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Chapter Title	Competitors and Alternants in Linguistic Morphology	
Copyright Year	2019	
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Keywords (separated by "-")	Complementary distribution - Morpheme alternants - Gause's law of competitive exclusion - Synonymy	

Competitors and Alternants in Linguistic Morphology

Mark Aronoff

The great Globe it selfe, Yea, all which it inherit, shall dissolue,
And like this insubstantiall Pageant faded Leaue not a racke
behind. (Shakespeare, Tempest, (1623) IV. *i. 155)*
The great bizarrity of Lewis's career is that he is a white-tie
Briton who has made his reputation playing blue-collar
Americans. (Lauren Collins. The New Yorker. January 18, 2016,
p. 45)

Abstract Complementary distribution is a consequence of a general principle of evolutionary biology, competitive exclusion, which further provides a uniform account of both allomorphic variation and the rivalry between affixes in terms of competition for distributional resources. The distribution of inflectional competitors is a type of spatial partitioning, restricted by the morphosyntactic system of a language, while derivational rivals benefit from having to name externally driven concepts. The English suffixes -ce, -cy, and -ntial are analyzed in detail as examples of competition for distribution.

Keywords Complementary distribution · Morpheme alternants · Gause's law of competitive exclusion · Synonymy

1 Introduction

The dichotomy between abstract entities that contrast and their more concrete correspondents that are distributed complementarily has been central to theoretical linguistics since the end of the nineteenth century. In the article, I will show that complementarity is a consequence of a central principle of ecology, *competitive exclusion* (Gause 1934), a more precise formulation of what Darwin called "the

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F. Rainer et al. (eds.), *Competition in Inflection and Word-Formation*,
Studies in Morphology 5, https://doi.org/10.1007/978-3-030-02550-2_2

struggle for existence". Gause's principle further provides a uniform account of both allomorphic variation and the rivalry between affixes, thus unifying two previously distinct phenomena under a single account. A further purpose of this article is to show the value of inverting a traditional scientific stance of linguistics: instead of attempting to reduce variance, we treat the putative variant forms as entirely independent competitors. If any readers feel in the end that this inverse stance has helped them to understand something new, then the article will have served its purpose.

The article constitutes an overview. More detailed analyses from the same perspective can be found in Lindsay and Aronoff (2013), Aronoff and Lindsay (2014), and Aronoff (2016). Here, as in all my recent work, I adopt a general framework of cultural evolution (Boyd and Richerson 2005), in which it is assumed that humans are cultural animals (Aronoff 2015). Cultural phenomena evolve in a manner analogous to biological phenomena and insights from modern biology can be applied to all culturally generated human systems, including languages.[1]

The article contains little direct reference to current work. Its purpose, however, is not simply historical, but rather to clarify, if only for myself, the roots of how linguists account for one of the most central phenomena in all human languages. The work is also a small homage to two of the morphologists I admire most, Stephen Anderson and Peter Matthews, both of whom have shown (Anderson 1985; Matthews 1993) how much light a deeper understanding of the ideological roots of our field can shed on our current thinking.

The distinction between contrast and complementarity was first made clear in Baudouin de Courtenay's (1895) redefinition of Dufriche-Desgenette's term *phonème* (Joseph 1999, Mugdan 2011) in terms of the system of a language.[2] Baudouin saw phonemes as contrasting abstract psychological (*psychophonetic*) units. Saussure, who understood abstract language as both psychological and social, later went on to claim that "phonemes are above all else opposing, relative, and negative entities" (Saussure 1916/1959, p. 119), his negative focus further cementing the importance of abstraction in the definition of contrasting linguistic units. In the same work, Baudouin coined the term *morpheme* (*morfema*) to name what he saw as the morphological unit parallel to his phoneme (*fonema*):

> that part of a word which is endowed with psychological autonomy and is for the very same reason not further divisible. It consequently subsumes such concepts as the *root* (*radix*), all possible *affixes*, (*suffixes*, *prefixes*), endings which are exponents of syntactic relationships, and the like. (1895/1972, p. 153)

Baudouin's student, Mikołaj Kruszewski in his pioneering (1881) study of sound alternations, had posited that his mentor's psychological phonemes were made up

[1] The fact that individual languages are cultural products is in no way incompatible with the fact that human language depends on innate biological properties, some of which may be specific to *homo sapiens*.

[2] More recently, Joseph (2012) has suggested that Baudouin adopted the term from Saussure's *Mémoire* of 1879, adapting Saussure's usage to more synchronic concerns and defining it explicitly.

of more concrete physiological (Baudouin's later anthropophonic) speech sounds (*zvuki*), which had both an articulatory and an acoustic reality. For both mentor and student, because the distribution of speech sounds within phonemes was determined by physiology; it was automatic and not contrastive.[3]

The broader investigation of complementary distribution rose to prominence a half century later with the realization that the distribution of the concrete alternant speech sound realizations of Baudouin's abstract distinctive units could be predicted, lending a more concrete reality to Saussure's negatively defined phonemes. Later researchers constructed an analogy from the relation between phonemes and their alternant realizations to that between contrastive morphemes and the distribution of their own automatically determined alternants, as revealed in Nida's words:

> Morphemic alternants can conveniently be called allomorphs. Accordingly, allomorphs are related to morphemes as allophones are related to phonemes. (Nida 1948, p.420)

For all these scholars, phonemes and morphemes were insubstantial elements, knowable only through their oppositions and their more concrete variant realizations.

2 The Competitive Exclusion Principle

Georgii Frantisevich Gause spent his entire scientific career in the Soviet Union but he is best known for a short book on theoretical, mathematical, and experimental ecology that he published in English at the age of twenty-four in 1934, *The Struggle for Existence*, devoted to a lucid exposition of what has come to be called *the competitive exclusion principle*, starting with the mathematics behind the principle and moving on to experimental verification.

Gause's principle of competitive exclusion (Gause 1934; Levin 1970) states simply that no two species with identical ecological niches can coexist in a stable equilibrium; when two species compete for the same exact 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. Gause's principle has roots in the earlier mathematical work of Lotka (1925) and Volterra (1926). In Gause's words, "the equation ... does not permit of any equilibrium between the competing species occupying the same 'niche', and leads to the entire displacing of one of them by the other ... One of the species must eventually disappear." (Gause 1934, p. 47) Furthermore, "The process of competition under our conditions has always resulted in one species being entirely displaced by another, in complete agreement with the predictions of the mathematical theory." (ibid., p. 103).

[3] More purely linguistically governed alternations were not physiologically based but could still be regarded as automatic.

I have discussed Gause's principle of competitive exclusion and its application to morphology at some length in Aronoff (2016), showing that this principle covers a variety of well-known types of morphological phenomena in language, from the general absence of synonymy to inflectional classes to aspects of language acquisition. In this article, I will extend the discussion to the traditional concepts of allomorphy and rivalry between derivational affixes. Gausian competition allows us to unify these seemingly distinct phenomena and to explain their differences in terms of the environmental conditions under which competitors thrive.

A word of caution: in human competition, there is often an element of mutual awareness; competitors know that they are competing against each other. Awareness does not figure into biological competition. When two organisms or two species compete for a resource they are simply striving for the same object without being aware that they are doing so or aware of each other. This is the undirected sense of *competition* that I apply to language, as opposed to competition between conscious agents.

2.1 The Dearth of Synonyms

A simple and sweeping linguistic prediction of Gause's principle is the dearth of exact lexical synonyms, first noted by the Abbé Girard in 1718. Girard's book was a list of sets of apparently synonymous words, with the members of each set distinguished by sense and use. Girard stated his central claim as follows:

> One can also mean by *synonymous* 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 . . . . If one takes the term *synonymous* in the second sense; **I do not believe that there is any synonymous word in any language**. (Girard 1718, pp. xviii–xx) [translation and emphasis MA]

Girard speaks in terms of meaning but his operative criterion is distribution ("that one can use them indifferently on all occasions"). If, as Darwin claims, "The survival or preservation of certain favoured words in the struggle for existence is natural selection" (1871, p. 61), then this struggle among words is subject to Gause's principle. It follows that, when two words happen to have the same exact distribution/meaning, either one of the words will become locally extinct (meaning extinct in this language or dialect) or they will diverge in distribution/meaning, with the result that their distribution is no longer the same. Several papers in this volume (Fradin 2019; Merkuur et al. 2019; Varvara and Zamparelli 2019) deal with the distribution of pairs of affixes. Masini (2019) discusses the competition between a word and a multiword expression, which also follows Gausian principles, as expected. Xu ("Chinese Adjective-Noun Combinations", this volume) treats a case of competition between compounds and phrases. Dressler et al. (2019) show, on the

basis of diminutive suffixes, that competition between affixes is not immediately resolved. In this respect, language follows biology, where resolution usually takes many millennia.

Gause's prediction is true when applied to word meaning and distribution. The divergent distribution of words pervades language. Even near synonyms, which are very rare, have distinct distributions. *Hurricane*, *typhoon*, and *cyclone* form a nice trio: they describe precisely the same type of storm, but in different geographic locations. The United States National Ocean Service distinguishes them as follows:

> Hurricanes, cyclones, and typhoons are all the same weather phenomenon; we just use different names for these storms in different places. In the Atlantic and Northeast Pacific, the term "hurricane" is used. The same type of disturbance in the Northwest Pacific is called a "typhoon" and "cyclones" occur in the South Pacific and Indian Ocean.
>
> Once a tropical cyclone reaches maximum sustained winds of 74 miles per hour or higher, it is then classified as a hurricane, typhoon, or cyclone depending upon where the storm originates in the world. (http://oceanservice.noaa.gov/facts/cyclone.html)

Girards's observation about the rarity of synonyms has often been repeated in the last half century (Aronoff 2016). Marchand, in discussing the English suffix pair *-ic* and *-ical*, observed the following[4]:

> 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, pp. 241–242).

3 Morpheme Alternants and Niche Differentiation

The beauty of the complementary distribution of alternants—allophones, allomorphs, and other *allo-* elements in language—lies in its simple systematicity. No more elegant or surprising universal property of human cultures has ever been found. All languages have contrasting phonemes but more strikingly, the phonemes of all languages have allophones and these are distributed complementarily. The same goes for morphemes and allomorphs. The discovery of the complementary distribution of allophones and allomorphs, although much less discussed than the contrast between phonemes or morphemes, was at least as great a milestone in the modern science of language and much more surprising. A communication system without contrast between meaningful elements is impossible but there is no need for each contrasting element to have predictable alternants, which is what makes

[4]I follow tradition and cite English affixes by their spelling: *-ic*, *-ical*. Sometimes it is important to highlight either spelling, for which I use angled brackets (<ic>), or phonology, for which I use slashes (/ɪk/). In later sections, I use *X* as a wild card followed by letters in Roman to designate any word that ends in a specific string of letters in written English, without commitment to a morphological analysis for the string. Thus, *Xft* designates the set of all words ending in the letters <ft>. Berg (2016) calls the letter strings at the ends of words *word endings*.

their existence surprising. A system without variance would seem to be neater. Theoreticians yearn to find one beneath the bustling surface of language.

The closest analogue of the distribution of alternants in evolutionary biology is the notion of *ecological niche differentiation* (also sometimes called *niche segregation,* or *niche separation*, or *niche partitioning*), the process by which natural selection drives competing species into different distribution patterns of resource use. Each distribution pattern of resource use is an ecological niche. There are many ways in which the differential distribution patterns of resource use can occur in nature. The closest analogue to linguistic systems of complementary distribution is *resource partitioning* (Schoener 1974; Walter 1991), in which two or more competing species divide up the resource (usually what they consume) along some lines, and its subtype, *spatial partitioning*, in which the resource is a distinct area or habitat that each species occupies.[5]

The special characteristic of the linguistic systems lies in what resources are being partitioned among the alternants of each phoneme or morpheme: the alternants compete for the total set of environments in which their 'parent' occurs. The allophones of /p/compete for the subparts of the distribution of/p/; the allomorphs of PLURAL compete in the same way to distribute among themselves the realization of all occurrences of PLURAL. The total distribution of all the alternants is determined at the level of the units being realized and the alternant forms partition this overall set of environments. For an alternant, the struggle for existence is the struggle to establish an environment in which it alone is found of all the alternants of its parent, or at least in which it predominates.

Why are the alternants in complementary distribution? In Slobodkin's (1961) formulation of Gause's principle, "[n]o two species can indefinitely continue to occupy the same ecological niche." For the same reason, no two alternants of a single phoneme or morpheme can indefinitely continue to occupy the same phonological or morphological niche. They eventually sort themselves into complementary distribution by means of resource partitioning. English [p^h] has found its habitat as the initial consonant of a stressed syllable. Similarly with the aspirated allophones of the other voiceless stops in English. The other allophones of the voiceless stops have been driven to local extinction in this environment, but each survives in another environment because it has struggled and successfully found a unique phonological niche where it predominates. The plain allophones [p,t,k] are scavengers, who scoop up what the others have left over.

Gause's principle predicts that competition between alternants will resolve itself in the end, but that there will always be some indeterminacy somewhere for a time. In most American dialects, the competition between stop allophones has not yet been resolved at the end of a word. Plain [p] and [k] both battle with their unreleased

[5]Interestingly, in his survey of the resource partitioning literature, Schoener finds that "Habitat dimensions are important more often than food-type dimensions" (p. 33). Of course, in linguistic systems, it is hard to differentiate the analogues of the two.

counterparts, while plain [t] is losing ground to unreleased [t].[6] Variation among allophonic sounds in each phonological environment is competition in action; complementary distribution is the resolution of competition.

4 A Little History

The intense study of the intricacies of the distribution of alternants (of both phonemes and morphemes) followed directly on the heels of the clarification of the status of the phoneme in the 1930s. The phoneme had been a central topic of linguistic research in the quarter century after the posthumous publication of Saussure's *Cours*, culminating in such classic works as Twaddell (1935) and Trubetzkoy (1938). Much less developed was the study of what Trubetzkoy, in the spirit of Kruszewski, called "merely optional phonetic variants," (ibid., p. 46). Indeed, only one five-page section of Trubetzkoy's posthumous masterpiece is devoted to the treatment of these alternants. One of his four "rules for the determination of phonemes" (ibid.), however, provides a classic statement of what came to be known as complementary distribution:

> Rule III: If two sounds of a given language, related acoustically or articulatorily, never occur in the same environment [original German *Lautumgebung*], they are to be considered combinatory variants of the same phoneme. (ibid., p. 49)

Why did linguists take up the study of combinatory variants in the late 1930's? It was an inevitable outcome of the discussion of the phoneme, which brought the topic of their alternants to the fore: the first cited use of the term *complementary distribution* occurs in Morris Swadesh's 1934 article on the phoneme (Dresher 2011), published the year after Swadesh's mentor, Edward Sapir (1933), showed so elegantly that speakers can be made aware of the phonemes of their language but not their actual phonetic manifestations, thus providing empirical evidence at last for the psychological reality of phonemes that Baudouin had proposed a half century before. Here I will emphasize the contribution to this discussion of two linguists, one American, one European, both of whom were consumed by abstraction: Benjamin Lee Whorf and Roman Jakobson. Jakobson's role is well known and I will discuss it shortly and briefly: as the champion of invariance, he was driven to explain away all variance. Whorf's role lies largely in his contribution to terminology, is not well known, and makes for a good story.

[6] In many British dialects, even the most prestigious, word-final [t] has succumbed entirely to [ʔ] over the last half-century (Fabricius 2002).

4.1 An Etymological Excursus

Benjamin Lee Whorf introduced to linguistics the prefix *allo-*, which took on a life of its own in linguistics in the 1950s, "with reference to variation in one particular property among members of a given class" (*Oxford English Dictionary*, henceforth OED), resulting in such novel terms as *allograph*, and *allographic*; *allolog*; *allomorphic* and *allomorphy*; *allophonic* and *allophony*; *alloseme* and *allosemic*; and *allotone*.[7] The prefix and the terms are important, not just because they have a curious history, but because they are testimony to the centrality of the study of complementary distribution in linguistic theory of the period, usurping the pride of place that had been given to the sister notion of contrast.

Whorf first used the term *allophone* in the modern sense linguistics in 1938 in a short manuscript entitled "Language: plan and conception of arrangement," consisting of an elaborate table and accompanying outline, which he circulated among close colleagues.[8] It was first published in Whorf (1956), the book that made him famous 15 years after his death.[9] The term appears on p. 126 as part of a large table that outlines Whorf's suggested standard format for a language description. Carroll considered this coinage important enough for him to list in his introduction to the book among Whorf's accomplishments that "[h]e was apparently the first to propose the term 'allophone', now in common use among linguistic scientists" (ibid., p. 33). The term was first used in print by George Trager, in a short book review published in *Language* only a few weeks before Whorf's death at the age of forty-four in 1941: "... the first allophone (subphonemic alternant) ... of the *j* phoneme ..." (Trager 1941, p. 170). We meet its earliest explicit definition in a joint article by Trager and *Language* editor Bernard Bloch published in the next issue, just after Whorf's death: "Sound-types as members of a phonemic class are called allophones" (Trager and Bloch 1941, p. 223). Trager published a one-page obituary note on Whorf in the December 1942 issue of *Language*, in which he recalls "discussing with him, for long hours that always ended too soon, his daringly brilliant views on linguistic theory and practice" (Trager 1942, p. 305).

Whorf was a chemical engineer, which sheds some light on the coining of the term *allophone*, along with the linguistic use of the analogous term *allomorph*, which is not found in his published writings. The Greek prefix *allo-* 'other' is first attested in scientific use in names of minerals, especially to denote the less stable of structurally distinct but chemically identical isomers or crystals, which were called

[7] Lindner (2016) discusses the use of *allo-* more fully in his detailed history of linguistic terminology, with examples dating to the end of the nineteenth century.

[8] Among the closest of his colleagues at Yale was Morris Swadesh, who had introduced the term *complementary distribution* not long before.

[9] Unlike Saussure and Trubetzkoy, who achieved similarly great posthumous fame, in his lifetime, Whorf never held any academic position, published almost nothing, and was unknown to the academic world outside the small circle of researchers that had gathered around Sapir at Yale in the 1930s.

allo-forms or *allomorphs*. It is still common in chemistry. The first attested use of the term *allomorph* in linguistics is in an article in *Language* by Paul Garvin (1945). Throughout the article, Garvin uses the term *morpheme alternant*, until he mentions "the front allomorph of the suffix (the alternant with a front vowel)" (p. 253). He continues to use the term *allomorph* for the rest of the article but only in the phrases *front* and *back allomorph*. Garvin's connection with the Yale crowd was indirect, through his mentor at Indiana, Carl Voegelin, who had overlapped with both Whorf and Trager at Yale and had corresponded frequently with Whorf. For neither Trager nor Garvin were the terms *allophone* and *allomorph* novel enough to be worthy of comment or attribution. I can only surmise that Whorf had picked up *allomorph* from chemistry, used it in the linguistic sense of *distributional alternant*, and coined *allophone* by analogy; and that he and his Yale friends, Trager and Voegelin and others, had used the two terms often enough in their long hours of conversation to make them part of the normal vocabulary of their scientific discourse. In any case, the prefix *allo-* in American structural linguistics came to take on the meaning 'element in complementary distribution' that was so central to structuralist thinking and remains central today.

4.2 Roman Jakobson and the Search for Invariance

Saussure and his students are usually credited with promulgating the idea that languages are systems of oppositions of signs, signifiers, and signified. It is to Roman Jakobson, though, that we owe the credo that, at some level of analysis, these oppositions are invariant in both signifier and signified. Once we adopt the ideal of invariance, the linguist's great task is to simultaneously uncover the abstract oppositions that structure the invariant elements and clear away the dross of variance that hides both the structure and the elements. Perhaps the best expression of this point of view is in Jakobson's celebrated article on Russian cases:

> One of the fundamental concepts in the development of modern linguistics was the idea of invariance, first recognized by the Kazan' school at the close of the 1870s, simultaneously and in parallel with the success of the same idea in mathematics.[10] Whereas the first stage of these inquiries gave birth to the theory of the phoneme, i.e. of the invariant on the level of sound variations, now the urgent need has arisen to establish and explicate grammatical invariants. (Jakobson 1958/1984, p. 106)[11]

Jakobson devotes this article to showing that "[a]ll of the specific contextual meanings of any case can be reduced to a common denominator. In relation to the

[10] It is not clear how the linguistic and mathematical senses of the terms are related and I have found nothing directly relevant in the work of the Kazan' linguists themselves.

[11] This article was first published in Russian in 1958 in *American Contributions to the Fourth International Congress of Slavists*. I quote here from the English translation that appeared in the 2004 posthumous collection of Jakobson's articles on Slavic.

other cases of the same declensional system each case is characterized by its own invariant general meaning" (ibid., p. 107). Jakobson followed Saussure in observing that the meanings of cases, like those of all (especially grammatical) morphemes, form a system of oppositions, but the credo that these meanings must be invariant is his own. The problem that confronts Jakobson and anyone else who holds such a belief is that "[e]ach case, in its multifarious applications, displays a set of more or less heterogeneous meanings" (ibid., p. 106). Jakobson's solution and task was to reveal that "[t]he differences between each of these specific, contextual meanings are determined by the [. . .] composition of the phrase in which the case occurs" (ibid.) and to reduce the multitudes to a single oppositional meaning for each case.

For Jakobson and his followers (notably Morris Halle), this basic assumption of invariance applied to all aspects of the linguistic sign, meaning and form. Their most important task, and the one that they willed to morphologists and phonologists since, was consequently that of cleaning up the variance that lies on top of the invariance that they sought to expose to the light of day.[12]

5 The Allophone to Allomorph Analogy and the Beginning of *Elsewhere*

American structuralist linguistic theory organized language and linguistic analysis into a system of successive levels, each with its own set of contrastive units (Harris 1951). Ideally, the analysis proceeded up from the physical signal, beginning with phonetics, following an established set of discovery procedures.[13] Bloomfield and his successors imposed parallelism on the organization of the levels. So, Bloomfield (1933) is filled with such novel technical terms as *taxeme*, *tagmeme*, *sememe*, and *episememe*, all long forgotten now, each designating the contrastive emic elements at a given level of analysis.[14] This zealous search for parallelism across the organization of levels certainly appeared to gain vindication at the level of morphology: just as the alternant phonetic forms of the phonemes of any language fell into complementary distribution, so too with the alternant forms of morphemes. Nida himself rephrased his memorable words in the following passage:

> We may call the forms morphemic alternants or allomorphs. The second term is convenient because it is shorter than the full phrase and because it follows an analogy: allophone is to

[12]The most egregious practitioner of this search for invariance was Theodore Lightner, who incorporated Indo-European sound changes in the synchronic analysis of modern languages. See Lightner (1975) for striking examples.

[13]These discovery procedures are often presented as resulting from a radical empiricist or positivist ideology. They are just as easily attributable to the roots of American linguistics in Boasian field work, where the investigator had little access to anything but the acoustic signal.

[14]The most audacious breakthroughs of Chomsky's early work (e.g., Chomsky 1957) came about because he discarded this search for parallelism and analyzed syntax from an entirely different perspective.

> phoneme as allomorph is to morpheme. The relationships are not completely parallel, but they are sufficiently so to constitute a valuable association. (Nida 1949, p. 14)

But does the analogy hold, given that "the relationships are not perfectly parallel"? Recall Kruszewski's physiological speech sounds (*zvuki*). For him, the distribution of these speech sounds within phonemes was automatic and not contrastive because they were determined by physiology. While we have long since learned that the direct physiological basis of the distribution of allophones (and their modern analogues) must be tempered considerably, it remains true that phonology in this sense has strong direct roots in the physiology of the vocal tract, as demonstrated over the last quarter century by the rise of laboratory phonology and its congeners (Cohn et al. 2012). No one disputes that phonology is grounded phonetically and physiologically. For the structuralists, this grounding took the form of the textbook dictum that allophones must be phonetically similar. This rule of thumb famously ruled out the possibility that [h] and [ŋ] are allophones of one phoneme, despite their complementary distribution in the onset and coda of a syllable, a textbook example (Nida 1949, p. 44, fn. 39). There is no suppletion in phonology.

But suppletion, or at least the absence of phonological relatedness between allomorphs, is the hallmark of morphological alternation. As Nida emphasizes in the same textbook, "[t]here are absolutely no limits to the degree of phonological difference between allomorphs" (Nida 1949, p. 44). This is where the analogy between phonological and morphological alternation begins to break down: for the most part, morphological variants are not predictable from physiology or phonetics. Yes, some morphological alternation is directly predictable from phonology: consider the famous case of English {/z/, /əz/, /s/} and {/d/, /əd/, /t/}. But most are not. Either the morpheme alternants are too diverse to be derived one from another phonologically, even when their distribution is predictable from phonology (as demonstrated so memorably by Carstairs 1988), or their distribution is determined morphologically or lexically, and often both. To return to the case of English plural markers, Nida (1949) sets up a morpheme PLURAL for the language, which is realized by the set of allomorphs that he notates as/(-əz ∼ -z ∼ -s), ∼ -ən ∼ -Ø/.[15] And in truth the set becomes larger when we move a little further afield to examples like *men*, *women*, *geese*, *people*, *dice*, *alumni*, *antennae*, *addenda*, *corpora*, *genera*, *criteria*, *appendices*, *axes*, *stigmata*, *rhinocerotes*, *beaux*, *cherubim*, *matzot*, *attorneys general*, *analyses*, both *octopodes* and *octopi*, and the very recent academic abomination, *processes* with final/iz/.[16] Most of these are clearly lexical, but if we include/-ən/, then we must certainly also include the Latin <-i> plural of <us> words, which is much more common and has a quasi-morphological status.[17]

[15]Later (p. 54), Nida adds "the replacement of /u/ by /iy/" in *foot* to the list of plural markers and analyzes *feet* as containing two plural markers, both the replacement and the zero suffix.

[16]Presumably on the analogy of *analyses* from *analysis* and similar *Xis* words.

[17]An entire industry has grown up around lexical exceptions, which we do not have the space to cover here, though see most recently Yang (2016). The phenomenon is highly problematic for any attempt to subsume all inflectional morphology under allomorphs.

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If phonology and morphology are parallel, then just as we choose in phonology one allophone per phoneme that "is in some way basic, or the NORM" (Pike 1947, p. 88), the one that occurs "elsewhere" (ibid.), so too should the morphologist choose one basic, elsewhere, default allomorph per morpheme. For Nida, "[t]he basic allomorph is defined in terms of three characteristics: statistical predominance, productivity of new formations, and regularity of formation" (Nida 1949, p. 45). To these criteria he later adds that of elsewhere or default, which we also find in phonology: the basic allomorph is the default variant.[18] The question that should immediately arise is why these criteria should fall together. On this, Nida is silent, as has been almost everyone since. I will now show that Gause's principle of competitive exclusion provides a simple answer if we turn the system upside-down and treat elements that realize the same values as competitors rather than variants.

6 A Gausian Approach to Morpheme Alternants

What if the analogy between phonology and morphology is simply wrong? What if it is not entirely true that allomorphs are to morphemes as allophones are to phonemes? Let's begin with the very basic question that leads us to group these elements together as variants. What do elements like the various plural markers in English have in common? Setting aside cases where allomorphs are predictable entirely from phonology, as with the {-ɘz ~ -z ~ -s} trio, the criterion that unites them is Nida's Principle 3:

> Forms which have a common semantic distinctiveness but which differ in phonemic form in such a way that their distribution cannot be phonologically defined constitute a single morpheme if the forms are in complementary distribution (p. 41)

The expression "common semantic distinctiveness" means that the forms are synonyms, considered in a Saussurian fashion. We know from Girard that exact synonyms cannot persist. We know from Gause why: because, when two species or linguistic forms compete for the exact same resources (meaning and distribution in the case of words), the fate of one will be local extinction. The solution for these forms "which have a common semantic distinctiveness" is not semantic differentiation, for reasons that we will explore below, but 'habitat' niche differentiation: each of the synonymous competitor 'variants' finds a distributional niche. Gause's principle guarantees that these niches must be complementary if the competitors are each to survive and emerge as 'variants'. Calling them variants is an insubstantial artifact of the analytical disposition that seeks to group the competitors together under a single invariant contrasting element.

If a competitor cannot find a suitable niche it will go extinct altogether, again following Gause. Consider the victory of English third person singular present *-s*

[18] Here too there is a large modern literature on these two notions, in terms of forms, rules, and conditions, which we can't cover in this short article.

over the now extinct synonymous *-eth*. In Chaucer's time, *-es* was confined to the North and stigmatized by southern gentlemen and poets.[19] A couple of centuries later, the carefully edited King James Version strongly favored the conservative Southern *-eth* but the more cavalier Shakespeare, from the same period, used both forms, indiscriminately or to serve the meter: "Sometime she driveth ore a Souldiers necke, & then dreames he of cutting Forraine throats" (*Romeo and Juliet*. I.iv. 82–83).[20] Soon after, *-eth* was gone and later appearances are all deliberately archaizing: "he prayeth well, who loveth well both man and bird and beast" (Coleridge, *The Rime of the Ancient Mariner*, Book 6. 1834).

The disappearance of second person singular *-est* was different. Here the morphosyntactic cell disappeared altogether, taking both pronoun and suffix with it. Another example of extinction from the history of English inflectional morphology is the demise of the present participle suffix *-end*, driven out by the expansion of the range of the gerund *-ing*, for mysterious reasons, since the distinction between participle and gerund would seem to be useful.

It is not all death and dying. The English zero plural marker has expanded its lexical range considerably since it acquired the niche of usually large, especially wild, animals (except birds). From originals like *sheep*, *deer*, and *fish* it has moved on to *elk*, *moose*, *wapiti*, *tuna*, *skate*, etc.[21] But all this makes sense only if we see the erstwhile allomorphs as independent forms, each vying for a meaning and distribution. The eventual complementary distribution that we see is simply a direct consequence of the competition that synonymy ("a common semantic distinctiveness") triggers.

6.1 Elsewhere and Invariance

Is calling one apparent variant the elsewhere or default variant simply a matter of convenience or is something deeper at stake? First, we must ask whether there always is an elsewhere variant. In Latin, for example (Matthews 1972), it is difficult to imagine why one would select any one of the first-person-singular active suffixes *-ō*, *-am*, and *-ī* as either basic or elsewhere or default. Each appears in a specific set of tenses and moods. The one used in dictionary citation forms, *-ō*, which learners of the language think of as default, appears only in the present indicative and future perfect. *-ī* appears only in the perfect indicative, leaving *-am* as the default. The most frequent form, though, is the present *-ō*. For Classical Greek, the analogous problem is even greater, since there are not only several suffixes depending on tense and aspect, but there is a separate set of athematic verbs with its own morphology.

[19] Only rude Northerners use *-es* in *The Canterbury Tales*.

[20] The text is from the First Folio of 1623 and is cited from Pyles (1971), p. 217.

[21] Compare the plural forms *shrimp* for the sea creature and *shrimps,* a derogatory term for small people (a usage that dates to at least Middle English).

The German plural *-s*, claimed by some to be the elsewhere variant (Marcus et al. 1995), is also far from the most frequent; *-en* is more frequent and just as productive, but morphologically restricted, and so not a default in the usual sense of the term.

Even more fundamentally, what drives the linguist's search for an elsewhere variant in the first place? In phonology, one might call on convenience. It makes sense to look for something to serve as the name of each phoneme, especially when, as with Pike (1948), one's practical goal is to create a writing system: we need a unique letter to represent each phoneme graphically. At least some of the American structuralists saw nothing more than convenience in the practice: the phoneme was simply the symbol that one used for the set of sounds in complementary distribution (Hockett 1958).

Jakobson's search for invariance reflects a deeper desire. At some level, so the belief goes, the native speaker perceives all the allophones of a given phoneme as one and the same sound, not individual sounds or a set of sounds in complementary distribution. This is Sapir's (1933) psychologically real phoneme, the sound that the native speaker 'hears' or the sound that this speaker is aware of. But there is no analogue to either naming or perceptual reality in morphology. We name an inflectional suffix for its function, not for its form: first-person-singular active, etc. When suffixes differ in form depending on their distribution, we call them by their distinct distribution and forms: the Latin first-person perfect indicative active suffix *-ī*, or the English plural suffixes <-s> and <-en>. There is no sense in which one distributional variant is derived from another. Hence no special perceptual significance can be imputed to an elsewhere form.

The search for invariance in inflectional morphology does not lead us to the elsewhere variant but rather to the invariant morphosyntactic or inflectional features and values of the language. The features of tense, aspect, mood, voice, person, and number apply across the system of Latin verbs and verb forms, not arbitrarily to some but not others. These features and values determine the system, providing the paradigmatic grid of cells that the forms fill.[22] Gausian competition then governs how forms are distributed complementarily in the grid, leading to the appearance of allomorphy.

Anderson (1969) and Kiparsky (1973) claimed that the apparent elsewhere/default distribution was not simply a convenience or an accident but that a deep principle lay behind it. Kiparsky named it the *elsewhere principle* and the name stuck, which is why most people forget that Anderson had proposed it some years before. The principle also goes by other names: the *subset principle*, *Panini's principle*, the *proper inclusion principle*. Recently, Bakovic (2013) has shown that the elsewhere condition in phonology is best explained in terms of constraint ranking within Optimality Theory, not some separate principle. Hippisley and Brown (2012) handle elsewhere phenomena in inflectional morphology in a similar fashion. In both cases, the result is the same: different variants find distinct

[22]Purely morphological features like conjugation class are laid over these and lexical properties laid over the morphological features.

niches, with most variants being specialized and the apparent elsewhere variant sweeping up the residue. The alternative, as Bakovic emphasizes, would be the obliteration of the locally restricted form, total extinction.

7 The Semantics of Derivation and Inflection

Morphologists have long puzzled over the relation between inflectional and derivational morphology. For starters, do they form one system or two? The traditional claim, made explicit in Anderson (1982), is that the difference is in their domains: inflection trades in syntactic features and values, while derivation deals in lexical categories, thus dividing the structural world at zero, with inflection above and derivation (including compounding) below (Aronoff 1994). Everything else should follow from that one difference. In fact, this simple line is sufficient to account for other empirical aspects of the two, once we place the entire system in a Gausian framework. I will concentrate on one difference here, the very different semantics of the two types, as suggested by Kiparsky (2010).

Derivational affixes are notoriously peculiar in their semantics and pragmatics. In English, we have examples like the twentieth-century American suffix *-teria*, which OED defines as "[a] suffix used commercially to form the names of self-service retail or catering establishments." This usage depended crucially on modern society. Examples of coinages are *washeteria* and *groceteria*. The Italian suffix *-eria* is used, much more productively and widely, to designate 'place where X is sold'. The English suffix *-ery* is its cognate. Tagalog has several affixes with rather idiosyncratic meaning. Here are two selected from Schachter and Otanes (1972) (Table 1).

AQ2

The prefix *mag-* accompanied by reduplication of the first CV of the base noun means 'vendor of the product designated by the base'. This prefix has many independent uses. For example, as shown in the Table 2, when used alone, it can mean 'two relatives, one of whom bears to the other the relation designated by the base noun'.

In addition, individual words formed by a single derivational process can vary dramatically in their meanings, not just because of semantic drift, but because the process itself is often quite open-ended semantically and pragmatically. For example, as Jespersen warned long ago, "the analysis of the possible sense-relations [of compounds] can never be exhaustive" (1946, p. 138). In Aronoff (1980), I

Table 1 Tagalog 'vendor' words

Base	Gloss	Derived form	Gloss
baboy	Pig	magbababoy	Pig vendor
bulaklak	Flower	magbubulaklak	Flower vendor
kandila	Candle	magkakandila	Candle vendor
makok	Chicken	magmamakok	Chicken vendor

Table 2 Tagalog terms for pairs of relatives

Base	Gloss	Derived form	Gloss	
ama	Father	magama	Father and child	t4.1
asawa	Spouse	magasawa	Husband and wife	t4.2
ina	Mother	magina	Mother and child	t4.3
pinsan	Cousin	magpinsan	Two cousins	t4.4
kapatid	Sibling	magkapatid	Two siblings	t4.5

suggested that denominal verbs like *pilot* and *sand* are the result of a rule of the form N → V, where the meaning of both base and derivative is unspecified except for category, with the result that all that we can or should predict about the meaning of any individual verb is that it is a predicate that has something to do with the corresponding noun.[23] 528 529 530 531 532

Many other affixes similarly do nothing more than derive one major lexical category from the other and so have similarly sparse semantics. Others can be more specific, ranging from simple agentives like *-er*, through abstract suffixes denoting states or conditions such as English *-hood*, *-ship*, and *-dom* (discussed below), through such more specialized cases as Latin *-alia*, used to denote the numerous Roman festivals (including *Compitalia*, *Carmentalia*, *Parentalia*, *Lupercalia*, *Terminalia*, *Liberalia*, *Veneralia*, *Cerialia*, and *Robigalia*, to name only those that fall between January and April). 533 534 535 536 537 538 539 540

All lexical formations, at their heart, serve an onomasiological or naming purpose that lies outside the grammar (Blank and Koch 1999; Blank 2003). Thus, their meanings are also determined by our experience of the world. And once we admit that concepts are at least in part culturally determined, there is no way to fix even the range of possible meanings of a lexical word in advance. Along these lines (Aronoff 2007), I have discussed the verb *friend* in the sense 'To add (a person) to a list of friends or contacts on a social networking website', which was later included in the OED Third Edition (March, 2013). This sense depends entirely on the existence of social networking websites, which were inconceivable 20 years ago. Compare *unfriend* and *defriend* 'To remove (a person) from a list of friends or contacts on a social networking website', both apparently added to the OED at the same time as *friend* in this sense. 541 542 543 544 545 546 547 548 549 550 551 552

The naming function of derivational morphology undergirds not only the wide variance that we find among the meanings of the words in a derivational set when they are first coined (e.g., all new zero-derived denominal verbs), but also what happens to these words once they are coined. The claim that *chaque mot a son histoire* is especially true for the meanings of established words, which change 553 554 555 556 557

[23] In that work I remarked on "[a] little-understood restriction against nouns denoting certain abstract concepts (*$science_V$, $justice_V$). (p. 746)." Recently, Olivier Bonami, Olaf Mikkelsen, and Miriam Schulz pointed out to me that the verb *science* can now be found in the following well-known line from the 2015 film *The Martian*: "I'm going to have to science the shit out of this." As Olivier notes, "Next time you write a paper on conversion, keep in mind what can happen on another planet in 35 years!"

in long-discussed but still mysterious ways (Blank 1997), because their denotata change in at least partly non-linguistic ways.

The semantics of inflection does not work at all in this way. All English past tense forms, regular or irregular, have the same sense, 'V + PAST', where V is the sense of the verb. A given paradigmatic form type may have more than one use, such as irrealis uses of the past tense or historical uses of the present, but these uses extend to all verbs and are not lexically restricted. Occasionally, a single inflected word will acquire a lexical use, as with adjectival uses of individual English past participles, which may then each stray semantically. However, the original participial sense remains as well, which does not usually happen with derivation. In the clearest cases, such as *molten* or *cursèd*, the verb will acquire a new regular participle (here *melted*, and *cursed* without the schwa) to replace the form that has gone rogue, but most pairs remain homophonous, spawning an entire industry for linguists, beginning with Wasow (1977), on how to deal with the syntax of both uses, one lexicalized, one not.

These rare examples of lexicalization of individual inflected forms of individual lexemes are the exceptions that prove the rule. Unlike derived words, inflected forms do not normally stray semantically, because they map onto meanings that are provided for them ready-made by the morphosyntax of the language (cells in a paradigm, for those who are paradigmatically inclined); the meanings of the rival affixes don't vary.

Occasionally, as Anna Thornton has demonstrated in a series of articles, two (or more) inflectional forms do become available to realize the same cell in an inflectional paradigm. Thornton (2011, 2012a, b, 2019) has named this phenomenon *overabundance* and shows ("Overabundance: A Canonical Typology", this volume) that it is non-canonical in terms of Corbett's theory of canonical morphology (Corbett 2007). Nowhere does Thornton remark on the absolute synonymy of all the many cases of overabundance that she has unearthed. This makes sense, because the synonymy of rivals is surprising only from a competition-based perspective. In its light, we see why inflectional and derivational affixes compete among one another so differently. The niches for inflectional affixes are pre-determined by the morphosyntax (what Stump 2016 calls the *content paradigm* of the language), with the result that rival affixes have little room for maneuvering, unable to differentiate themselves in their denotation. The affixes within a language variety can find distinct niches only in their phonological or morphological environments.[24] Occasionally,

[24]Thornton (this volume) discusses with insight the insistence of linguists that all variation be explained, if not by grammar, then by geo-socio-stylistic conditions. She cites Nancy Dorian's observation that, in communities with little social stratification, overabundance may be genuine. The rampant variation in the forms of terms for the same concept in Al-Sayyid Bedouin Sign Language, a new language within a very small community, provides a nice example (Meir et al. 2010; Sandler et al. 2011).

two affixes will find themselves in the same cell, but Gausian competition makes sure that such cases are few and far between.[25]

As Yang (2016) has convincingly shown, we normally find in inflection a system of rules and lexical exceptions, with the maximum number of exceptions to any given rule equal to the number of cases that the rule can apply to divided by the natural logarithm of that number. Yang's formula can work only when, as in inflection, there is no semantic variance in the outputs of the rule and every lexeme must have a grammatical form for each cell. In derivation, there are no paradigmatic cells to be filled, so there is no way to count how many inputs or outputs there are for a given rule. Furthermore, semantic and pragmatic factors allow competing affixes to differentiate themselves in many ways. Remember the difference between a cyclone, a hurricane, and a typhoon. Similar distinctions can emerge between the individual token outputs of rival derivational affixes, resulting in many doublets but few true instances of overabundance, since the doublets have many pragmatic and semantic options for differentiating among each other. In Aronoff (1983), I showed how foregrounding serves to distinguish the outputs of a less productive rule from those of its more productive rival. Experimental and statistical study (Aronoff and Schvaneveldt 1978; Aronoff and Anshen 1981) reveals that English speakers normally much prefer the suffix *-ness* to its rival *-ity* when attached to words ending in *-ive*. But words of the form *Xivity* survive because they can be used, for among other purposes, to coin technical terms like *productivity*, where the use of the less productive rule signals that the word has a special sense.

Similarly, not just individual items but synonymous affixes can differentiate among themselves semantically over time. Gause's principle tells us that they must become differentiated in some way. Otherwise, all but one will face extinction (see the discussion above), and semantics is as good a differentiator as any. Sungeon Cho and I explored how the English suffixes *-hood* and *-ship*, both descended from lexical words by grammaticalization in earlier stages of the language and originally similar in meaning, have become differentiated over time (Aronoff and Cho 2001). Consider the contrast in (1) below:

1.

(a) airmanship, friendship, penmanship, sponsorship vs. *parentship, *wifeship, *womanship

(b) *airmanhood, *friendhood, *penmanhood, *sponsorhood vs. parenthood, wifehood, womanhood

As we showed in detail in our article, *-ship* attaches to stage-level predicates that do not denote permanent conditions, while *-hood* has no such restriction and can attach to individual-level predicates (Carlson 1977). Another rival suffix, *-dom*, also a free noun in Old English, has specialized for 'domain' or 'realm'. Compare *kingship* (a temporary condition) with *kingdom*, *fanship* with *fandom*,

[25] Thornton (this volume) describes other forms of overabundance, such as the availability of alternate stems and double marking.

or *husbandship* with *husbanddom* ('a realm ruled over by a husband or husband' listed by OED as a nonce use). The notion of a domain or realm is unquestionably culturally grounded—there were no domains or realms ten thousand years ago. Thus, these three suffixes, all derived from free words with similar senses, have survived because over the last millennium they have each found a niche, two specialized and one more general. The cognate suffixes in German, *-heit, -schaft, and -tum*, have similarly acquired distinct meanings in that language, different from those of the English suffixes, which we do not have space to discuss here.

8 Rivals: Divvying Up the Spoils

There are many ways for synonyms to differentiate among each other besides semantics. Aronoff and Lindsay (2014) describe in detail the distribution of the two synonymous English comparative constructions (the suffix *-er* and the degree modifier *more*), in which we incorporate the detailed findings of earlier researchers as well as our own corpus-based research. The most important lesson to take away from this work is that, although the two constructions have been rivals for millennia, their distribution is still not completely settled.

Here I will turn to a set of suffixes that I have revisited periodically throughout my career, English suffixes that form abstract nouns from adjectives. The best known of these are *-ity* and *–ness* and it was this pair that originally caused me to adopt the term *rival affixes* (Aronoff 1976). My colleagues and I (Aronoff and Schvaneveldt 1978; Aronoff and Anshen 1981; Anshen and Aronoff 1988) used a variety of statistical and experimental techniques to show that, while *-ness* is more productive overall, *-ity* is preferred after a small set of suffixes, notably *-al* (*duality* is preferred to (>) *dualness*), *-i/able* (*feasibility* > *feasibleness*), and *-ic* (*telicity* > *telicness*). This is an example of what Plag (1999) calls *base-driven productivity* ("restrictions imposed by . . . the suffix of the base word on the kind of suffix it can take" (ibid., p. 69) and what Williams (1981) call *potentiation*. This category easily extends to include phonologically-conditioned environments of the sort discussed by Carstairs-McCarthy if we broaden the category to include all aspects of the form of the base.

8.1 Quasi-Morphemes

Kristian Berg and I have recently uncovered another phenomenon that falls under the same umbrella, what we may call *quasi-morphemes*. Here, a suffix is especially productive when it follows a specific sequence of sounds or letters on the surface, although there may be no reason to claim that this sequence is a morpheme: it may have little or no meaning and plays no other morphological role besides triggering the preference for this suffix and signaling a lexical category. With written language, where we have observed it, one may broadly call this an *orthographic neighborhood*

Table 3 Words of the form *Xility*

Stem- final letter string	Number of possible adjective bases of *Xility* nouns	Number of corresponding *Xility* nouns listed in OED	
ble	3400	700	t8.1
bile	8	5	t8.2
cile	7	5	t8.3
dile	2	1	t8.4
gile	3	2	t8.5
phile	32	0	t8.6
lile	2	0	t8.7
nile	5	4	t8.8
rile	12	6	t8.9
sile	25	3	t8.10
tile	83	29	t8.11
vile	3	2	t8.12
xile	6	1	t8.13

effect (Coltheart et al. 1977). It is also reminiscent of Goldsmith's (2001) method for inferring morphological structure from words. We have already seen that the output sequence *X(a/i)bility* is productive in forming abstract nouns. Tradition would have it that this string results from attaching *-ity* to words ending in the suffix that is spelled either *Xable* or *Xible*.[26] I will broaden the scope of inquiry to other words of the form *Xility*, in which the suffix *-ity* has been added to words of the form *Xile*. There is no reason to believe that *-il(e)* is a suffix in English (though it is in Latin). Table 3 is based on all current *Xility* words listed in the OED online.

Using the ratio of attested to possible words as a rough measure, and restricting ourselves to stem-final strings with more than 25 words, we see that *Xbility* is productive (700/3400); *Xtility* is even more so (29/83) and *Xphility* and *Xsility* are not productive at all. There may be a threshold effect: to be eligible for potentiation a word-final letter sequence must reach a certain number. In the case of *Xphility*, the rival *Xphilia* is productive, leaving little for any other suffix to feed on, as Rainer (1988) notes for the corresponding German case: OED lists 25 *Xphilia* words, corresponding to 58 *Xphile* words. This all makes sense from a Gausian perspective: a niche must be of sufficient size to be useful as a possible niche and it must not be already occupied by a strong competitor. From the opposite perspective, it may be that anything can serve as a niche, so long as it is sufficiently salient, not just a morpheme.

[26] Most linguists treat the two spellings as orthographic variants (Marchand 1969).

Table 4 Derivatives of *Xnt* adjectives

Final neighborhood of adjective stem	Number of entries in stem neighborhood	Number of *Xntness* derivatives	Number of *Xncy* derivatives	Number of *Xnce* derivatives	Number of $Xntial_A$ derivatives of *Xnce/y* or *Xnt*	
Xnt_A	1900	62	600	1200	119	t11.1
$Xant_A$	700	20	289 (8 *Xstancy*)	500	14 (11 *Xstantial*)	t11.2
$Xent_A$	1000	36	300	600	104	t11.3

8.2 *Xa/ence/y*

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The salience of final sequences, especially letter sequences rather than phoneme sequences, is even more striking with abstract nominals derived from adjectives of the forms *Xa/ent*. Neither permits *-ity* at all.[27] Table 4 shows that there are also few *-ness* derivatives of these words.[28] Instead of either, we find the two adjective suffixes written as <-cy> and <-ce>, which are not otherwise common at all.[29]

The table shows that there are about 1900 adjectives in OED of the form *Xnt*. Almost 90% of them (1700) end in <ant> or <ent>. There are approximately 2600 nouns in English of the form *Xce* or *Xcy*. In 1800 of them <n> precedes <ce> and in almost 1700 of these, the <n> is preceded by <a> or <e>, as the table shows. All words of the form *Xa/entness* listed in OED have rivals of the form *Xa/ence/y*: *ferventness/fervency*. In these pairs, the member ending in *-ness* is always less common than the one ending in <ce> or <cy>. For example, while *brilliance* has a Google visibility score of 200, *brilliantness* has a score of 0. Words of the form *Xntness* are found when the stem is a monosyllable, usually when <nt> is not preceded by <a/e>: *bluntness, faintness, gauntness, quaintness, scantness*. In none of these is an equivalent of the form *Xnc/e/y* at all possible: **blunce/y, *faince/y, *gaunce/y, *quaince/y *scance/y*. In short, *Xnce/y* derivatives of *Xnt* are among the most dominant derivational patterns I have ever encountered in any niche.

Both suffixes, <-ce> and <-cy>, thrive only in the niche provided by *Xant* and *Xent* words. I have not been able to find any other words that plausibly bear the suffix <-ce>. *Xacy* is the only sizable neighborhood for <-cy> besides *Xncy*: OED lists 207 nouns of this form, of which about half (93) are of the form *Xcracy*. Many, but not all *Xcracy* nouns have corresponding *Xcrat* nouns (e.g., *bureaucrat, bureaucracy*) and are therefore not deadjectival. Of the remaining hundred or so

[27] The only examples of nouns of the form *Xntity* in OED Online are *cantity, entity, identity, nonentity, overquantity, quantity, scantity, tantity*, of which only *entity* and its derivatives contain a full syllable before the suffix, and all of which are borrowed.

[28] 3.3%, compared to 32% for *-ncy* and 63% for *-nce*.

[29] <-ce> is especially interesting. Phonologically, it is /s/, with the silent letter <e> serving only to 'soften' the letter <c>. <-cy> contains the same /s/ followed by final /i/, which is normally spelled <y>. In English, the sequence /nt + s/ is homophonous with /ns/: compare *sense* and *cents*.

Xacy nouns, we can identify those that pair with adjective ending in <-ate> (e.g., *obstinate, obstinacy*), but getting an accurate count is technically difficult and there are about as many words like *fallacy* and *legacy* (with no related free word), and *lunacy*, where the related word is not of the form *Xate*. In short, both suffixes, <-ce> and <-cy>, are remarkably robust in the niche provided by *Xant* and *Xent* adjectives and not productive elsewhere. This is a classic neighborhood effect (Lindsay and Aronoff 2013). *Xnt* is a large final 2-letter neighborhood. We noted above that *Xa/ent* constitutes 90% of the final three-letter subsets of *Xnt*, making the form salient enough to sustain productive affixation on its own. In a nutshell, the two deadjectival abstract nominal suffixes <-ce> and <-cy > are productive **only** with adjectives in *Xa/ent*, but in this niche, they have almost completely resisted their rivals, including the powerful *-ness*. Compare *-ity*, which is productive in several niches, not only *Xbility* and *Xtility*, as we have just shown, but also with *-ality*, and most robustly *-icity*, where it outnumbers *-icness* almost seven to one in OED.

Ecological competition allows us to see this long-studied set of rivals in a new light. The distinct suffixes—*-ness*, *-ity*, *-ce*, and *-cy*—are completely independent actors. Each one struggles to survive, to find one or more distributional niches. The most restricted, *-ce* and *-cy*, like pandas, are completely dominant in a tightly circumscribed environment—so much so that none of the others can gain any purchase there—but these two are absent everywhere else.[30] *-ity* has found a few distinct niches, in some of which it thrives more than in others. Where it is less robust, as in the *Xive* set of adjectives, it hangs on by specializing (*expressivity* vs. *expressiveness*). *-ness* is the generalist, in part because of the size of its population. It can live off pretty much any adjective, which is why we call it the default, but it is less pervasive (albeit still found to some extent) in places where others thrive. There is no such thing as general productivity, but only productivity of affix/niche pairs, as first noted by Zimmer (1964). We may call *-ness* a default, but only because it is unrestricted in its distribution.

8.3 *Xential: A Purely Orthographic Neighborhood*

The great majority of the words listed in OED or any other large dictionary of English occur only in writing. It stands to reason that written form may play a role in the morphology of the language of these dictionaries, especially when it comes to those parts of the language that have their roots in written languages, notably French, Classical Latin, and Classical Greek, what we call the learned vocabulary.[31]

[30] The small size of the environment may explain why most researchers, present company included, have not noticed it, but Marchand did, as Franz Rainer points out to me: "Formative restrictions [on *–ness* (MA)] exist in so far as adjectives in -ate, -ant, -ent chiefly derive substantives in -acy, -ancy, -ency." (Marchand 1969, p. 335).

[31] About 75% of the words in any comprehensive dictionary can be traced to one or more of these three languages (Durkin 2014a, b).

We should expect, then, to find derivational affixes in English (and other long-written languages) whose niches are defined orthographically. In Lindsay and Aronoff (2013), we showed that the English suffix combination *-ical* was productive only in the orthographic neighborhood of surface stems of the form *Xolog*, where it overwhelmed the generally much more productive *-ic*. (e.g. *ontological* vs. *ontologic*). We showed further that *Xolog-* was by far the most dominant set of stems in English with a final neighborhood of length 4, making up 2/3 of all stems of the form *Xg*, exceeding all other final stem neighborhoods of length 4 as a fraction of its superset of length 1 by a wide margin. Its closest competitor is *Xgraph,* which comprises 1/3 of its length-1 superset (stems ending in <h>). We concluded that *-ical* has found its niche with stems of the form *Xolog* and that it is potentiated by the salience of its neighborhood. We now see that the same holds for *Xbility*, *Xtility*, *Xancy*, and *Xency*. In each case, a suffix has found a small, well-defined neighborhood in which it can thrive and outnumber its generally more productive rival *-ness*.

This perspective of stem-final orthographic neighborhoods allows us to understand the *Xntial* adjectives in the last column of Table 4, analyzed further in Table 5.[32] I will show, following the suggestion of Marchand (1969), that *Xntial* words are formed on *Xence* bases and not on *Xance* bases, where the final vowel is unstressed.[33] This is notable, since these base sets differ only in the *spelling* of this final vowel, not in its pronunciation: <e > vs. <a>. After we have cleaned the list manually by excluding further derivatives (e.g., *inessential* from *essential*), we find a total of 77 *Xntial* words to work with. About half have been coined in English, most of the rest borrowed from either Latin or French. Table 5 lists the potential bases of these words by their word endings. The results support Marchand's (1969) observation that the only productive pattern is *Xence* → *Xential*. The second column lists the number of words (50 out of 77) for which there is a corresponding *Xence* word in OED. The other columns list those for which there is no *Xence* word. Of these 27 words, six have corresponding *Xency* words (e.g., *presidency, contingency*) and ten have *Xent* correpondents only (e.g., *tangent, component*). Only three of the *Xntial* words have corresponding *Xance* words (*concordantial, instantial, protuberantial*), and none have only *Xancy* or *Xant* words, although we know from Table 3 that there are nearly as many *XanY* words as there are *XenY* words in the language. The most remarkable conclusion that we can make from Table 5 is therefore negative: there is no productive pattern deriving *Xantial* words from *Xance* words. This pattern is remarkable for two reasons. First, the difference between the productive base *XenY* and the potential but unproductive base *XanY* lies *only in the spelling of the vowel letter*. There is no phonological difference. Second,

[32]There are barely 100 words in total of the rival denominal adjective forms *Xntory*, *Xntist*, and *Xntive* in OED.

[33]When the final vowel is stressed (e.g., *circumstance*), *Xantial* is possible (*circumstantial*), but almost all the words of this form in OED (14/18) are based on nouns of the form *Xstance* and this comprise a distinct neighborhood.

Table 5 *Xntial* words and their likely bases

Xntial	*Xence*	*Xance* (no *Xence*)	*Xency* (no *Xence*)	*Xent* (no *Xence* or *Xency*)	Other
77	50	3	6	10	8

t14.1

as Kristian Berg points out to me (p.c.), *Xant* words are twice as likely as *Xent* words to be analyzable, making the word ending <ent> more opaque than <ant>, and hence, one would suppose, less salient.

We have shown elsewhere (Berg and Aronoff 2017) that English spelling has evolved to distinguish suffixes from the homophonous endings of simple words (compare *gimmick* with *gnomic*). The example here is a little different: two homophonous word endings with different spellings. The closest comparable example that we have found in our previous work are the adjectival suffixes <-y > and <-i>, the latter being restricted to ethnonyms (e.g., *Israeli, Pakistani*). Here we have two endings, <-ant> and <-ent>, that appear to differ *only* in their spellings, but the patterning of **ntial* adjectives tells us that the language distinguishes between the two, despite their homophony. We conclude that spelling can constitute a possible niche in a written language with a long and stable history.

9 Conclusion

The story is told of the family tradition of cutting the two ends off a roast before beginning to cook it. No one knew why. Those who followed the tradition reported that their mothers had done the same and when the mothers were questioned, they gave the same response. Finally, the grandmother was asked if she knew why. She responded that her roasting pan was too small to accommodate a full roast. Too often, we follow the practices of our forebears without asking why they did what they did. Here I have shown that what morphologists have long treated as variants are in fact rivals whose distribution is governed by a well-known principle: competitive exclusion. This inverse perspective allows us to unite a variety of previously disconnected phenomena and to understand them better than we had in the past. It also shows that yet another type of pattern that linguists had long cherished as purely linguistic is susceptible to more general explanation.

In this article, I have provided several morphological analogues of *ecological niche differentiation*, the process by which natural selection drives competing species into different distribution patterns of resource use. In ecology, there is no way to characterize in advance what a possible niche might be. A biological resource need not be biological, but must rather only sustain biological success. So too with the resources on which linguistic patterns thrive. The patterns must be linguistic, not the resources.

Acknowledgments Thanks to the many people who have helped with this article, especially to the organizers of the 2016 Vienna IMM 2017 meeting, who so kindly invited me to speak

about competition. Thanks for comments to Stephen Anderson, Kristian Berg, Andrew Carstairs-McCarthy, Greville Corbett, Franz Rainer, and especially to Anna Thornton, who has taught me a great deal. Thanks also to the students who provided feedback on an earlier version. The analysis of the absence of *Xantial* words in English was sparked by a discussion with Peter Aronoff of the technical term *performant*, which, he pointed out, should be *performantial*. We now know why it is not.

References

AQ3

Anderson, S. R. (1969). *West scandinavian vowel systems and the ordering of phonological rules*. Dissertation. Cambridge, MA: MIT.

Anderson, S. R. (1982). Where's morphology? *Linguistic Inquiry, 13*, 571–612.

Anderson, S. R. (1985). *Phonology in the twentieth century: Theories of rules and theories of representations*. Chicago: University of Chicago Press.

Anshen, F., & Aronoff, M. (1988). Producing morphologically complex words. *Linguistics, 26*, 641–655.

Aronoff, M. (1976). *Word formation in generative grammar*. Cambridge, MA: MIT Press.

Aronoff, M. (1980). Contextuals. *Language, 56*, 744–758.

Aronoff, M. (1983). *Actual words, potential words, productivity and frequency*. Proceedings of the thirteenth international congress of linguists. 163–171.

Aronoff, M. (1994). *Morphology by itself: Stems and inflectional classes*. Cambridge, MA: MIT Press.

Aronoff, M. (2007). In the beginning was the word. *Language, 83*, 803–830.

Aronoff, M. (2015). Thoughts on morphological and cultural evolution. In L. Bauer, L. Körtvélyessy, & P. Štekauer (Eds.), *Semantics of complex words* (pp. 277–288). Cham: Springer International.

Aronoff, M. (2016). Competition and the lexicon. In A. Elia, C. Iacobino, & M. Voghera (Eds.), *Livelli di Analisi e fenomeni di interfaccia. Atti del XLVII congresso internazionale della società di linguistica Italiana* (pp. 39–52). Roma: Bulzoni Editore.

Aronoff, M., & Anshen, F. (1981). Morphological productivity and phonological transparency. *Canadian Journal of Linguistics, 26*, 63–72.

Aronoff, M., & Cho, S. (2001). The semantics of -ship suffixation. *Linguistic Inquiry, 23*, 167–173.

Aronoff, M., & Lindsay, M. (2014). Partial organization in languages: la langue est un système où la plupart se tient. In S. Augendre, G. Couasnon-Torlois, D. Lebon, C. Michard, G. Boyé, & F. Montermini (Eds.), *Proceedings of Décembrettes 8* (pp. 1–14). Rapport Interne No. 22 de CLLE-ERSS.

Aronoff, M., & Schvaneveldt, R. (1978). Testing morphological productivity. *Annals of the New York Academy of Sciences, 3318*, 106–114.

Bakovic, E. (2013). *Blocking and complementarity in phonological theory*. Sheffield: Equinox.

Baudouin de Courtenay, J. (1895/1972). An attempt at a theory of phonetic alternations. In *A Baudouin de Courtenay anthology: Translated and edited with an introduction by Edward Stankiewicz* (pp. 144–212). Bloomington: Indiana University Press.

Berg, K. (2016). Double consonants in English: Graphemic, morphological, prosodic and etymological determinants. *Reading and Writing, 29*, 453–474.

Berg, K., & Aronoff, M. (2017). Spelling English suffixes. *Language, 93*, 1–28.

Blank, A. (1997). *Prinzipien des lexikalischen Bedeutungswandels*. Tübingen: Niemeyer.

Blank, A. (2003). Words and concepts in time: Towards diachronic cognitive onomasiology. In R. Eckard, K. von Heusinger, & C. Schwarze (Eds.), *Words in time: Diachronic semantics* (pp. 37–65). Berlin/New York: Walter de Gruyter.

Blank, A., & Koch, P. (1999). Onomasiologie et étymologie cognitive: l'exemple de la TÊTE. In M. Vilela & S. Fátima (Eds.), *Actas do 1° Encontro de Linguística Cognitiva* (pp. 49–71). Porto: FLUP.

Bloomfield, L. (1933). *Language*. New York: Harcourt Brace.

Boyd, R., & Richerson, P. (2005). *Not by genes alone: How culture transformed human evolution*. Chicago: University of Chicago Press.

Carlson, G. (1977). *Reference to kinds in English*. Doctoral dissertation. University of Massachusetts, Amherst.

Carstairs, A. (1988). Some implications of phonologically conditioned suppletion. *Yearbook of Morphology, 1*, 67–94.

Chomsky, N. (1957). *Syntactic structures*. 'S-Gravenhage: Mouton.

Cohn, A., Fougeron, C., & Huffman, M. (Eds.). (2012). *The Oxford handbook of laboratory phonology*. Oxford: Oxford University Press.

Coltheart, M., Davelaar, E., Jonasson, J. T., & Besner, D. (1977). Access to the internal lexicon. In S. Dornic (Ed.), *Attention and performance VI* (pp. 535–555). New York: Academic.

Corbett, G. G. (2007). Canonical typology, suppletion, and possible words. *Language, 83*, 8–41.

Darwin, C. (1871). *The descent of man, and selection in relation to sex*. London: John Murray.

de Saussure, F. (1879). *Mémoire sur le système primitive des voyelles dans les langues indo-européennes*. Leipzig: B. G. Teubner.

de Saussure, F. (1916/1959). *Course in general linguistics (Translated by Wade Baskin)*. New York: The Philosophical Library.

Dresher, B. E. (2011). The phoneme. In M. van Oostendorp, C. J. Ewen, E. Hume, & K. Rice (Eds.), *The Blackwell companion to phonology* (Vol. 1, pp. 241–266). Malden/Oxford: Wiley-Blackwell.

Dressler, W. U., Barbaresi, L. M., Schwaiger, S., Ransmayr, J., Sommer-Lolei, S., & Korecky-Kröll, K. (2019). *Rivalry and lack of blocking among Italian and German diminutives in adult and child language*. In F. Rainer, F. Gardani, W. U. Dressler, & H. C. Luschützky (Eds.), *Competition in inflection and word-formation* (pp. XX–XX). Cham: Springer.

AQ4

Durkin, P. (2014a). *Borrowed words: A history of loanwords in English*. Oxford: Oxford University Press.

AQ5

Durkin, P. (2014b). *Loanwords in English*. http://blog.oxforddictionaries.com/2014/03/borrowed-words/

Fabricius, A. H. (2002). Ongoing change in modern RP: Evidence for the disappearing stigma of t-glottaling. *English Worldwide, 23*, 115–136.

Fradin, B. (2019). Competition in derivation: What can we learn from French doublets in -age and -ment? In F. Rainer, F. Gardani, W. U. Dressler, & H. C. Luschützky (Eds.), *Competition in inflection and word-formation* (pp. XX–XX). Cham: Springer.

Garvin, P. L. (1945). Pure-relational suffixes and postpositions in Hungarian. *Language, 21*, 250–255.

Gause, G. F. (1934). *The struggle for existence*. Baltimore: Williams and Wilkins.

Girard, G. (1718). *La justesse de la langue françoise ou les différentes significations des mots qui passent pour synonimes*. Paris: Laurent d'Houry.

Goldsmith, J. (2001). Unsupervised learning of the morphology of a natural language. *Computational Linguistics, 27*, 153–198.

~~Harris, Z. S. (1942). Morpheme alternants in linguistic analysis. *Language, 18*, 169–180.~~

Harris, Z. S. (1951). *Methods in structural linguistics*. Chicago: University of Chicago Press.

Hippisley, A., & Brown, D. (2012). *Network morphology. A defaults-based theory of word structure*. Cambridge: Cambridge University Press.

Hockett, C. (1958). *A course in modern linguistics*. New York: Macmillan.

Jakobson, R. (1958/1984). Morphological observations on Slavic declension. In L. R. Waugh & M. Halle (Eds.), *Roman Jakobson, Russian and slavic grammar: Studies 1931–1981* (pp. 105–134). Berlin: Mouton.

Jespersen, O. (1946). *A modern English grammar on historical principles: Part VI morphology*. London: George Allen and Unwin.

Joseph, J. E. (1999). Dufriche-desgenettes and the birth of the phoneme. In S. Embleton, J. E. Joseph, & H.-J. Niederehe (Eds.), *The emergence of the modern language sciences: Studies on the transition from historical-comparative to structural linguistics in honour of E.F.K. Koerner* (Vol. 1, pp. 55–75). Amsterdam/Philadelphia: Benjamins.

Joseph, J. E. (2012). *Saussure*. Oxford: Oxford University Press.

Kiparsky, P. (1973). Elsewhere in phonology. In S. R. Anderson & P. Kiparsky (Eds.), *A Festschrift for Morris Halle* (pp. 93–106). New York: Holt, Rinehart, and Winston.

Kiparsky, P. (2010). Dvandvas, blocking, and the associative: The bumpy ride from phrase to word. *Language, 86*, 302–331.

~~Kruszewski, M. (1995). In E. F. K. Koerner (Ed.), *Writings in general linguistics: On sound alternation (1881) and outline of linguistic science (1883)*. Amsterdam: John Benjamins.~~

Levin, S. (1970). Community equilibria and stability, and an extension of the competitive exclusion principle. *The American Naturalist., 104*, 413–423.

Lightner, T. M. (1975). The role of derivational morphology in generative morphology. *Language, 31*, 617–638.

Lindner, T. (2016). *200 Jahre Indogermanistik*. Salzburg/Wien: Edition Tandem.

Lindsay, M., & Aronoff, M. (2013). Natural selection in self-organizing morphological systems. In F. Montermini, G. Boyé, & J. Tseng (Eds.), *Morphology in toulouse: Selected proceedings of Décembrettes 7* (pp. 133–153). Muenchen: Lincom Europa.

Lotka, A. J. (1925). *Elements of physical biology*. Baltimore: Williams and Wilkins.

Marchand, H. (1969). *The categories and types of present-day English word-formation (second completely revised and enlarged edition)*. München: Beck.

Marcus, G. F., Brinkmann, U., Clahsen, H., Wiese, R., & Pinker, S. (1995). German inflection: The exception that proves the rule. *Cognitive Psychology, 29*, 189–256.

Masini, F. (2019). *Competition between morphological words and multiword expressions*. In F. Rainer, F. Gardani, W. U. Dressler, & H. C. Luschützky (Eds.), *Competition in inflection and word-formation* (pp. XX–XX). Cham: Springer.

Matthews, P. (1972). *Inflectional morphology: A theoretical study based on aspects of Latin verb conjugation*. Cambridge: Cambridge University Press.

Matthews, P. (1993). *Grammatical theory in the United States from Bloomfield to Chomsky*. Cambridge: Cambridge University Press.

Meir, I., Aronoff, M., Sandler, W., & Padden, C. (2010). Sign languages and compounding. In S. Scalise & I. Vogel (Eds.), *Compounding*. Amsterdam: John Benjamins.

Merkuur, A., Versloot, A., & Visser, W. (2019). *Competition in Frisian past participles*. In F. Rainer, F. Gardani, W. U. Dressler, & H. C. Luschützky (Eds.), *Competition in inflection and word-formation* (pp. XX–XX). Cham: Springer.

Mugdan, J. (2011). On the origins of the term *phoneme*. *HIstoriographica Linguistica, 38*, 85–110.

Nida, E. A. (1948). The identification of morphemes. *Language, 24*, 414–441.

Nida, E. A. (1949). *Morphology: The descriptive analysis of words* (2nd ed.). Ann Arbor: University of Michigan Press.

Oxford English Dictionary Online. www.oed.com

Pike, K. L. (1948). *Phonemics: A technique for reducing languages to writing*. Ann Arbor: University of Michigan Press.

Plag, I. (1999). *Morphological productivity: Structural constraints in English derivation*. Berlin: Walter de Gruyter.

Pyles, T. (1971). *The origin and development of the English language* (2nd ed.). New York: Harcourt Brace Jovanovich.

Rainer, F. (1988). Towards a theory of blocking: The case of Italian and German quality nouns. In G. Booij & J. van Marle (Eds.), *Yearbook of morphology 1988* (pp. 155–185). Dordrecht: Foris.

Rossella, V., & Zamparelli, R. (2019). *Competition between event-denoting deverbal nouns and nominal infinitives in Italian*. In F. Rainer, F. Gardani, W. U. Dressler, & H. C. Luschützky (Eds.), *Competition in inflection and word-formation* (pp. XX–XX). Cham: Springer.

Sandler, W., Aronoff, M., Meir, I., & Padden, C. (2011). The gradual emergence of phonological form in a new language. *Natural Language and Linguistic Theory, 29*, 503–543.

Sapir, E. (1933). La réalité psychologique des phonèmes. *Journal de Psychologie Normale et Pathologique, 30*, 247–265.
Schachter, P., & Otanes, F. T. (1972). *Tagalog reference grammar*. Berkeley: University of California Press.
Schoener, T. W. (1974). Resource partitioning in ecological communities. *Science, 185*, 27–39.
Slobodkin, L. B. (1961). *Growth and regulation of animal populations*. New York: Holt, Rinehart and Winston.
Stump, G. (2016). *Inflectional paradigms. Content and form at the syntax-morphology interface*. Cambridge: Cambridge University Press.
Swadesh, M. (1934). The phonemic principle. *Language, 10*, 117–129.
Thornton, A. M. (2011). Overabundance (multiple forms realizing the same cell): A non-canonical phenomenon in Italian verb morphology. In M. Maiden, J. C. Smith, M. Goldbach, & M.-O. Hinzelin (Eds.), *Morphological autonomy: Perspectives from romance inflectional morphology* (pp. 358–381). Oxford: Oxford University Press.
Thornton, A. M. (2012a). Overabundance in Italian verb morphology and its interactions with other non-canonical phenomena. In T. Stolz, H. Otsuka, A. Urdze, & J. van der Auwera (Eds.), *Irregularity in morphology (and Beyond)* (pp. 251–269). Berlin: Akademie Verlag.
Thornton, A. M. (2012b). Reduction and maintenance of overabundance. A case study on Italian verb paradigms. *Word Structure, 5*, 183–207.
Thornton, A. (2019). *Overabundance: A canonical typology*. In F. Rainer, F. Gardani, W. U. Dressler, & H. C. Luschützky (Eds.), *Competition in inflection and word-formation* (pp. XX–XX). Cham: Springer.
Trager, G. L. (1941). Review of a Serbo-Croat phonetic reader, by Dennis Fry and Djordje Kostić. *Language, 17*, 170–171.
Trager, G. L. (1942). Notes [containing death notice of Benjamin Lee Whorf]. *Language, 18*, 305–309.
Trager, G. L., & Bloch, B. (1941). The syllabic phonemes of English. *Language, 17*, 223–246.
Trubetzkoy, N. (1938/1969). *Principles of phonology (translated with a Foreword by Christine A. Baltaxe)*. Berkeley: University of California Press.
Twaddell, W. F. (1935).*On defining the phoneme*. Language monograph no. 16.
Volterra, V. (1926). Fluctuations in the abundance of a species considered mathematically. *Nature, 118*, 558–560.
Walter, G. H. (1991). What is resource partitioning. *Journal of Theoretical Biology, 150*, 137–143.
Wasow, T. (1977). Transformations and the lexicon. In P. Culicover, T. Wasow, & J. Bresnan (Eds.), *Formal syntax* (pp. 327–360). New York: Academic.
Whorf, B. L. (1956). *Language, thought, and reality: Selected writings of Benjamin Lee Whorf*. ed. and with an introduction by John. B. Carroll. Cambridge, MA: MIT Press.
Williams, E. S. (1981). On the notions 'lexically related' and 'head of a word'. *Linguistic Inquiry, 12*, 245–274.
Yang, C. (2016). *The price of linguistic productivity: How children learn to break the rules of language*. Cambridge, MA: MIT Press.
Zimmer, K. (1964). *Affixal negation in English and other languages: An investigation of restricted productivity*, *Supplement to word 20.2, monograph 5*. New York: Linguistic Circle of New York.

AUTHOR QUERIES

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