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## COMPETITION AND THE LEXICON

### 1. INTRODUCTION

This article begins with a general axiom of competition that originates in evolutionary biology. The axiom holds generally across organized systems. I show in particular that this version of competition, rooted in biology, helps us to understand and unify a range of lexical and morphological phenomena in language. The overall message is that languages can have properties that are not peculiarly linguistic but hold generally across organized systems. The wide scope of these properties removes some of the explanatory burden from both linguistics and psychology. It is not the job of linguistics or psychology to account for why languages have properties that can be attributed to competition, although there is no denying that the job of linguistics and psychology is to account for how these properties are implemented in languages. I will discuss a number of phenomena: the rarity of synonyms, competition between affixes, and the possibility of a state of equilibrium between rival realizations of the same morphosyntactic meaning.

### 2. FOUNDATIONAL NOTIONS

#### 2.1 *Gause's Axiom of Competitive Exclusion*

Georgii Frantsevich Gause (1910 – 1986) was one of the founders of modern ecology. His competitive exclusion principle, best known from his book, *The Struggle for Existence* (Gause, 1934), states that no two species with similar ecological niches can coexist in a stable equilibrium. When two species compete for exactly the same requirements, one will be slightly more efficient than the other and will reproduce at a higher rate. The fate of the less efficient species is local extinction. Volterra (1931) demonstrated that only one species can survive on a single resource in principle, given certain assumptions. Gause's experiments on competition between *Paramecium caudatum* and *P. aurelia* demonstrated this same point experimentally. The result of competition need not always be the elimination of one species, but instead adaptive changes in the competing species. MacArthur (1958), for example, famously studied five species of warbler very similar in their ecological preferences, showing that the feeding habits of the five species were significantly different from one another, so that the species occupied distinct ecological niches.

#### 2.2 *L'Abbé Gabriel Girard: The synonymist*

In 1718, the Abbé Gabriel Girard, chaplain to the scandalous Duchess of Berry, published a book entitled *La justesse de la langue françoise ou les différentes*

*significations des mots qui passent pour synonymes* [the accuracy of the French language or the different or the different meanings of words that pass for synonyms]. The book was a spectacular success. The Abbé stated his central claim simply and starkly: “je ne crois pas qu’il y’ait de mot synonyme dans aucune langue [I do not believe that there is a synonymous word in any language].” Girard’s claim rests on a very strict definition of synonymy:

A resemblance in meaning so complete and so perfect that the meaning, taken in all its force and in all circumstances, should be always and absolutely the same; so that one of the synonyms signifies no more and no less than the other; that one can use them indifferently on all occasions; and that there is no more choice to make between them, for meaning, than between the drops of water from the same well, in taste. (xviii – xx) [translation MA]

By this definition, candidate synonyms must have exactly the same meaning and distribution. If we follow it, then even such apparent synonyms as the English pair *hazelnut* and *filbert* fail the test, since there are collocations in which *hazelnut* is much more likely than *filbert*: *hazelnut spread* vs. ?*filbert spread*; *hazelnut praline* vs. ?*filbert praline*. Synonymy, by this definition, is simply an example of Gaussian competition and its absence an instance of Gause’s Axiom at work. The bulk of this paper will be devoted to working out this observation in more detail.

Girard’s book consisted of a list of entries, each containing a set of putative synonyms and each demonstrating the nuances of differences between or among the words in the entry, for example *académiste* vs. *académicien*. Most of Girard’s examples of apparent (but not real) synonym pairs are unrelated morphologically: *demeurer* /*rester*; *bref* /*court*. A small fraction, though, are: *action* /*acte*; *arme* /*armure*. Remarkably unaware that they were reviving a three-hundred-year old line of thought, modern morphologists have turned the Abbé’s conjecture into an academic industry in the last thirty-five years under a different name, *blocking*. This term was first used in (Aronoff, 1976) and has been adopted throughout the field. Blocking encodes the observation that a new word is unlikely to be coined when a synonymous term already exists. The actual word is said to block the potential word.

Since (Rainer, 1988), two forms of blocking have been recognized, which I will call *single word blocking* and *pattern blocking*. Rainer’s terms are *token blocking* and *type blocking*. Single word blocking was first defined as “the nonoccurrence of one form due to the simple existence of another” (Aronoff, 1976, p. 43). All subsequent work has assumed that the two words must be synonymous. Blocking includes derivation, as in *glory* / \**gloriosity*, and inflection, as in *fought* / \**fighted*. The morphological blocking of individual words is clearly the result of Gaussian competition for a single meaning between two potentially synonymous words. Gause’s axiom predicts only that one word will win somehow, not which one wins or why or how. None of these questions will be discussed here.

Remember that the result of competition between species need not be the elimination of one, but instead adaptive changes. The same is true of individual words. Two potentially synonymous words can co-exist if they manage to avoid synonymy by differentiation of meaning. Some examples in English are *historic* / *historical*; *economic* / *economical*; and *brothers* / *brethren*. Since individual word blocking results from competition, these meaning-differentiated words do not block each other, because

they do not compete. Each member of each pair has acquired a differentiated sense that allows it to survive by avoiding competition for the same resource/meaning. In ecological terms, each word has found its own *niche*. This term *niche* will come in handy in further discussion.

In many cases of blocking, a morphological pattern produces a word that maps onto the meaning of an existing lexically listed word. The result is a potential synonym pair: *\*gloriosity/glory*; *\*runned/ran*; *\*foughted/fought*. Gause's axiom predicts that one of the synonymous words will win in each pair. In most cases, the existing word will win because it is entrenched, but victory may be temporary: *spilled* has gained enough traction in some varieties to outflank *spilt*; similarly for *roofs* vs. *rooves*. Even *gloriosity* lives, but only on the Internet, and then most frequently as the name of any one of a number of hair salons.

Finally, we have rival affixes, where the morphological system has the potential to create structured synonymy. Each morphological pattern (affix) in a language is a function from form/meaning inputs to form/meaning outputs. Two morphological patterns sometimes converge on the same meaning output and thus produce potential synonym pairs: *ness* vs. *-ity* (*receptiveness/receptivity*); *-ic/-ical* (*cyclic* vs. *cyclical*). It is easy to understand from an evolutionary perspective how a language develops rival affixes: each emerges completely independently. From a more top-down perspective, such emergences are more puzzling. The potential systematic synonymy of patterns can be resolved by competition in two ways. In cases of *extinction*, one affix/pattern will simply drive out the other, just as a single word can drive out its synonym. In cases of *differentiation*, one affix/pattern becomes specialized either in meaning or in distribution. These are the same two resolutions as in individual word blocking but they operate between patterns, rather than between individual words. This distinction is analogous to individual vs. species competition in biology. We may also find a resolution of individual word pairs formed from two rival affixes. The word *collectivity*, for example, first cited from the mid-19<sup>th</sup> century, has taken on a special meaning in political and sociological discourse, denoting 'the collective body of people forming a community or state', while its rival *collectiveness*, cited as early as 1664, has the predicted sense 'collective quality or condition'.

### 2.3 Affix Extinction

In the simplest cases, one affix is overwhelmed and driven to extinction by the ascendancy of another. This happened to English *-ment* in the face of *-ation* (Lindsay, Aronoff, 2013). Both *-ment* and *-ation* were borrowed into English from French as ways of forming abstract deverbal nouns, but *-ment* lost traction during the 17th century due to a dearth of new verbs. A weakened *-ment* was driven to extinction by *-ation*, which drew strength from continued borrowing in the 17th century and later. The details of this history, as gleaned from the *Oxford English Dictionary*, are laid out in our article. The same sorts of developments occur in inflection. The Old English "strong" plural ending *-s*, for example, drove out the "weak" plural ending *-n* once the distinction between consonant-final and vowel-final noun classes was lost through sound change. Only a few relics like *oxen* and *children* remain.

## 2.4 Affix Differentiation through Linguistic Niches

A weaker affix pattern does not have to go extinct. It may survive if it finds a linguistic niche that differentiates it from the stronger type. There is no way to know in advance what will constitute a niche, but the standard linguistic variables (morphology, phonology, and others) usually provide opportunities. A nice example of a phonological niche involves the verbal suffixes *-ize* and *-ify*. The first was borrowed into Latin from Greek around the time of the *Vulgate*, ca. 400 CE) and many of the first borrowings were technical Christian religious terms. The second is originally a native Latin suffix of the form *-ficare*, descended historically from compounds with the verb *facere* ‘make’ as a second element. Both suffixes were borrowed from Latin into the major European literary languages. Lindsay and Aronoff (2013) show how the two are distributed in English. While there are about five times as many *-ize* words as *-ify* words, the ratio is almost reversed for words with monosyllabic stems, where *-ify* words outnumber *-ize* words by almost the same ratio. There are a few *-ify* words with disyllabic stems, but almost none with trisyllabic stems and none with longer stems. We conclude that *-ify* survives because it has found a phonological niche: monosyllabic stems. This pair shows very similar distribution in other European languages show. Compare Lignon, 2013 for French.

In the same article, we discuss another morphological rivalry in English in terms of a morphological niche, the distribution of *-ic* and *-ical*. Again, the history is very interesting. The suffix *-ic* is borrowed from Latin *-ic* (reinforced by Greek *-ik*) which was productive in Late Latin, through French. Likewise, *-al* is from Latin *-al* through French, but with no Greek analogue. Both suffixes form adjectives. The suffix *-ical* is a pleonastic combination of the two, not found in any other language besides Medieval Latin, where it is much less common than in English. The two appear to be completely synonymous, except for a few pairs whose members have both survived because of semantic differentiation: *historic/historical*; *economic/economical*; *comic/comical*. Nothing about these pairs is general or systematic. As Marchand notes: “There was, at the beginning, indiscriminate coexistence of two synonymous adjectives. But language does not like to have two words for one and the same notion, and competition was bound to come.” (Marchand, 1969, p. 241-242).

Except for an interesting register difference, the resolution of competition between these two patterns has been completely morphological, as shown by Lindsay and Aronoff (2013). Put simply, for any given pair of potential words of the form *Xic* and *Xical*, *-ic* is more likely to be preferred in almost eight times as many cases, but in the subset where the stem *X* is of the form *Yology* (e.g., *psychology*, *biology*, *histology*), the results are reversed. The *-ical* form is preferred (*psychological*, *biological*, *histological*) by almost the same ratio. I have found, however (Aronoff, 2007), that in some scientific and medical circles, the *-ic* form is used: *psychologic*, *biologic*, etc. OED lists about 120 of these forms, all of which have corresponding *-ical* forms. This register difference was first noticed by Hans Marchand: “the scholar uses the unextended [*-ic*] forms much more, as for him the quality expressed by the adjective is more directly and intimately connected with the thing to which it is applied than it is for a non-scientist . . . (Marchand 1969: 242).” This surmised cause is impossible to verify, but the difference in usage remains and can be found in such notable terms as the recent noun conversion form *biologic*, ‘a drug produced by a biological rather than chemical process’.

## 2.5 *What Latin Deponent Verbs are Really Like*

A great quantity of ink has been spilled in the last couple of decades on Latin deponent verbs. Most modern analysts have striven (or is it *strived*?) to provide a formal analysis of how passive verb forms fill in for the expected active verb forms. There have been many such accounts in the last couple of decades. There is no consensus whatsoever on which analysis is correct. Ignore for a moment the mechanics of getting the right form in the right box. Almost no linguists have asked the more basic question of why Latin deponent verbs exist in the first place. Our own work (Xu, Aronoff, Anshen, 2007) has concentrated on trying to identify the circumstances under which Latin deponent verbs flourish. We have discovered that they occupy a number of types of niches, most of which can be characterized as antitypical. For example, while the prototypical transitive verb meaning in any language has an affected object (e.g., *kill*, *cut*), almost no transitive Latin deponent verb meanings do. Similarly, denominal and deadjectival deponent verbs are non-causative in meaning, as opposed to other denominal and deadjectival verbs, which are usually causative. There are also deponent verb roots like *gradi*— or *sequ*—. Almost 40 verbs containing these two roots are attested in the Classical language, all of which are deponent, regardless of their semantics. Deponent roots thus contrast with the vast majority of verb roots, which are consistently active. The four niches I have touched on accounted for over 90% of the more than 550 deponent verbs that we were able to identify. We concluded (*ibid.* p. 142) that “On a more general level, this is an unusual example of a very general principle sometimes called ‘avoid synonymy’ (Kiparsky, 1982): when a language gives you two constructions, use them in such a way as to make them non-synonymous.” I now realize that this account puts the cart before the horse. The correct conclusion is not that the language *gives* you two constructions but rather that the deponent survives only because it *finds* a productive niche or set of niches. In this case, the construction is notable because it has not found any single niche or even any single type of niche but rather a number of them, some semantic or syntactic and some purely morphological.

## 3. PRINCIPLES OF CONTRAST

This section reviews a number of principles that have been proposed in the literature, not just on morphology but also, most prominently, on language acquisition, all of which are reducible to Gause’s axiom.

### 3.1 *Contrast and Competition in First Language Acquisition*

In the literature on the acquisition of first-language lexical vocabulary, a number of principles have been formulated, all of which are designed to account for the fact that children normally do not acquire synonymous terms. These include the principle of one-to-one mapping (Slobin, 1973); the uniqueness principle (Pinker, 1984); the contrastive principle (Clark, 1987); the principle of mutual exclusivity (Markman, Wachtel, 1988); and fast mapping (Carey, Bartlett, 1978).

Kaminski et al. (2004) caused quite a stir in the general scientific world by demonstrating that a border collie named Rico could distinguish hundreds of objects by name and that Rico appeared to obey Carey and Bartlett’s fast mapping rule: when

given a name that he had never heard before, Rico would reliably retrieve the one object from a collection whose name he had not previously learned, just as a child would do. The authors conclude that this particularly intelligent dog is demonstrating something like whatever ability lies behind the children's. Since then, other border collies have been shown to master thousands of object names and, in the recent case of Chaser, even some rudiments of verb differentiation.

Anyone who has been following the basic point of this article will quickly grasp that all these principles are reducible to Gause's axiom: different words should name different things because words compete for meanings. This is not to say that we have accounted for first language acquisition by invoking Gause. Gause tells us nothing about why children are driven to acquire language and words in the first place or why border collies are so good at this type of discrimination despite the fact that they themselves do not speak or possess language in any real sense of the term. The point is that there is no need to believe that these principles, by whatever name, are specific to language, or even to humans. Once what Deacon (1997) calls symbols become part of our cognitive system, general principles of system organization will apply, one of which is Gause's axiom. Deacon emphasizes that only humans are capable of symbolic reasoning. There is no evidence that the dogs in these studies have anything like symbolic reasoning. They associate individual objects with individual terms. The fact that they do obey Gause's axiom thus tells us that fast mapping is not dependent on symbolic reasoning but rather on systematicity.

### 3.2 *Carstairs-McCarthy's Principle of Contrast*

Carstairs-McCarthy (1994) applies Clark's principle of contrast in first language acquisition ("every two forms contrast in meaning") to inflectional classes and gender. Clark's principle is a clear restatement of Girard's principle of anti-synonymy and, like Girard's principle, it follows directly from Gause's axiom. If, as Carstairs-McCarthy claims, Clark's principle sheds light on inflectional classes and syntactic gender, then so does Gause's axiom. Carstairs-McCarthy observes that inflectional classes would seem at first glance to contradict any theory based on the avoidance of synonyms, because they involve the use of distinct inflectional realizations of the same information. Carstairs-McCarthy solves this problem by expanding the scope of *meaning* for inflection to include not just morphosyntactic property combinations and lexical information but also inflectional classes. This entails enlarging the scope of Clark's principle by exchanging *information content* for *meaning*, which seems reasonable. The principle will still fall under the scope of Gause's axiom, since the axiom deals with competition for resources broadly and does not care what the resources are. In fact, it is only by expanding the purview of the term *resources* that we can apply the axiom to lexical information in the first place. Carstairs-McCarthy restricts the possible information content of an affix by formulating the *No blur principle*: "Within any set of competing inflectional affixal realizations for the same paradigmatic cell, no more than one can fail to identify inflection class unambiguously." Put another way, among competing realizations, all will be unique except for what Carstairs-McCarthy terms a *class-default form*. There are no 'blurred' realizations. Carstairs-McCarthy restricts his claim to affixal realization, including theme vowels. He spends the bulk of his article comparing his claim with a variety of alternatives. The final section of his article

extends the no blur principle to gender systems: “Within any set of inflectional affixes which realize the same paradigmatic cell (apart from difference of gender) on a gender target, no more than one can fail to identify the gender of the controller unambiguously” (p. 765). Note that this observation holds only for target gender marking (e.g. gender agreement markers on adjectives), not for controller genders, lexical gender on nouns, which may be partly or even completely covert. Just as with inflectional classes, there may be a default marker for target genders for any given cell in the morphosyntactic paradigm, but all other gender markers must be unambiguous. Carstairs-McCarthy observes that this pattern of unique markers plus a default also follows from Clark’s principle, which, we recall, itself follows from Gause’s axiom. Carstairs-McCarthy reviews a number of target gender systems, finding that most, though not all, follow his principle. The ones that do not are members of the Niger-Congo family and normally show overt gender marking on their controllers. He then reviews a number of phenomena having to do with conditions determining the distribution of variant realizations, all unrelated to gender, and concludes that the overarching generalization is that there is always contrast *somewhere* in realization of a morphosyntactic cell paradigm.

Carstairs-McCarthy compares the principle of contrast with the Principles and Parameters of Universal Grammar as formulated at the time. He notes that the two types of principles have the same effect of limiting the number of possible grammars that a child needs to entertain. As a principle of vocabulary acquisition, the principle of contrast would seem to lie outside the area of core grammar. The problem is that it also affects the realization of inflection, gender, and perhaps other grammatical morphology. He concludes that there are either constraints on grammar acquisition that lie outside the scope of UG or that there is no simple way to distinguish purely grammatical principles from others. At about the same time as Carstairs-McCarthy’s article, a new theory of core grammar was being formulated, Minimalism (Chomsky, 1995), which reduced the principles of grammar to a much smaller set. Since then, Chomsky (2005) has suggested that there may be factors in the organization of grammars besides those specific to language. He calls these others ‘third factors’. Carstairs-McCarthy’s principle of contrast, and by extension Gause’s axiom, would seem to fall into this set of third factors, further supporting Carstairs-McCarthy’s conclusion.

#### 4. EQUILIBRIUM

A good framework not only allows us to address known questions, it also brings to light new sorts of phenomena that we might not have thought of outside this framework. In this last section, I will discuss a type of data that has received little attention in the past and show how competition and Gause’s axiom help us to understand this otherwise puzzling phenomenon.

Gause’s axiom tells us that competition will always be resolved eventually. But it will always take some time for competition to work itself out. This period has no determinate length. If we think in terms of ecology, competitive states may be more normal than resolutions. We also expect that there will be states of equilibrium in which no competitor has a clear advantage and such states may persist for long periods. I am reminded of a conversation I once had with a server in a restaurant in Malta. The

fish of the day was *ćerna* ‘grouper’. The word is borrowed from a Romance language (Italian *cernia*, Spanish and Portuguese *cherne*). The final *-a* in Maltese is a feminine gender marker. When I asked the server the word for more than one of these fish, she hesitated and finally exclaimed in exasperation “Oh, *ćeren*, *ćerni*, *ćerniet*, *ćrien*, I don’t really know!” As it happens, there are many ways to form plurals in Maltese, especially for feminine nouns, and the exact form is often indeterminate for borrowed words, or, put another way, the various plural patterns are in equilibrium.

#### 4.1 *Cellmates*

In a series of articles (Thornton, 2011a, 2011b, 2012), Anna Thornton has shed new light on the fact that a single lexeme can sometimes have more than one realization available for a single slot in its paradigm: *inflectional doublets* or *cellmates*. Inflectional cellmates are puzzling within most theoretical frameworks, but they make perfect sense when viewed in terms of competition: two (or very infrequently three) items compete for the same niche. Because the competition has not yet been resolved, both forms occur. Section 3 of this article is devoted to an examination of this sort of competition and the ways in which it is resolved in derivation. It should be clear by now that, although one competitor is usually more common than the other in any given environment at any given point in time, competition is rarely completely resolved. In that sense, doublets comprise a common phenomenon but in a somewhat unusual domain, inflection.

It is possible to think of inflectional classes as the resolution of inflectional competition (Gardani, 2013) and there are certainly resolutions that involve phonologically distributed environments (Carstairs, 1988). But the nature of morphosyntactic categories makes other sorts of resolution more difficult in the case of inflectional doublets: here is no possibility of semantic differentiation, for one, because the ‘meanings’ of paradigmatic slots are fixed externally by the syntax.

#### 4.2 *The English Comparative and Superlative*

English famously has two ways of forming the comparative and superlative grades of adjectives, one *suffixing* (e.g., *bigger*, *biggest*) and the other *periphrastic* (e.g., *more interesting*, *most interesting*). Wisdom has it that the two are in complementary distribution, so that *\*more big*, *\*most big* and *\*interestinger*, *\*interestingest* are ungrammatical. Close empirical study shows, however, that this is not at all true. In Aronoff and Lindsay 2014, we reviewed the recent corpus-based literature and conducted a study of our own, based on the Google Books N-gram Corpus. The results are strikingly clear. First, the two strategies have been in competition for at least as far back as the English language has been written down (about 1200 years) and undoubtedly much longer. Second, the conventional account of how the two are distributed is largely incorrect. With participles and words of three or more syllables, the periphrastic form is completely dominant. Also, as Gonzalez-Diaz (2008) shows, based on a study of the British National Corpus, the periphrastic forms prefer the predicate position and the suffixing form is more likely than the periphrastic when there is a following *than-phrase*. But with disyllabic words, even those ending in *-y* and *-le*, where the suffix is commonly said to be preferred, the two strategies are almost

completely balanced. Our own word, which is confined to books published since 1900, confirms that monosyllables prefer the suffix form, but even some monosyllables show close to a 50/50 split. Disyllables ending in *-y* are especially likely to show this *balanced* distribution.

Overall, the competition, which has been raging for all of recorded history, shows no signs of resolution. In biology, competition is the normal state. Yes, competition must be resolved eventually if two species compete for exactly the same resources, but it can take a very long time. We now see that the same can be true with competing linguistic strategies, a finding that is completely unexpected within other frameworks.

## 5. CONCLUSION

Gause's axiom, a well-known principle of ecology, states that no two species with similar ecological niches can coexist in a stable equilibrium. I have shown in this article that this principle applies to a wide variety of lexical and morphological phenomena in language and that it subsumes a number of previously proposed independent principles. More generally, I hope to have shown that it is fruitful to apply broad principles of system organization to questions of language.

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