties of the reference, predication and modification constructions that they occur in. Specifically, there is a typological prototype of object reference, another prototype of action predication, and a third prototype of property modification, which are typologically unmarked as defined by structural coding and behavioral potential. I treat these prototypes as comparative concepts, and name them 'noun', 'verb' and 'adjective' respectively.

There are three observations to be made about these typological comparative concepts. First, although a cross-linguistic distributional analysis was performed, the result was not a universal word class. The comparative concepts of noun, verb and adjective in *Radical Construction Grammar* and *Morphosyntax* are functional prototypes.

Second, these part of speech prototypes are not arbitrary observer-created categories. They are comparative concepts that emerged from the empirical data. The term 'prototype' is shorthand for typological universals of structural coding and behavioral potential. They reflect 'natural' properties in the data. Of course, like all empirical data, they are observed data.

Third, the 'comparative concept'—the functional prototype—is equally relevant to single language description. Object reference is the best place to start to describe a language's Noun word class, and action predication the best place to start to describe a language's Verb word class. And those starting points, coupled with the typological universals, are important for describing distributional variation in single language description. Languages have a very high degree of distributional variation for words and other units that fill the roles of larger constructions. But the same patterns of variation emerge in single-language analysis as in cross-linguistic typological analysis. Table 1 illustrates this point.

<i>Distributional variation:</i>	<i>Single-language</i>	<i>Cross-linguistic</i>	
<i>Predication of:</i>	English	Nubian	Ainu
object concepts	<i>Kim is a violinist.</i>	<i>ai Ilāhina rasūl ē-ri</i> 1sg God.GEN messenger COP-1sg.PRS 'I am a messenger of God.'	<i>taanpe seta ne</i> this dog COP 'This is a dog.'
property concepts	<i>Kim is tall.</i>	<i>ai séri ē-ri</i> 1sg good COP-1sg.PRS 'I am good.'	<i>ku-mismu</i> 1sg-lonely 'I am lonely.'
action concepts	<i>Kim sings.</i>	<i>arrág-jur</i> dance-1pl.PRS 'We dance.'	<i>ku-ipe</i> 1sg-eat 'I eat/ate/will eat.'

Table 1. Comparison of single-language and cross-linguistic distributional variation in predication of object, property and action concepts. Cross-linguistic data from Stassen (1997:133, 145; see Refsing 1986:145, 117, 244; Reinisch 1879:157, 102, 140)

In English, property predication involves a form of the copula *be*; object predication involves *be* and also the indefinite article *a*. As a result, in English, property predication has more overt coding than action predication, and object predication has more overt coding than property predication. Cross-linguistically, property predication may have more overt coding than action predication, as in Nubian, and object predication may have more overt coding than property predication, as in Ainu. The same distribution pattern of overt coding of predication of different semantic classes is found within English and across languages. It's just that cross-linguistic comparison with a diverse language sample is likely to reveal universal patterns of variation faster than a single language description.

Van der Auwera and Sahoo argue that comparative concepts and language-specific categories are 'the same sorts of entities', because 'they are both sets of properties' (van der Auwera and Sahoo 2015:139). This is not sufficient: everything is a set of properties, and properties can be defined as anything. What matters is what kind of things they are—in this case, kinds or populations—and what kinds of properties they have—type properties or historical properties, or in the case of language comparison, typological comparative concepts or historical comparative concepts.

4.4. Additional issues in the ontology of theoretical concepts in linguistics and elsewhere

A good deal of the discussion in Dahl (2016), Haspelmath (2018) and Spike (2020) is about the vagueness of theoretical concepts such as 'mountain', or differences over theoretical concepts such as biological species. Haspelmath calls 'mountain' a comparative concept rather than a natural kind because the distinction between a mountain and a hill is rather arbitrary (Haspelmath 2018:90). But Spike argues that 'mountain' is a useful theoretical concept in geology; for instance, orogeny, the process by which mountains are formed, is a phenomenon that has been studied extensively (Spike 2020:482). 'Mountain' may require more precise definition, or perhaps can only be defined in terms of certain geological processes. But it is clearly a kind, not a population: it is not a spatiotemporally bounded category.

The population theory of species is still questioned by some in evolutionary biology (Mayr 1982:276, 279; Hull 1988:213, fn. 2). Hull's 1988 book uses this debate as a case study for Hull's General Analysis of Selection as a theory of conceptual change in science. Both Dahl (2016) and Spike (2020) appeal to the theoretical concept of a homeostatic property cluster to define biological species, following Boyd (1999). A homeostatic property cluster is a set of properties that most but not all members of the category have, and those properties are relatively stable. An appeal to a homeostatic property cluster allows for some members to lack properties, such that the category as whole cannot be defined by a set of properties; and those properties tend to persist over time.

It is hard to see how the homeostatic property cluster concept would be a useful one for defining species. It is a pseudo-essentialist concept: a set of properties that are not spatiotemporally bounded defines membership in the category, but not every member has to have every property, as long as they have most of the properties for a long enough period of time. But what counts as 'most of the properties', and what counts as a 'long enough period of time' is not defined. Defining a species, or a linguistic category, as a homeostatic property cluster does not predict the evolutionary properties of species or linguistic categories. However, if one adopts the population theory of biological species and linguistic categories, the population theory predicts that species will look like homeostatic property clusters, at least over a short period of time (or a not too lengthy sequence of replications). Replication is mostly faithful, so members of the population will share most of their type properties, at least over a relatively short period of time. But over longer periods, populations will evolve to the point that type properties of the original replicators may be completely lost and replaced with other type properties. Finally, despite the variety of definitions of species in biology, de Queiroz (1998, 2005) argues that many apparent conflicts in details among different definitions of biological species can be resolved by seeing them as variations on, or epiphenomenal on, a more general lineage-based population definition—which is the one used in this chapter.

Both Dahl and Spike propose comparative concepts of linguistic categories as homeostatic property clusters. But the question is whether they are more useful as such than more precisely defined comparative concepts as kinds, combined with language specific categories as populations. The methods and results that Dahl uses for tense-aspect categories (e.g. in Dahl 1985; see also Dahl and Wälchli 2016) are compatible with comparative concepts defined in cross-linguistically valid ways (i.e. as kinds) and a population theory of grammatical categories. Dahl and Wälchli argue that whereas most typological analyses proceed onomasiologically, starting from function or meaning and comparing languages as to how they express forms, they proceed semasiologically, proceeding from forms and comparing the range of functions or meanings they express (Dahl and Wälchli 2016:328-29). However, in order to compare forms across languages, Dahl and Wälchli must initially look at the set of functions expressed by the forms in order to categorize those forms in term of clusters or relevant functions (e.g. as 'perfect' or 'iamitive' in their 2016 article). That is, there is an initial onomasiological stage in their analysis, before grouping functions in terms of a shared form in a specific language.

Dahl (2016) and Gil (2016) suggest that different dialects, varieties and even languages may have the "same" category, e.g. the Perfect in different English dialects or the Relative Case in Eskimo-Aleut languages (Dahl 2016:430). Gil extends this idea to code-mixing and borrowing. What these categories have in common is a shared lineage (language contact can lead to category lineages "jumping" from one language to another via bilingual speakers). These are historical comparative concepts, not typological comparative concepts. One can still ask how these

grammatical categories are defined in the different dialects or languages. If they are defined by the historically same construction in all of the languages, that is, cognate constructions, then the grammatical category defined by that construction can be considered a legitimate historical comparative concept.

Finally, with respect to Haspelmath's concern with supposedly observer-free, naturally recognizable categories vs. categories created by observers: all categories are part of scientific theories. Scientific theories are debated by communities of scientists, such as typologists or descriptive linguists. As a result, the definitions of theoretical concepts vary across scientists. As a theory evolves, the definitions of theoretical concepts often change; the older definitions in retrospect seem vague, ambiguous, or just plain wrong. In other words, theoretical concepts in a scientific theory also form a population; they do not have essentialist definitions (this is the basic thesis of Hull 1988; see also Hull 2006; Croft 2024). However, we can ask for a particular scientist, or a particular publication of that scientist, whether her definition of a theoretical concept depends on spatiotemporal boundedness or not, and then conclude whether her theoretical concept represents a population or a kind.

5. Replicators, artifacts and language revitalization

In language endangerment research, and particularly among community members, the biological metaphor of languages as “living” or “extinct” has been criticized. Extinction implies that the language is gone forever. A language is instead considered to be ‘sleeping’ when there are no living users of the language. But a ‘sleeping’ language can be ‘awakened’ if there exists documentation that can be used by community members to start using the language again. The theory of language described in this chapter is obviously very close in structure to the theory of biological evolution, specifically population thinking in that theory. How does this theory accommodate language awakening?

In §3, replicators are described as instances of linguistic behavior, specifically the production and reception of utterances by interlocutors in acts of communication. The same applies to many other types of cultural evolution, such as pottery making, riding a horse, or music performance. Demonstrating the cultural act and its imitation are examples of cultural replication; these can of course also be mediated through verbal instruction.

But artifacts are also cultural replicators (see §3.3). They are individuals with structure that can be replicated with varying degrees of faithfulness. They form lineages that diverge, and can for example provide archaeologists with evidence of cultural evolution. Written language is an artifact that can serve as a replicator. Replication involving artifacts need not include direct interaction between the person who created the artifact and the person who is replicating the artifact. For example, in this and other publications, I have replicated technical terms and the theoretical concepts they express from linguists I have not met, or who died long ago.

If a language stops being used, the lineages of behavioral replicators end; but if there are artifactual replicators, they will survive as long as the artifacts survive. This is unlike behavioral replicators, which vanish as soon as they are produced, except for the traces in the memories of those who produced, heard or viewed them. Of course, the meaning and context of use of replicators must be inferred, and much of that is difficult if not impossible to extract from artifactual replicators after their initial (re)production, though such replicators may be supplemented with, for example, translations that shed light on their meaning to their users.

The artifactual replicators (writing, audio, video) that survive can serve as the parent of future behavioral replicators which can be replicated in social and functional contexts resembling those of the behavioral replicators that came to an end with the deaths of the previous fluent speakers/signers. Due to the lack of context of artifactual replicators, once they are replicated anew in interpersonal communication, they will be altered in function, as Modern Hebrew is compared to its Ancient Hebrew ancestor. But all languages change, so this phenomenon is not surprising.

6. Conclusion

Linguistics is a scientific discipline whose object of study—language, its structure, function and social context of use—is not kinds but populations: speech communities and the speakers that belong to them, and utterances and the grammatical categories and constructions (i.e., linguemes) that constitute them. A population is a set of individuals that are connected to each other through intertwining lineages of replications, and distinguished from other populations by the (near) absence of replication relations with individuals in the other populations. Both populations as wholes and the individuals that make them up are spatiotemporally bounded, that is, historical entities. The replication process is a social-interactional one; hence grammatical categories are in effect social histories of the use of the linguistic form in a language community. This is lineage-based linguistics. Although populations and individuals are historical entities, they possess type properties, at least for a period of time, and those type properties enter into causal relations with the evolutionary processes of replication and selection of individuals in the populations. Lineage-based linguistics thus requires identifying what is a historical entity (individual or population) and what is a kind, and how their interplay allows us to describe languages and explain language diversity and change.

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