

*Affordances perspective and grammaticalization:  
Incorporation of language, environment and  
users in the model of semantic paths<sup>1</sup>*

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Abstract

The present paper demonstrates that insights from the affordances perspective can contribute to developing a more comprehensive model of grammaticalization. The authors argue that the grammaticalization process is afforded differently depending on the values of three contributing parameters: the factor (schematized as a qualitative-quantitative map or a wave of a gram), environment (understood as the structure of the stream along which the gram travels), and actor (narrowed to certain cognitive-epistemological capacities of the users, in particular to the fact of being a native speaker). By relating grammaticalization to these three parameters and by connecting it to the theory of optimization, the proposed model offers a better approximation to realistic cases of grammaticalization: The actor and environment are overtly incorporated into the model and divergences from canonical grammaticalization paths are both tolerated and explicable.

*Keywords:* affordances; grammaticalization; cognitive maps; verbal semantics; complexity; optimization

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## 1. Introduction: The affordances perspective

The concept of affordances has recently become a crucial idea in some branches of linguistic science. It has been employed in sociolinguistics, but the areas where it has gained particular importance are language acquisition, language teaching (Dewaele, 2010; Otwinowska-Kasztelanic, 2009, 2011; Van Lier, 2000, 2007) and, especially—due to the pioneering but far-advanced studies conducted by Larissa Aronin and David Singleton— bilingualism and multilingualism (Aronin & Singleton, 2010, 2012; Singleton & Aronin, 2007).

The very idea of affordances originates from the ecological work of Gibson (1977, 1979/1986), who coined the term *affordance(s)* in relation to animals and their ecosystems, defining it as follows: “The *affordances* of the environment is what it *offers* the animal, what it *provides* or *furnishes*, either for good or for ill” (Gibson, 1979/1986, p. 127). By resorting to a simplification, it is possible to say that affordances are “possibilities for action” (Aronin & Singleton, 2012, p. 311). These possibilities are activated as a result of a joint coexistence of the properties characterizing a specific factor (an object or one of its dimensions that is viewed as ultimately causing the action), its environment (the settings that assure that the action can be performed) and the actor (the agent that may perform the action). In other words, the biological idea of affordances means that certain physical properties of an element, accompanied by environmental settings, instigate species to act in a determined manner. The action as such is, thus, conditioned by parameters related to the three aforementioned variables: factor, environment and actor. This implies that an individual factor (or factors that belong to the same type, being characterized by analogical properties) may offer different affordances for distinct actors and for distinct contexts. For example, a red light can act as a warning, triggering the state of being alert and, as such, can be used in various places and devices. However, this effect ceases to exist if the actor is sightless or if the context does not enable redness to be distinguished from the accompanying settings (for instance, if the red light is placed on an equally red wall). Even though the light with the exact physical dimensions that make it red (i.e., a specific wave length) can—and usually does—afford for the expected action, the properties of the environment and actor (who is aimed at performing a given action triggered by this red object) have an important impact on the actual effect. In fact, certain characteristics of the environment and actor are necessary so that the factor is able to initiate the demanded action. Therefore, it is safe to say that the affordances perspective<sup>2</sup> in ecology emphasizes the connection and mutual influence between all the

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<sup>2</sup> Instead of using the terms *theory*, *approach* or *framework*, we will employ the word *perspective*.

components of an ecosystem, be they factors (physical dimensions of a causal object), environment (structure of the milieu in which both the factor and actor exist) or actors (species performing the action).

As noted by Aronin and Singleton (2012, p. 323), the explanatory power of the concept of affordances is immense. Although the affordances perspective is applicable to various fields of research, it is particularly useful for treating problems related to cognition, society and language. Having adapted the idea of affordances to the area of multilingual studies, Aronin and Singleton (2012) view the phenomenon as emergent at interfaces of language(s), users and environment. In general terms, language affordances are “affordances through the realization of which communication via a language or languages or the acquisition of a language or languages is possible” (Aronin & Singleton, 2012, p. 318). This approach to affordances harmonizes with a tripartite model of multilingualism, where three elements—language, environment and user—are closely interconnected, if not inseparable. Affordances emerge at cross-sections of the border areas, where two (user-environment, user-language and environment-language) or all three of the aforementioned components (user-environment-language) interact. As in ecology, the use of affordances in linguistics stresses the interconnection of the factor, environment and actor in certain actions.

As explained above, the concept of affordances has mainly been used in sociolinguistics, applied linguistics and bilingualism or multilingualism. The more theoretical fields of linguistics have, thus far, paid less attention to this approach and the explanatory benefits it offers. This article aims at introducing the idea of affordances to grammaticalization theory and, in particular, to the theory of semantic paths and cognitive maps.<sup>3</sup>

In order to explore how insights provided by the idea of affordances can contribute to grammaticalization theory, our paper will be organized in the following manner: We will begin the study by explaining the standard model of grammaticalization, grammaticalization paths and cognitive maps. This theoretical discussion will be illustrated by an exemplary developmental scenario, referred to as an anterior path, and the mappings that are built on it (cf. Section 2). Next, by using the affordances perspective, we will argue that the action of grammaticalization is afforded differently (a gram<sup>4</sup> is grammaticalized in a distinct manner) depending on the values of the three parameters: the factor, environment

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<sup>3</sup> It is worth noting that in *The Oxford handbook of grammaticalization* (Narrog & Heine, 2011), there is no reference to the concept of affordances, affordances perspective, or theory.

<sup>4</sup> In this paper, a gram refers to a broadly understood grammatical construction of any grammatical, diachronic or synchronic status. Therefore, it can refer both to locutions that are periphrastic, analytical, poorly grammaticalized and peripheral from the system’s perspective; and to forms that are synthetic, well grammaticalized and constitute the grammatical core of a given linguistic system.

and actor. By fixing two parameters but treating one as a variable,<sup>5</sup> we will show how each one of them can condition grammaticalization. In this manner, the realistic grammaticalization process, that is, grammaticalization that is found in actual languages, will be viewed as a set of affordances for actors (users) to identify a grammatical factor (gram) with a determined grammatical status, given the factor's environment (other grams of the same path; cf. Section 3). First, the parameter of the factor (i.e., the kinetic qualitative-quantitative map<sup>6</sup> of a gram; cf. Section 4) will be analyzed, next the parameter of the environment (i.e., the structure of the stream;<sup>7</sup> cf. Section 5), and finally the parameter of the actor (cognitive-epistemological abilities of speakers; cf. Section 6).<sup>8</sup> After that, we will argue that our technique of allowing only one parameter to be a variable is an oversimplification. In harmony with complexity theory, in the real world, all three parameters – themselves composed of an infinite number of sub-parameters – are variable (cf. Section 7). Subsequently, in the section dedicated to discussion, a further reinterpretation of the adaptation of the affordances perspective to the grammaticalization framework in terms of optimization will be suggested (cf. Section 8). Lastly, in the closing part of the article, the most important conclusions will be drawn and a plan of possible future research designed (cf. Section 9).

We are fully aware of the fact that, for a customary reader of *Studies in Second Language Learning and Teaching*, the topic of this paper may seem foreign and distant as the grammaticalization framework is not typically associated with second language learning. However, we are convinced that, because of the reasons specified below, this article has a suitable home in this journal. First, this paper continues the line of research on affordances that has flourished in the

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<sup>5</sup> This fixing constitutes, of course, an example of scientific simplification, necessary in this type of studies (see below in this paragraph; see also Section 7).

<sup>6</sup> A kinetic (i.e., dynamic and/or directional) map is a semantic map that has a diachronic dimension. The qualitative array of senses conveyed by a form is mapped by means of a template that corresponds to a grammaticalization cline. Each sense (viewed as a stage on the path) is also accompanied by quantitative information concerning its prototypicality or frequency (cf. Section 2).

<sup>7</sup> A stream is an evolutionary channel that is recursively activated in a language to generate formations that develop along and are mapped by the same grammaticalization path (see Section 2).

<sup>8</sup> It is important to note that the reader will be presented with rather narrow views of the environment and the actor. The actor will be narrowed to the stream or the other grams that develop along, and are mapped by the same grammaticalization path. The environment will be limited to certain cognitive-epistemological abilities of speakers, in particular, to the fact of being a native speaker or not. Such a simplification is necessary due to constraints on the length of the paper. It is evident that each one of these two parameters can be further explored so that multiple types of environmental factors and actors can be distinguished and analyzed (cf. the conclusion section).

field of applied linguistics, in particular in the area of second language acquisition and in studies on bilingualism and multilingualism. Our article intergrades the idea of affordances with the theory of grammaticalization, showing how the affordances perspective can be expanded to other branches of linguistic science. Second, as will be evident from the subsequent discussion (see especially Section 6), a part of our discussion is directly related to second language acquisition. To be exact, it concerns the relationship of nonnative speakers or second language learners (either immigrants, who “construct” their pidgin versions of a superstrate, or classroom students, who develop intermediate versions of the target language) to the grammatical status of verbal constructions. Additionally, we demonstrate that language evolution and second language acquisition are governed by the same grammaticalization phenomena and that knowledge of this can enhance the teaching of second language to nonnative speakers. Third, in further parts of the article, another issue, well-known and popular in applied linguistics and second language studies, is considered, namely complexity (see Sections 7 and 8; see also the conclusion section).

## 2. Grammaticalization

Broadly understood, grammaticalization theory studies the evolution of components of grammar at the level of glossogeny (historical change in a population) or ontogeny (in an individual human being). In particular, it “is concerned with such a question as how lexical items and constructions come in certain linguistic contexts to serve as grammatical functions or how grammatical items develop new grammatical functions” (Hopper & Traugott, 2003, p. 1). Of course, grammaticalization is a multifaceted and complex process, in which a number of phenomena take part and converge (e.g., generalization, decategorialization, specialization, increased frequency, morphologization and phonological reduction; cf. Hopper & Traugott, 2003).

As far as verbal meaning is concerned, grammaticalization can be viewed as a theory of developmental semantic paths leading from more lexical inputs to more functional outputs.<sup>9</sup> Such clines offer theoretical, abstract and simplified models of the growth of grammatical formations, showing the crosslinguistic evolutionary tendencies of grams belonging to a similar type. More specifically, they indicate from what types of lexical constructions certain grammatical classes emerge; how they evolve into central categories such as taxis, aspect, tense or mood; and how they disappear or are reused for new grammatical purposes. Consequently, by specifying the source and goal of the development typical of

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<sup>9</sup> In this paper, the theory of grammaticalization of meaning will be narrowed to verbal semantics.

members of a certain class of formations, as well as by linking these two edges (i.e., the original source and the most probable outcome) by an unidirectional sequence of consecutive stages, grammaticalization paths codify exemplary models of the life of grammatical entities. It is assumed that paths represent typologically common evolutions, being travelled by grams belonging to various linguistic families and emerging from a variety of possible input locutions actually found in the languages of the world (Bybee, Perkins, & Pagliuca, 1994; Dahl, 2000).

Currently, rather than indicating realistic developmental stages typical of determined components of a grammar, paths are understood as crosslinguistic models of the incorporation of new senses into the semantic potential of grams belonging to a certain type. This means that grammaticalization clines determine a sequence of values gradually acquired by constructions that are typologically similar; they specify how certain classes of polysemies evolve by integrating new semantic components. Under this view, each stage on the path represents a new meaning to be incorporated and not a realistic state of a gram, as grammatical formations can accumulate values acquired previously in the order predicted by the cline.

Since paths determine the most probable meaning extensions of a given group of verbal formations, they are commonly used as templates for mapping out the semantic potential of synchronic grams. In this manner, by employing grammaticalization clines, it is possible to hypothesize a conceptual and diachronic structure of a given polysemy and propose the most probable chaining of its components. This ordered grid of senses offered by a construction is known as a semantic map. Accordingly, the (total) meaning of a gram at a specific moment of its development is understood as a collection of senses that match a certain path or a section of it. Thus, the meaning can be viewed as the gram's state portrayed as a portion of the cline. This approximation to verbal semantics is typical of cognitive linguistics and usage-based linguistic approaches, where the meaning of a form is represented as a cline (or a network)<sup>10</sup> of interrelated values whose connection is both conceptual and historical, and reflects the direction and sequentiality of grammaticalization paths. In other words, the chaining between the components of the map is based upon diachronic grammaticalization paths, and the extension of one constituent of the map into another is warranted by certain typologically plausible evolutionary scenarios (Bybee, 2010; Haspelmath, 2003; Heine, 1997; Heine, Claudi, & Hünemeyer, 1991; Narrog & Van der Auwera, 2011; Van der Auwera & Gast, 2011).

Since at a given synchronic moment, the meaning of a gram equals a map structured in accordance with a grammaticalization path, the semantic content

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<sup>10</sup> The network analysis is typical of so-called psychological, statistically based and/or space-driven or meaning-driven maps (Zwarts 2010; Narrog & Van der Auwera, 2011).

of a gram being an amalgam of the values acquired and preserved up to that particular moment in time, the realistic evolution of a gram consists in the modification of such a state or map. An actual grammatical evolution can be defined as a historical collection of states or maps displayed by a gram: It indicates how the semantic potential of this form, mapped by means of a grammaticalization path, has been evolving over time. It is, thus, a diachronic trajectory where each stage represents a map constructed at a determined historical moment. The map can change qualitatively, modifying its topology. Namely, it can correspond with different sections of a grammaticalization path at distinct historical periods; it can shrink, expand, and both shrink and expand. However, the map may also be altered quantitatively. This quantitative modification usually equals a change in the frequency distribution of the senses that jointly constitute a map, which leads to a modification of the prototypicality associated with certain parts of the map and with the entire form itself.

Grammaticalization is correlated with the change in prototypicality. Prototypicality, in turn, directly reflects the modifications in frequency. In usage-based linguistic theories, the most prototypical sense is viewed as a conceptual nucleus of the map: It is cognitively most salient, the first to come to mind, and the most frequent. Nonprototypical senses do not enter into the users' representation of a form since they are statistically rare. In corpus linguistics and linguistic studies based on and dedicated to *performance*, the prototypicality is overtly estimable by equaling it with high frequency (Geeraerts, 1988; Gilquin, 2006; Gries & Stefanowitsch, 2006; Stubb, 2004; see also Bybee, 2010, p. 214; Hawkins, 2004, p. 3).

Frequency is a decisive force in grammaticalization, in language evolution and in language change. Frequency is, in fact, regarded as an explicit sign of the progression in grammaticalization. Namely, the modification of the statistical distribution of features (for example, the statistical increase of a sense) triggers the reinterpretation of a form as a member of a new category, because, as explained previously, the more frequent senses are those which users associate with a form and, thus, perceive as independent, context-free and prototypical (for examples of this, see Section 4). Consequently, a change in the statistical distribution of the components of a map causes the modification in the prototypicality of the gram and its association with a grammatical class. Regularly, with a historical progression, the senses covering more advanced sections of the grammaticalization cline increase their frequency while values corresponding to initial fragments of the cline become less common.

To conclude, grammaticalization, understood as an evolution of a gram, stems from the modification of prototypicality, where the change in the statistical weight of the components of the map triggers the reinterpretation of a form

as gradually more grammaticalized; the construction travels towards more advanced sections of the path. In this manner, grammaticalization results from the perception of the frequencies by users and their intuitive association of the form with the meaning (on the role of frequency in grammaticalization, see Ariel, 2008, p. 142; Bybee, 2010, pp. 50-56, 171-172, 193; Bybee et al., 1994, pp. 8-23; Dahl, 2000; Hopper & Traugott, 2003, pp. 126, 129, 172-174).

Unfortunately, in theoretical models of grammaticalization, the role of the human actor and the environment, even though tacitly recognized, is omitted and the process is portrayed as entirely independent of the users and milieu. The standard model presents the grammaticalization of a form as an isolated process where a gram permutes into new evolutionary stages given its internal properties. Let us illustrate this theoretical discussion by the example of an anterior path, an evolutionary scenario—and, thus, a mapping template—which will be used extensively in Section 3.

The anterior path is a diachronic trajectory (visualized as a kinetic vector) that codifies an exemplary evolution of original resultative constructions, specifying the order of the incorporation of a given value into their semantic potential. The path states that resultative grams<sup>11</sup> first evolve into perfects (in the beginning, inclusive<sup>12</sup> and resultative<sup>13</sup> present perfects; later, experiential<sup>14</sup> and indefinite<sup>15</sup> perfects) and subsequently into definite past tenses (initially, recent

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<sup>11</sup> Resultative proper grams (such as *is written* in *The letter is written*) are formations whose meanings consist of two equally relevant components: One indicates the currently attested state of an object or person, and the other makes reference to an action, formerly accomplished, from which this ongoing state has resulted. In such expressions, neither the prior dynamic event nor the posterior static result is emphasized. Frequently, they are intransitive and de-transitive (Nedjalkov, 2001).

<sup>12</sup> The inclusive perfect (also labelled *universal perfect*, *perfect of persistent situation* or *anterior continuing*) indicates that an action or state holds without interruption from a determined point in the past to the present moment: *I have known Max since 1960* (Jónsson, 1992), *Bill has lived in Timbuktu for ten years* (Comrie, 1976, pp. 52-54, 60; De Haan, 2011, pp. 456-457).

<sup>13</sup> The resultative perfect introduces dynamic events, portraying them as highly relevant for the present state of affairs; from a given anterior action it is possible to infer certain properties of the present situation: *I cannot come to your party – I have caught the flu* (i.e., *I am still sick*; McCawley, 1971), *He has arrived* (i.e., *He is still here*; Bybee et al., 1994, pp. 61-62; Nurse, 2008, p. 154).

<sup>14</sup> The experiential perfect indicates that the subject has an experience of having performed (or not having performed) a given action. This means that the activity is portrayed as an experience which occurred at least once, and which might have been repeatable: *I have been to London* or *I have read Principia Mathematica five times* (Bybee et al., 1994, p. 62; Jónsson, 1992).

<sup>15</sup> The sense of an indefinite perfect (also labelled indefinite past) implies that “the situation referred to stops before the moment of speaking” and, thus, that the event occurred in the past (Depraetere & Reed, 2000, p. 97). However, this past time frame cannot be overtly specified and the verbal form fails to be accompanied by overt past temporal adverbials.



and discursive; next, general, remote and narrative). Additionally, during the transformation from a present perfect into a definite past tense, the developing gram may first acquire an explicit aspectual perfective sense and only later evolve durative nuances or values, usually associated with an imperfective meaning (this group of senses will be referred to as a simple past). In general terms, the anterior cline can be represented schematically as in Figure 1.

resultative proper → present perfect → perfective past → simple past

Figure 1 The anterior path

As already explained, grams do not usually jump from one stage to another—especially, if the phases distinguished on the path are very fine-grained—but rather accumulate senses as predicted by the cline. They typically express more than one meaning located on the path, even being able to cover the entire length of the trajectory. Thus, the cline can be used to encapsulate the semantic potential of grammatical constructions. The map of a locution can consist of two, three or more stages, to the degree that, as indicated above, it can span the entire length of the path. For example, grams referred to as old perfects typically cover the intermediate stages of the cline: perfect and perfective past.

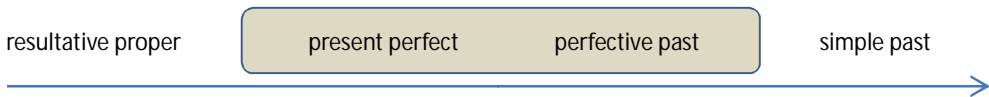


Figure 2 Qualitative map of an “old perfect” based on the anterior path

The map in Figure 2 is referred to as qualitative since it indicates a variety of senses a gram can convey. However, qualitative maps show only a part of the relevant information. The other one is related to the prototypicality of senses. This type of information can be included in the model by expanding the qualitative networks to quantitative ones, that is, by introducing the data concerning the frequency of senses. This information can be represented in the model by means of a vertical axis which specifies the prototypicality (frequency) of a given

Additionally, the idea of the current relevance of the event is less straightforward. Thus, in this usage, which is typical in discourse, a present perfect form may be employed to talk about events which occurred previously, even in a sequential way, without specifying their exact temporal location. As a result, by combining certain properties of perfects and past tenses, this type of perfect constitutes a linking stage between the exemplary sense of a present perfect and a subsequent evolutionary phase, a definite past (Lindstedt, 2000). The indefinite perfect also surfaces in another typical use of present perfects, that is, as the “journalistic perfect of hot news.” This category of perfect introduces events that are clearly located in a past time frame, pairing them with a special stylistic value.

sense available along the anterior cline. Thus, using the qualitative and quantitative information, the meaning of a gram can be depicted as a wave: The horizontal axis represents the sense-stages available on the path, while the vertical axis represents prototypicality (frequency). In this way, the adopted representation indicates the range of the meaning (i.e., the set of senses that are expressed by the gram) and its prototypicality (i.e., it specifies which senses are common and which are rare). Taking as an example the category of old perfects shown in Figure 3, the prototypicality peaks are located in the intermediate zones of a perfect and perfective past, while the values corresponding to the more external sections of the cline, although possible, are significantly less prototypical. For the sake of simplicity, only four values are distinguished on the vertical axis of prototypicality: prototypical (P), middle-prototypical (MP), nonprototypical (NP) and void (0). Of course, this is a considerable rounding of the real state of affairs, which can be infinitely fine-grained and precise since, in this study, prototypicality is understood to reflect numerical frequency.



Figure 3 Qualitative and quantitative map of an “old perfect” based on the anterior path

The development of an anterior-path gram consists of qualitative and quantitative modifications of the map. The former involves the changes in the extent of the path with which a given polysemy can be matched, whereas the latter concerns the changes of the prototypicality of senses corresponding to the stages of the cline. During its grammatical life, an original resultative construction can, thus, be imagined as a wave travelling on an evolutionary stream (in this case, an anterior-path stream, i.e., a channel containing anterior-path grams).<sup>16</sup> Along the stream, there are various—strictly ordered—values to be acquired (resultative, perfect, perfective and simple past). When moving along the stream, the gram takes the shape of a wave placing its front at the prototypicality peaks. While the stages on the anterior cline are predictable and finite, possible configurations of waves on the stream traced by the anterior cline are unpredictable and infinite.<sup>17</sup> In

<sup>16</sup> On the concept of stream compare Note 7.

<sup>17</sup> Since the vertical axis represents the frequency, which can range from 0% to 100% with infinite granularity, there are an infinite number of possible curves of waves, even if the horizontal axis is very coarse-grained, as in Figure 3.

general terms, more grammaticalized and advanced formations will have their wave front at the section located further to the right, while less grammaticalized and less advanced grams will lift their waves at the section located to the left.

Thus, the model also enables researchers to compare grams that (a) can be derived from different lexical sources and (b) offer distinct semantic potential and/or dissimilar prototypical uses. All of them can be represented as waves travelling along the same evolutionary channel, in our case, a stream traced by the anterior path. By conquering or losing domains available along the stream and by transposing its front or prototypicality peak to more advanced regions, each gram of the stream invariably moves forward to the right side of the model (i.e., further from the source located to the left in the model), becoming gradually more grammaticalized. Once more, it is evident that this representation does not account for any influence exerted by the environment (for example, other grams) and the actors (users of the language). The grams develop in isolation as if located in a vacuum.

### 3. Grammaticalization and affordances

The model of grammaticalization paths suggests that if the prototypicality peak of a map is located at one of the distinguished stages of the cline, the gram is grammaticalized as an expression of the senses associated with this stage. This implies that grammaticalization is a direct product of the frequency offered by the components of the semantic potential of a form. In this shape, the properties of a gram under analysis are completely sufficient to determine the grammaticalization status of a formation. Using the example of the anterior path, if a gram locates its prototypicality in the area of a resultative sense, it is grammaticalized as a resultative proper. If the front of the wave is placed in the zone of perfect senses, the locution is grammaticalized as a present perfect. Lastly, if the prototypicality area corresponds to the section of a past value, the form is grammaticalized as a past tense (either perfective or simple). Consequently, the model equates the physical dimension of a gram with a sufficient cause, triggering grammaticalization. It treats grams in isolation from other grams (environment) and users (actors, who perform the grammaticalization action, associating the form with a meaning).

We will argue that the structure of the semantic map offered by a gram corresponds only to one component (i.e., to the factor) that can afford for the grammaticalization of this form as a means of conveying a certain meaning, that is, as a taxis, aspect or tense category.<sup>18</sup> The other two, as implied by and deduced

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<sup>18</sup> Certainly, frequency is an important indicator of usage and the gramatical status of a form, given that it is not only a driving force in the gramaticalziation process but also this

from the affordances perspective, are the environment and actors. Accordingly, the action of grammaticalization is afforded differently if one varies the values of the three parameters: the factor, environment and actor.

For the sake of simplicity, in this paper, the concept of an environment will be narrowed and understood as the organization of the stream along which various grams, mapped by the same path, travel. Put differently, the milieu concerns the question of how the analyzed formation coexists on the stream with other constructions of the same path-map class. As far as the actors are concerned, these will only be studied in respect to their cognitive and epistemological characteristics: How they can perceive the input data offered by the usage, given their knowledge, in particular, whether they are native speakers of the language or not. Last, it should be noted that the discussion will only be illustrated by the grams of the anterior-path type.

By adopting the triangular model of affordances in studies of multilingualism (Aronin & Singleton, 2012, pp. 323-324), in light of the affordances perspective, the theory of grammaticalization—after all the approximations and rounding explained in the previous paragraph have been made—can be schematized as shown in Figure 4. In order to demonstrate how each of the three components of this triangle is important for grammaticalization, we will adopt the following procedure: In each section, a situation where two of the parameters are fixed while one of them is variable will be discussed. By modifying the values of this unique variable, we will show that the grammaticalization status of a gram changes proportionally.

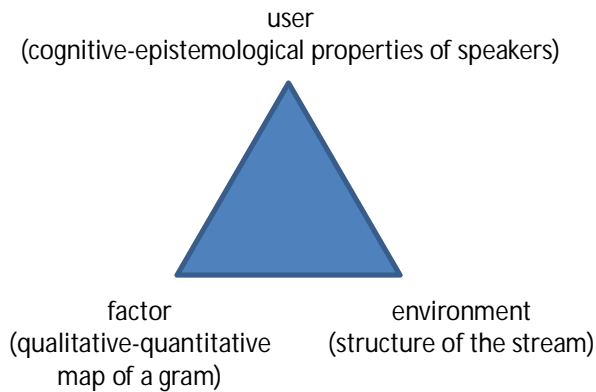


Figure 4 Grammaticalization taking into account the affordances perspective

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process's manifestation. In other words, frequency "produces" grammaticalization and is inversely one of its most obvious indicators (see Section 2). However, even though frequency is a highly relevant characteristic, in our view, it offers an incomplete explanation.

#### 4. Modification of the parameter related to the factor

The first possibility corresponds with a situation where the parameters of the environment (stream) and actors (users) are fixed, while the properties of the factor (semantic maps of grams) are variable. The environment can be understood as fixed if two or more constructions coexist on the same stream of a given language as they inhabit the same grammatical milieu. The users can be treated as fixed if all of them share certain macroscopic cognitive-epistemological characteristics being native speakers of the language in question. Under such conditions, the modification of the parameters of the factor, that is, the prototypicality distribution of the components of a map, will trigger different actions of grammaticalization: Some grams will be reinterpreted as more grammaticalized (more advanced on the path) while others as less so (less advanced on the path). Under this approximation, which is the most common in grammaticalization studies, the extent of the grammaticalization of a form depends directly on the structure of its qualitative and quantitative map. This means that the frequency distribution of senses offered by a gram is directly translated into the grammaticalization status of this construction. To illustrate this phenomenon, two pairs of grams, one from Biblical Hebrew and another from Mandinka,<sup>19</sup> will be studied.

Biblical Hebrew possesses two grams whose meaning has been mapped by using the template of an anterior cline: the QATAL and WAYYIQTOL (Ander- sen, 2000; Andrason, 2013a; Cook, 2012).<sup>20</sup> The QATAL form most typically offers the sense of a perfect and perfective past. The value of a resultative proper is highly uncommon, while the sense of a simple past, although nonprototypical, is not rare. Accordingly, the map of the QATAL gram spans the entire cline, ranging from the sense of a resultative proper to the sense of a simple past through a perfect and perfective past. The prototypicality peaks are located in the area of a perfect and perfective past so that the wave in Figure 5, schematizing the semantic qualitative and quantitative potential of the QATAL form, can be designed (for detailed statistical data, see Andrason & Van der Merwe, in press; see also Andrason, 2013a; Cook, 2012).

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<sup>19</sup> Mandinka is one of the languages spoken in Gambia, Senegal and other West African countries. Together with Bambara, Maninka, Dyula or Jaahanka, it forms the Manding group: a relatively mutually intelligible collection of dialects or languages. Manding, itself, constitutes a part of the Western branch of the Mande family, which in turn is classified as a member of the Niger-Congo linguistic realm (Kastenholz, 1996; Vydrine, Bergman, & Benjamin, 2000; Williamson & Blench, 2000).

<sup>20</sup> The QATAL is also called *suffix conjugation* as it only uses suffixes in order to mark the person and gender of the subject. The WAYYIQTOL is sometimes labelled *prefix conjugation* given that, besides suffixes, it always makes use of affixes to mark the person and gender.

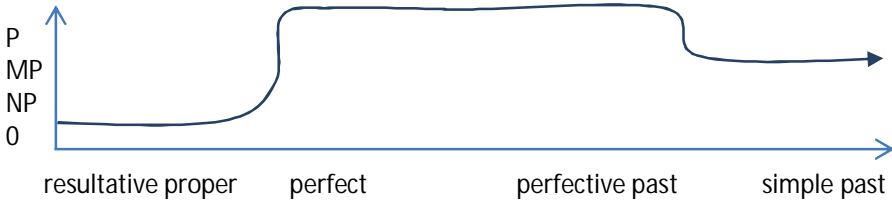


Figure 5 The wave model of the QATAL form

The WAYYIQTOL form most commonly offers past perfective values, while the senses of a perfect and simple past are uncommon and the meaning of a resultative proper entirely missing. Once more, the gram spans almost the entire length of the anterior cline with the exception of its initial stage. The prototypicality peak is located in the zone of a perfective past. Accordingly, the meaning of the WAYYIQTOL form can be portrayed in the dynamic or wave manner of Figure 6 (for a detailed analysis see Andrason, 2011a, 2013a):

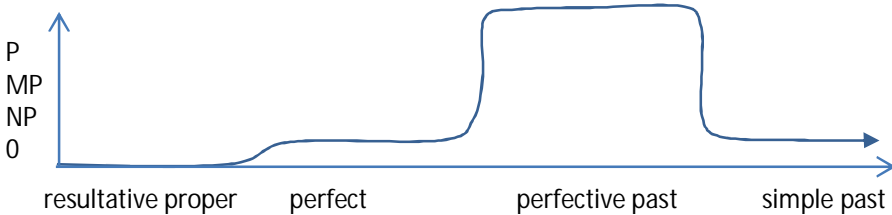


Figure 6 The wave model of the WAYYIQTOL form

If one compares the two maps, the former is interpreted as less grammaticalized as its prototypicality peak is less advanced, being located in the stage of a perfect and perfective, while the latter is viewed as more grammaticalized since its front is placed at more advanced sections of the path, namely only in the phase of a perfective past. As a result, the QATAL is usually identified with the taxis-aspectual category of a perfect and perfective, whereas the WAYYIQTOL is classified as an aspectual-temporal category of a perfective past. The two definitions and the grammaticalization status they encapsulate are directly derivable from the respective maps of each gram (Andrason, 2013a; Cook, 2012).

A slightly different situation is found in Mandinka. In this language, the anterior path is used to map at least three verbal constructions: the RIN, NAATA and TA grams. The RIN formation—named thus because it is formed by adding the suffix *riŋ* to a verbal base (e.g., *A be safeeriŋ* ‘It is written’)—is a nonadvanced anterior-path gram covering two initial sections of the cline: resultative proper and perfect, with the prototypicality zone clearly located in the area of resultativity (cf. Andrason, 2013b; Creissels & Sambou, 2013), as shown in Figure

7. The NAATA locution—a periphrastic gram formed by the entity *naata* (literally ‘has come’) and a verbal base (e.g., *A naata taa* ‘He has gone’)—is also classified as a manifestation of the anterior path, covering the phases of this cline from the stage of a perfect to a simple past tense, with the prototypicality peak located in the stage of a perfect and perfective past. The wave representation of the NAATA form can, hence, be designed as in Figure 8 (for details, see Andrason, 2012). Lastly, The TA gram—derived by suffixing the ending *ta* to a verbal base (e.g., *A naata* ‘He has come’)—covers the entire anterior path spanning its full length from the stage of a resultative proper to a simple past, passing by the intermediate sections of a perfect and perfective. The prototypicality peak is equally spread throughout the whole cline so that all the values appear as prototypical (cf. Andrason, 2011b; Creissels & Sambou, 2013), as shown in Figure 9. Since, under this approximation, the grammaticalization status of the three grams is directly derived from their semantic maps, the RIN locution is identified with the category of a resultative proper, the NAATA form with the category of a perfect and perfective, and the TA construction with a broad and taxonomically elusive gram that can function as a resultative, perfect, perfective and past (Creissels, 1983; Creissels & Sambou, 2013; Gamble, 1987). While the RIN gram is clearly less grammaticalized than the NAATA form (inversely, the latter is more grammaticalized than the former), the grammaticalization status of the TA locution is more complex. As its prototypicality peak spans the entire anterior cline, this gram can be viewed as both more and less advanced than the NAATA form. It offers prototypicality areas that correspond to the sections of the cline that are more grammaticalized than those provided by the NAATA gram (i.e., the value of a simple past) and also expresses senses that are diachronically less developed (i.e., the value of a resultative proper).

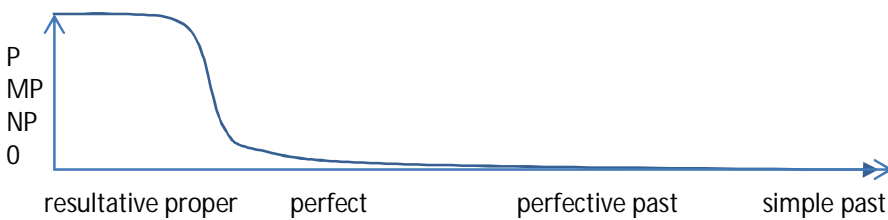


Figure 7 The wave model of the RIN form

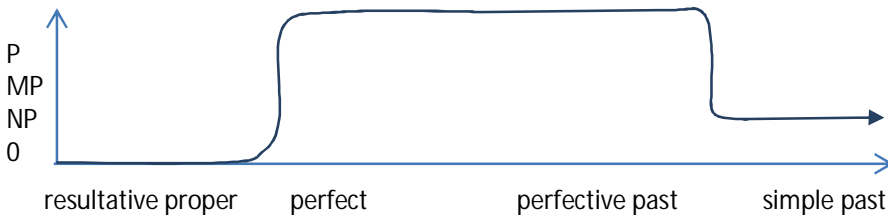


Figure 8 The wave model of the NAATA form

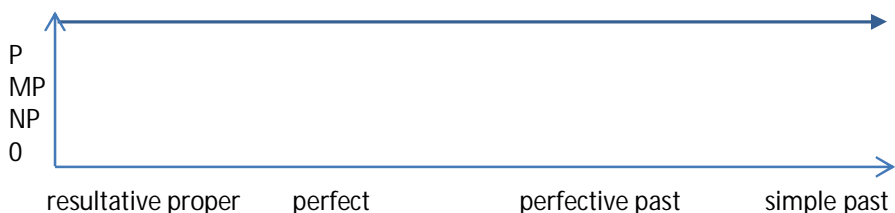


Figure 9 The wave model of the TA form

It is important to note that in all the mappings, from which the grammaticalization status of the forms was deduced, the properties of the speakers and environment were identical for the grams belonging to the same language. As fixed, they are assumed not to participate in the grammaticalization action. Therefore, they are ignored in the model.

##### 5. Modification of the parameter related to the environment

Another situation corresponds to conditions where the same or similar semantic qualitative and quantitative maps afford differently for grammaticalization, given the distinct settings in which they are found. This time, therefore, it is the factor and actor that are fixed, while the environment constitutes a variable whose dimensions affect the grammaticalization status of a form. In other words, although the properties of factors and actors are comparable, the action of reinterpreting a form as more or less grammaticalized is distinct due to different characteristics of the milieu, that is, the population or travel-ness of the stream in which the gram (factor) is hosted.

It is difficult to find two grams, belonging to two languages, whose semantic maps would be fully analogical. In this section, we will resort to an approximation treating as similar maps that fulfil two conditions: Their qualitative shapes are identical and their quantitative values are comparable at least for two of the four sections of the anterior cline. More simply, the waves are generally alike. If we use the grams described in the previous section, it is possible to argue that the waves of the QATAL (found in Biblical Hebrew) and TA (found in Mandinka) formations are comparable. The two grams span the entire length of the anterior path, thus being compatible with the senses of a resultative proper, perfect, perfective past and simple past. As far as the quantitative dimensions are concerned, the QATAL and TA grams overlap in the areas of the perfect and perfective past as well as, although less so, in the zone of the simple past. The former stages are prototypical for the two locutions, while the latter is moderately prototypical in the QATAL but highly prototypical in the TA form. With respect to the section of the resultative proper, this value constitutes another



prototypicality peak in the semantic wave of the TA, while in the map of the QATAL it is the least prototypical sense. This general similarity of the two maps or waves is visualized in Figure 10.

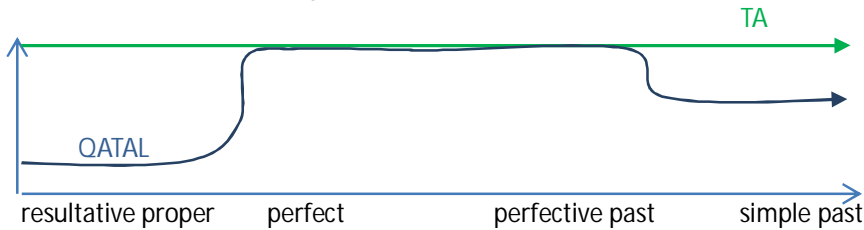


Figure 10 The wave models of the TA and QATAL grams

Although from the perspective of their waves or maps, the QATAL and TA grams can be viewed as similar, the reinterpretation of their grammaticalization status changes if the structure of the respective streams along which they travel is taken into consideration. The organization of the anterior-path stream in Biblical Hebrew and Basse Mandinka is different. In Biblical Hebrew, the anterior-path stream is only inhabited by two grams, namely the QATAL and WAYYIQTOL forms. Thus, if its immediate neighborhood is considered, the QATAL exists only in the context of the WAYYIQTOL. As explained, the WAYYIQTOL covers three more advanced sections of the anterior cline and locates its prototypicality in the area of the perfective past. Since the perfective past domain is the only prototypicality zone of the WAYYIQTOL, naturally the gram is identified with this sense and viewed as a grammaticalized perfective past. This is, by far, its most common job. These characteristics of the WAYYIQTOL— and, thus, the organization of the anterior-path stream in Biblical Hebrew—have some effects on the QATAL. As mentioned, the QATAL form spans the entire length of the anterior cline, raising its wave front at the stages of the perfect and the perfective past. However, due to the identification of the WAYYIQTOL with the category of the perfective past, the QATAL is typically reanalyzed as the grammaticalized form of the perfect, the domain which is only marginal in the semantic potential of the WAYYIQTOL. This is how the QATAL is commonly defined in grammars (Cohen, 1924; Kuryłowicz, 1972; Watts, 1951) and how it may have been perceived by the speakers. This identification of the QATAL with a perfect and WAYYIQTOL with a perfective stems also from another relational property involving environmental elements. Namely, if one analyses how the semantic domains of a perfect and perfective past are statistically expressed by the Biblical Hebrew grams, the following interaction emerges: The WAYYIQTOL constitutes 89% of all the cases of the perfective past sense, while the QATAL is only found in 10.9%. As far as the perfect value is concerned, the QATAL constitutes 81.5% of all the instances

where this sense is to be conveyed in the Hebrew Bible, while the WAYYIQTOL appears in 15% (Andrason, in press). The interaction of the waves traced by the anterior-path grams QATAL and WAYYIQTOL is portrayed in Figure 11.

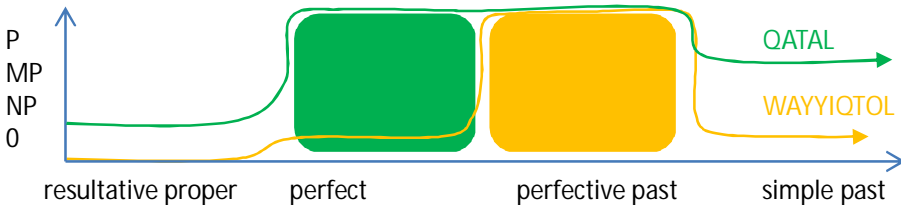


Figure 11 Grammaticalization status of the QATAL and WAYYIQTOL forms

In Mandinka, although the wave of the TA form is similar to the wave traced by the TA gram, the reinterpretation of the TA locution and its grammaticalization status is different because of an entirely distinct organization of the anterior-path stream. In particular, in Mandinka, the anterior stream is travelled by at least three grams: Besides hosting the TA form, the stream also includes the RIN and NAATA constructions. As explained, the RIN gram covers two initial sections of the cline (resultative proper and perfect) with the prototypicality located in the stage of a resultative proper, while the NAATA locution matches two intermediate phases (perfect and perfective) with an equal prototypicality in both of them. This arrangement of the grams existing on the anterior stream, shown in Figure 12, has an important impact on the perception of the TA gram and its grammaticalization status. Since the RIN form is associated with the category of the resultative proper and the NAATA form with those of the dynamic perfect and perfective, the TA construction is commonly viewed by speakers as an exemplary means of conveying the general past value, in particular, the simple past (Andrason, 2015).

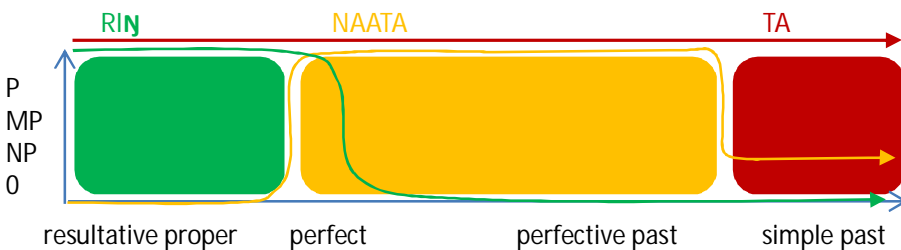


Figure 12 Grammaticalization status of the RIN, NAATA and TA forms

In general, the main associations between a form and its meaning, and therefore their grammaticalization status as intuitively formulated by the speakers, arise

not only from semantic maps or waves of the specific grams, but also from the interaction and competition that exist among the grams traveling along a shared stream. In this action of grammaticalization, both the peak of prototypicality of a map and its uniqueness on the stream play important roles. No less important is general frequency, considering how a given semantic domain is conveyed in the language: This type of statistic concerns not what the most prototypical sense of a given gram is (cf. Section 3), but what gram is the most prototypical means of conveying a certain value. Accordingly, a formation tends to be grammaticalized as the expression of senses that are not only prototypical to the gram in question but also those that are nonprototypical to other constructions. For a given semantic domain, this form appears as the most common mode of expression. It is evident that from this perspective, the environment plays a crucial role in the grammaticalization process.

#### 6. Modification of the parameter related to the actor

The last situation analyzed in this paper (which may probably be the most interesting for the reader of this journal) involves cases where the factor and the environment are fixed, but the values related to actors are variable. In such instances, the dimensions of the maps and their contexts are assumed to be identical, but the users are characterized by different cognitive and epistemological properties. One of the most evident examples of dissimilar cognitive abilities of the agents that stem from their distinct epistemological foundations involves cases where native and nonnative speakers are generally exposed to the same input data, that is, to qualitatively and quantitatively analogous maps enrooted in identical contexts. In such situations, native speakers of a language and second language learners (i.e., speakers of other tongues who acquire this language) reinterpret the incoming evidence in a different manner because of the dissimilar properties of the languages that underlie and shape their cognitive abilities. This phenomenon can be illustrated by a relation that exists between a gram found in a natural language and in its pidginized variety, or between a gram that is found in a language that is to be learned and in its possible interlanguages. In both cases, the modification of a given semantic map is conditioned by properties of second language learners, either immigrants who are immersed in a new linguistic situation (pidgin) or students who are deliberately learning a new tongue (interlanguage or classroom second language acquisition).

The former situation may be exemplified by the grammaticalization status of the *BÚINN* expression in Standard Icelandic and Pidgin Icelandic, schematized in Figure 13. Icelandic includes in its verbal repertory a gram referred to as the *BÚINN* construction. It is built of the verb *vera* 'to be' (inflected in person, number,

and tense), the adjective or particle *búinn* ‘finished’ (inflected in number and gender), and the preposition or infinitive marker *að* ‘to,’ for instance *Ég er búinn að mála* ‘I have painted’ (literally: I am finished to paint). This construction expresses the sense of an inclusive and resultative perfect. It is normally not used in the function of an experiential perfect. Furthermore, it is never employed as an indefinite perfect, perfective past or simple past. These four values are regularly conveyed by other formations. The senses of an experiential and indefinite perfect are typically expressed by the HAVA perfect (e.g., *Ég hef málað* ‘I have painted’), which can also appear with the force of an inclusive and resultative perfect, coinciding with the aforementioned BÚINN gram. Last, the function of a past tense—both perfective and simple—is expressed by the synthetic preterite (e.g., *Ég málaði* ‘I painted’), although this formation can also less frequently convey certain perfectal senses. Native Icelandic speakers who are exposed to the data concerning the senses offered by the BÚINN form and the two other grams hosted by the anterior cline stream, and to their respective frequencies, reanalyze the three constructions as the expressions of an inclusive-resultative perfect (BÚINN), broad perfect (HAFA) and past (preterite; for details, see Andrason, 2008; Friðjónsson, 1989; Jónsson, 1992).



Figure 13 Grammaticalization status of the BÚINN and HAFA grams and the preterite<sup>21</sup>

The same arrangement of input data (i.e., the exposure to the qualitative and quantitative maps of the three grams) and identical structure of their environment (the organization of the stream that contains the three formations) is interpreted quite differently in Pidgin Icelandic, a nonstabilized early pidgin variety spoken by immigrants (on the characteristics of Pidgin Icelandic, see Andrason, 2008). To be exact, as shown in Figure 14, the BÚINN gram—now formally

<sup>21</sup> In this figure, the horizontal axis, which schematizes the evolutionary principle of an anterior path, is organized following a 4-stage granularity. The initial phases of an inclusive and resultative perfect are grouped as the first stage. The more advanced perfectal senses (experiential and indefinite) are treated as the second stage. The two remaining stages harmonize with a granularity typical of the anterior path, where the phase of the perfective past is followed by the simple past.

restructured as BÚNA due to the loss of the auxiliary verb *vera* ‘to be’ and the incorporation of the preposition/infinite marker *að* to the invariant form of the participle (e.g., *É búna mála* ‘I have painted’)—is grammaticalized as spanning the entire cline. It provides the senses that range from the values that are typical of the standard Icelandic language (inclusive and resultative perfect) to the values of experiential and indefinite perfect, on the one hand, and perfective and simple past, on the other. In fact, in Pidgin Icelandic the BÚNA formation is the main gram of the anterior-path type. The HAFA perfect has almost entirely disappeared, while the preterite persists only with a few, usually static, verbs in a simple (more specifically durative-imperfective) past sense (for a detailed discussion of the BÚNA construction in Pidgin Icelandic, see Andrason, 2008). This new grammaticalization status of the BÚINN gram as BÚNA and a new arrangement of the anterior-path stream can be represented as in Figure 14.



Figure 14 Grammaticalization status of the BÚNA form and the preterite

Another example of how the cognitive-epistemological properties of the actors can influence the grammaticalization status of grams, whose input data concerning the qualitative and quantitative maps and their environments are identical, is provided by a language learning situation. The following experiment was performed during a course of Spanish for beginners at Stellenbosch University. Over two weeks, two verbal formations mapped by means of the anterior path were introduced to the students: the HABER locution and the preterite. The HABER form, built of the auxiliary *haber*, originally meaning ‘have,’ and a past participle (e.g., *He pintado* ‘I have painted’), is a prototypical present perfect gram, being also acceptable in the function of an immediate or hodiernal past (cf. Bybee et al., 1994). The preterite specializes in the values of the perfective and simple past, even though it can also be employed in certain perfect

<sup>22</sup> This smaller rectangle makes a graphic reference to the uncommonness of the preterite in the simple past sense when compared with the BÚNA gram. As explained, the preterite is restricted to a few static verbs. In other words, although the simple past value is the prototypical sense of the preterite, it is the BÚNA form that is, by far, the most prototypical means of expression of the simple past domain in Pidgin Icelandic.

uses.<sup>23</sup> The structure of the waves of the HABER form and the preterite, and the arrangement of the anterior-path stream jointly cause the native speaker of Spanish to associate the two grams with the following grammaticalization status: the HABER gram is a perfect while the preterite is a past tense, as shown in Figure 15.

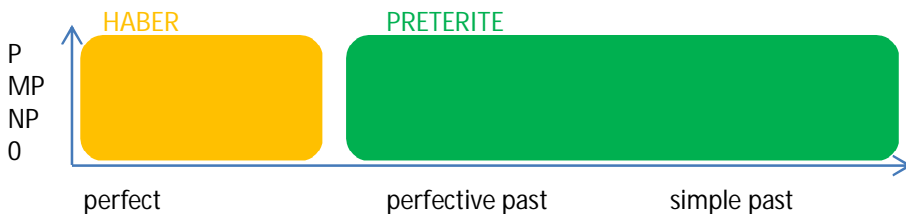


Figure 15 Grammaticalization status of the HABER form and the preterite

In the course of two weeks, both constructions were given similar emphasis so that the students were exposed to a comparable amount of input related to the two grams and their respective maps, as well as to their mutual interaction within the stream. However, on the test taken by the students, the status of the HABER and preterite were quite different depending on the mother tongue of the learners. Those students whose mother tongue offered a similar situation to that available in Spanish (i.e., the anterior-path stream hosts two grams of which one is typically used as a perfect while the other functions almost exclusively as a perfective and simple past; for instance English) tended to preserve the usage found in Spanish; they used the two grams with comparable frequency and in expected ranges of meanings. However, those students whose mother tongue included only one gram travelling along the anterior cline (e.g., French and Afrikaans) presented a strong tendency to use the HABER perfect in the function otherwise typical of the preterite. Moreover, in the past tense function, these students regularly preferred the HABER form over the preterite, which, in the case of some learners, failed to be employed at all, delivering the monotone structure of the stream shown in Figure 16.<sup>24</sup>

<sup>23</sup> At this stage, the students had not been familiarized with the resultative proper gram, formed with the auxiliary *tener*, e.g., *Lo tengo pintado* 'I have it painted' (as opposed to the dynamic perfect *Lo he pintado* 'I have painted it').

<sup>24</sup> The experiment was carried out twice, in 2012 and 2013, and involved 40 students (15 and 25 persons respectively). Their mother tongues were English, Afrikaans, Dutch, French and German. The test consisted of three parts: (a) filling in blank spaces with a verbal form (HABER or preterite), (b) providing short answers to questions in which a verbal form in the HABER or preterite was used, and (c) describing situations or activities which could prompt the use of the HABER and/or preterite forms.



Figure 16 Grammaticalization status of the HABER form

This discussion also shows that grammaticalization paths operate in second language acquisition. In the process of the acquisition of a second language, grams travel along the same, well known grammaticalization clines, thus incorporating senses in accordance with the order of these diachronic templates, established for native grammatical systems. It seems however that, in certain instances (at least, in initial and intermediate stages of learning and in pidgins), learners tend to accelerate the grammaticalization process if compared to the language under acquisition. To be exact, when learning the new language and, hence, in their interlanguages or pidginized varieties, speakers show a tendency to expand a form that is less advanced on the path in the targeted or superstrate language (this form is usually more analytic, more explicitly marked, more semantically transparent or iconic, more morphologically regular and more typical of colloquial usage) to senses that correspond to more advanced stages of the path. In this way, they “push” other, more advanced constructions located on the stream (the forms are often synthetic, less explicitly marked, less cognitively transparent, with more exceptions and typical of a more formal and/or written usage) to move to even more advanced sections of the stream or entirely eliminate them from the stream. Accordingly, language evolution and second language acquisition are governed by the same grammaticalization universals. Whereas the direction and order of development is analogous, there is a however significant difference in the speed of the process. As a result, second language systems are usually more advanced than their input targeted and/or superstrate equivalents.

The knowledge of this phenomenon, as well as the familiarity with the structure of the grammaticalization stream in the languages of the learners and in the language to be acquired, may in turn be used in classrooms for more efficient language teaching. Being aware of the fact that learners tend to accelerate the grammaticalization process and advance grams that are less advanced in the targeted/superstrate system (especially if their native systems do not mirror the structure of the stream found in the language under acquisition), the instructor can prevent possible erroneous use, a result of such accelerated grammaticalization typical in second language acquisition. In other words, by anticipating the most likely meaning extension of a gram (a sense that is missing from the standard

language but which corresponds to a further stage on the grammaticalization cline which is expected to be “grammaticalized” in interlanguages and pidginized varieties with a good degree of probability), the teacher can pay more attention to this issue and, thus, successfully prevent the occurrence of possible students’ errors.<sup>25</sup>

## 7. Modification of all the parameters: Complexity

In the previous section, by applying the affordances perspective, we showed that the action of grammaticalization is afforded differently (a gram is grammaticalized in a distinct manner) if the values of the three parameters (the factor, environment and actor) are distinct. To be exact, we have introduced three situations where the dependence of the grammaticalization status on each one of three types of variables was demonstrated separately. Consequently, it is possible to conclude that the realist grammaticalization process, that is, grammaticalization that is found in actual languages, should be viewed as a set of affordances that enable the actors (users) to identify a grammatical factor (gram) with a determined grammatical status given this factor’s environment (other grams of the same path). In this way, the application of the affordance framework to the phenomenon of grammaticalization gives us the possibility to overtly incorporate the actors and environment into grammaticalization theory and, as a result, approximate the representation of the entire grammaticalization process closer to the real state of affairs.

Nevertheless, it is important to acknowledge that the situations discussed in the previous sections themselves are not realistic but rather correspond to scientific approximations. The simplification involved two major spheres. First, only one dimension of changeable parameters related to the factor, environment or actor was taken into consideration: the structure of the map based on the anterior path with granularity limited to four stages (factor), the organization of the anterior-path stream (environment), and whether or not speakers

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<sup>25</sup> During the teaching of Icelandic to immigrants, the familiarity with the anterior path and knowledge of the structure of the anterior-path stream in Icelandic, Polish, Spanish and Arabic have enabled Alexander Andrason to reduce the number of errors that would have stemmed from accelerated grammaticalization. Accordingly, learners have been introduced to the three Icelandic grams (BÚINN, HAFA and preterite) from the perspective of the stream extant in their native language, emphasizing similarities and dissimilarities between the organizations found in the two languages (i.e., Icelandic and a respective mother tongue of a learner). In particular, senses that correspond to adjacent stages on the stream in Icelandic (i.e., adjacent senses/stages of which one is expressed by a less advanced gram, while the other is conveyed by the more advanced one) have received a special attention in case this adjacency does not correlate with the structure of the stream in the language of the learners.



are native speakers (actor). Second, only one parameter of the three possible ones was treated as a variable affecting the output of grammaticalization, while the others were assumed to be fixed. As already mentioned, such an approximation technique was necessitated by our goal, which was the demonstration of the dependency of grammaticalization on the three parameters.

In real life, however, the situation that is to be encountered is quite different: On the one hand, each parameter (i.e., factor, environment and actor) present in a situation is infinitely complex, being compounded of an unlimited number of more specific properties, while, on the other hand, the three parameters act simultaneously as variables. Thus, the network of connections and relations that may exist within the parameters is infinite. For example, as far as the factor is concerned, the properties of a gram not only include the semantic values (i.e., senses) and their global frequencies but also depend on formal characteristics. Moreover, the map and wave derived only from senses can have a different form if a more fine-grained perspective is adopted or if different types of texts or genres are analyzed. Furthermore, the extent of the environment is not limited to the shared stream travelled by the gram and its “neighbors” but should, if it aims to be complete, include the entire language. It should, at least, make reference to other verbal forms developing along other paths. Last, in respect to the actor, the dissimilarities between users are far more complex than the distinction between native and nonnative speakers. In fact, if the approach is sufficiently microscopic, every agent’s cognitive and epistemological properties somehow differ from the properties of the other speakers. The complexity of emerging networks of affordances is overwhelming and fully harmonizes with the understanding of language in terms of a complex system (Andrason, 2014; Cilliers, 1998; Culicover & Nowak, 2003; Dahl, 2011; Ellis & Larsen-Freeman, 2009; Larsen-Freeman, 1997; Lightfoot 1999; Massip-Bonet, 2013; Mufwene, 2013; Munné, 2013). In this manner, the model designed in this paper is again compatible with the affordances perspective developed by Aronin and Singleton (2008, 2012), for whom the idea of complexity is crucial and underlies language (see also Aronin & Jessner, 2015).

It is due to this complexity that individual grammaticalization processes are unpredictable and may differ from the universal clines predicted by grammaticalization theory. Given that the number of possible waves traced by grams travelling along an analogical stream is infinite, and given that the arrangement on a typologically common stream is uncontrollable and given, furthermore, that the variations in knowledge and cognition of speakers are unlimited, the number of components and relations affording grammaticalization is absolutely untreatable. As a result, the number of grammaticalization possibilities, which derive from these three parameters and relations existing among them, expands

exponentially into the *infinitum* rendering any exact long term prediction or reconstruction unviable. In this manner, even though grammaticalization paths can be viewed as universal, any realistic language evolution is unrepeatable and erratic. As a result, language fulfils one of the most typical characteristics of complex systems: It is deterministically chaotic, albeit governed by deterministic rules dictated by dynamic equations (such as theoretical universal grammaticalization paths), and it is nonlinearly sensitive to initial conditions and virtually unpredictable (Andrason, 2014; Massip-Bonet, 2013; Munné, 2013; Smith, 1998).

## 8. From the affordances perspective to an optimization model

The application of the affordances perspective to grammaticalization results in an additional property offered by such a model. That is to say, the affordances perspective as outlined above can relate the phenomenon of grammaticalization to the idea of optimization and optimality modelling and consequently offer a scientific representation of possible divergences from the canonical grammaticalization paths.

To be optimal is a characteristic whereby a system maximizes or minimizes a certain function under determined constraints. In mathematics and related sciences, optimization involves the selection of a value from a set of possibilities which is the best with regard to given criteria. In more theoretical terminology, optimization consists of maximizing or minimizing a function by calculating the value of that function for the selected available input arguments. Thus, given a function  $f$  such as  $A \rightarrow \mathbb{R}$  (i.e., from a set  $A$  to the set of real numbers) one seeks an element  $x_0$  in  $A$  such that, for all  $x$  of the set  $A$ , any value of the function  $f$  is lower than the value of the selected element  $x_0$  (i.e.,  $f(x_0) \leq f(x)$ ); or such that for all  $x$  of the set  $A$ , any value of the function  $f$  is higher than the value of the selected element  $x_0$  (i.e.,  $f(x_0) \geq f(x)$ ). The former approach is known as minimization, while the latter is labelled maximization. The set  $A$  is referred to as the search space or the choice set, and the arguments of  $A$  as candidates or feasible solutions. The function  $f$  is denominated a fitness function (for maximization) or a cost function (for minimization). The best solution for the function  $f$ , called an optimal solution, is codified as  $\max_{x \in A} f(x)$  (for maximization) or  $\min_{x \in A} f(x)$  (for minimization). Traditionally, optimization problems are formulated in terms of minimization, especially in behavioral models where the energy cost is in focus.

The optimization has been extensively used in applied mathematics, computer science, physics, engineering, biology and economics. In behavioral sciences, closer to linguistics than pure mathematics, the optimization is typically envisaged in terms of energy minimization. In this view, the optimal solution corresponds to the most efficient energy use and, hence, to its minimal consumption

to achieve a goal (cf. the theory of foraging strategy Emlen, 1966; MacArthur & Pianka, 1966; Schoener, 1971).

Transferring this mathematical terminology to linguistics, we could state the following: The incorporation of the affordances approach to grammaticalization theory opens this branch of linguistic enterprise to new areas of research in terms of optimization. In general terms, by “tuning” the values of the three arguments, that is, the parameters affording for the action of grammaticalization (factor, environment and actor), one may search for an optimal solution where grams behave and develop as predicted by theoretical grammaticalization clines. Of course, in every optimization technique, the elements of the set  $A$  (i.e., properties of the factor, environment and actor) will be predetermined so that the optimization may involve testing the model for its behavior in respect of the set  $A$  of the preestablished input arguments. The output that approximates the most values that are the closest to those predicted by the grammaticalization cline could be viewed as optimal. Inversely, the output that necessitates the least of energy to convert the sum of the input arguments into the output value could be regarded as the most efficient and, thus, again as the most optimal.

In the problem discussed in this paper, which involves grams mapped by the anterior path and the situation where native speakers are contrasted with nonnative speakers, the optimization of the affordances for grammaticalization can be viewed in the following manner: Given the input parameters related to the dimension of the map, its location in the stream and perception of the users, the function  $g$  determines which dimensions and arrangements of these three parameters can deliver a grammaticalization status that would be optimal, that is, the closest to the stages predicated by the anterior cline. Ideally, the optimal solution for the problem discussed in this article would be if (a) the map of a gram under analysis were confined to one stage which would also constitute its prototypicality peak, (b) the stream were populated by grams that divide it sharply with no overlapping and in four distinguished types (resultative, perfect and past, possibly with two subtypes: perfective and simple), and (c) the users' cognitive-epistemological abilities would be consistent with such a structure of the maps and the stream that hosts them (i.e., native speakers or speakers whose mother tongue has an identical organization). Of course, this ideal scenario is far from realistic as grams are typically polysemous, qualitatively overlap and share sections of the hosting stream and, moreover, as cognitive-epistemological properties of the users, even though similar, at the ultimate fine-grained approximation are never identical. It is therefore possible that in realistic languages, the function  $g$  never reaches its optimum.

However, the very fact of postulating the function  $g$  with its optimum and, thus, proposing the dimensions of the arguments that could satisfy it so that a

gram could match a given theoretical path, enables us to include the noise in the grammaticalization model instead of disregarding it, as has traditionally been done. The function  $g$  can thus be employed in order to explain why certain—or many—grammatical developments are only similar to that posited by the universal grammaticalization paths, while some can even display a diverging form. In this manner, the use of the affordances for the grammaticalization theory could approximate the latter to the real world, connecting the abstract model with a number of realistic situations and offering a scientific representation of possible discrepancies.

As a final point, one should note that in the representation discussed above we have assumed only one optimum—the grammaticalization status coherent with the stages posited by a grammaticalization path. In the grammar of a language, all the grams can be viewed as seeking for their optima as predicted by the clines they travel. In some cases, such different optima can stand in conflict. The grammaticalization of one gram can slow down, disrupt or entirely hinder the grammaticalization of another. Additionally, even for a single gram, the construction can be engaged in a quest for more than one optimum. Sometimes, such two optimization processes aimed at by a single form can be conflicting. In general, in a realistic language, there are many objectives to be optimized which necessarily conflict: The optimum of one objective cannot be achieved without compromising the optimum of the other. This is what scholars refer to as multi-optimization or multiobjective optimization, a type of optimization that involves a variety of fitness or cost functions, where an optimal solution can be made only from a more global system perspective as a result of trade-offs between various conflicting objectives or optima. In mathematics, for nontrivial cases of multioptimization (or multiobjective optimization problems), no single solution exists that could optimize all the specific functions at the same time. Instead, there are a number of possible solutions (so-called Pareto optimal solutions) that can all be viewed as equally satisfactory. Similarly, in language, there may be no one optimum but a cloud of acceptable solutions with none of them able to solve optimally for all the fitness and cost functions. This impossibility of reaching a total global optimum, where all the local and microscopic optima are satisfied, may be the force responsible for the inherently dynamic character of language and its incessant evolution.

## 9. Conclusion

The present paper has demonstrated that the affordances perspective might contribute to a better understanding of grammaticalization theory. By incorporating the idea whereby ecological and/or linguistic phenomena are afforded

differently because of dissimilar properties of three parameters of factor, environment and actor, we have argued that verbal grams are likewise grammaticalized in a distinct manner, depending on the values of the factor, environment and actor. Since each one of these parameters has been shown to be able to determine the grammaticalization status of a form individually, we have proposed that the realistic grammaticalization process, that is, the process as it is found in actual languages, should be understood as a set of affordances exerted by the factor, environment and actor. In this approximation, the factor was made equal with a qualitative-quantitative map of a gram (graphically represented as its wave), the environment with the structure of the stream along which the gram travels, and the actor with users' cognitive-epistemological capacities (i.e., their status as native or nonnative speakers). We have also explained that in the realistic process of grammaticalization, all the three parameters are not only equally relevant but also operate simultaneously and with infinite complexity. In this manner, the use of the affordances perspective has allowed us to overtly incorporate the actor and environment into grammaticalization theory. These have been thus far absent from theoretical models of grammaticalization, which is traditionally represented as if located in a vacuum. Consequently, the theoretical representation of grammaticalization comes closer to the real state of affairs perceivable in our universe. In addition, the application of the affordances perspective has enabled us to relate grammaticalization to optimality modeling. Accordingly, an explanatory model of divergences from the canonical grammaticalization paths, based on the idea of an optimizing function  $g$ , has been formulated. This function, which specifies the dimensions of the arguments that could satisfy the optimum, has made it possible to include the noise in the grammaticalization model. This could approximate the theory of grammaticalization yet closer to the real word, connecting it with realistic situations as discrepancies become tolerable in the model.

Our study shows that by using the theoretical perspective of affordances, the theories of grammaticalization, complexity and optimization relate to each other, yielding a more comprehensive model of language change. In this way, it demonstrates that scholars who conduct their research within different frameworks and "schools" of linguistics may communicate and collaborate if they work under an overarching umbrella of affordances. This also signifies that the model of grammaticalization analyzed from the affordances perspective should not be understood as nullifying the validity of grammaticalization theory in its standard version. It rather adds a new dimension to the recognized and fully legitimate grammaticalization paths; it connects them to the aspects (actors and environment) whose relevance in the standard theory is strongly marginal.

It is evident that in our study we have only investigated a microscopic portion of the problem. As explained, the factor was narrowed to the kinetic semantic

map, the environment to the structure of the stream along which the factor evolves, and the actor to the fact of being a native speaker (or not). There are a great number of other approaches to factors, environments and actors. It is obvious that these should be researched in depth. Furthermore, the representation of a simultaneous interaction of the three parameters, missing from our article, where only one parameter was treated as a variable at once, should be given a more formulaic expression. Last, more research on the optimization issue, the incorporation of the function  $g$  into the model of grammaticalization, and the expansion of such a representation to a variety of competing functions  $g_n$  is also necessitated since our paper has only proposed the connection between grammaticalization and optimization, without specifying its detailed modelling and application. The substantiation of all and each one of these deficiencies will constitute one of the future research activities of the authors.

Lastly, we believe that our study, which has benefited from certain ideas developed in the field of applied linguistics and studies dedicated to second language acquisition, may inversely contribute to these two branches. First, it shows that the knowledge of grammaticalization paths and the concept of a stream are applicable to studies on second language acquisition and teaching. In their interlanguages and/or pidgins, learners usually accelerate the grammaticalization process restructuring the composition of the stream in the way that less advanced grams advance, while those that are already advanced are either further advanced or removed from the stream. The familiarity with this can be used in preventing this phenomenon from happening, thus reducing possible errors in the usage of grams in the language to be acquired. Second, our approach suggests a possible more theoretical and more formal approach to affordances, in general. To be exact, the optimal function  $g$  or a cloud of such functions, conditioned by the three types of variables hypothesized by affordances perspective (i.e., language, user and context), could be designed for situations of second language learning. A solution of this function or the determination of a set of optimal solutions would possibly establish situations in which second language acquisition would, again, be more effective.

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