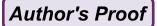
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Keywords (separated by "-")	Complementary distribution - Morpheme alternants - Gause's law of competitive exclusion - Synonymy				



Competitors and Alternants in Linguistic Morphology

Mark Aronoff 3

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, 9, 45)

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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 that is a type of spatial partitioning, restricted by the morphosyntactic system of a language, while derivational rivals benefit from having to name externally driven to 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 21

The dichotomy between abstract entities that contrast and their more concrete 22 correspondents that are distributed complementarily has been central to theoretical 23 linguistics since the end of the nineteenth century. In the article, I will show that 24 complementarity is a consequence of a central principle of ecology, *competitive* 25 *exclusion* (Gause 1934), a more precise formulation of what Darwin called "the 26

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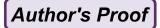
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struggle for existence". Gause's principle further provides a uniform account of both 27 allomorphic variation and the rivalry between affixes, thus unifying two previously 28 distinct phenomena under a single account. A further purpose of this article is to 29 show the value of inverting a traditional scientific stance of linguistics: instead 30 of attempting to reduce variance, we treat the putative variant forms as entirely 31 independent competitors. If any readers feel in the end that this inverse stance 32 has helped them to understand something new, then the article will have served 33 its purpose.

The article constitutes an overview. More detailed analyses from the same 35 perspective can be found in Lindsay and Aronoff (2013), Aronoff and Lindsay 36 (2014), and Aronoff (2016). Here, as in all my recent work, I adopt a general 37 framework of cultural evolution (Boyd and Richerson 2005), in which it is assumed 38 that humans are cultural animals (Aronoff 2015). Cultural phenomena evolve in a 39 manner analogous to biological phenomena and insights from modern biology can 40 be applied to all culturally generated human systems, including languages. ¹

The article contains little direct reference to current work. Its purpose, however, 42 is not simply historical, but rather to clarify, if only for myself, the roots of how 43 linguists account for one of the most central phenomena in all human languages. 44 The work is also a small homage to two of the morphologists I admire most, 45 Stephen Anderson and Peter Matthews, both of whom have shown (Anderson 1985; 46 Matthews 1993) how much light a deeper understanding of the ideological roots of 47 our field can shed on our current thinking.

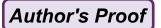
The distinction between contrast and complementarity was first made clear 49 in Baudouin de Courtenay's (1895) redefinition of Dufriche-Desgenette's term 50 phonème (Joseph 1999, Mugdan 2011) in terms of the system of a language.² 51 Baudouin saw phonemes as contrasting abstract psychological (psychophonetic) 52 units. Saussure, who understood abstract language as both psychological and social, 53 later went on to claim that "phonemes are above all else opposing, relative, 54 and negative entities" (Saussure 1916/1959, p. 119), his negative focus further 55 cementing the importance of abstraction in the definition of contrasting linguistic 56 units. In the same work, Baudouin coined the term morpheme (morfema) to name 57 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 63 alternations, had posited that his mentor's psychological phonemes were made up 64

¹The 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.

²More 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.



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of more concrete physiological (Baudouin's later anthropophonic) speech sounds 65 (zvuki), which had both an articulatory and an acoustic reality. For both mentor and 66 student, because the distribution of speech sounds within phonemes was determined 67 by physiology; it was automatic and not contrastive.³

The broader investigation of complementary distribution rose to prominence 69 a half century later with the realization that the distribution of the concrete 70 alternant speech sound realizations of Baudouin's abstract distinctive units could 71 be predicted, lending a more concrete reality to Saussure's negatively defined 72 phonemes. Later researchers constructed an analogy from the relation between 73 phonemes and their alternant realizations to that between contrastive morphemes 74 and the distribution of their own automatically determined alternants, as revealed in 75 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)

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For all these scholars, phonemes and morphemes were insubstantial elements, 79 knowable only through their oppositions and their more concrete variant realizations.

The Competitive Exclusion Principle 2

Georgii Frantisevich Gause spent his entire scientific career in the Soviet Union but 83 he is best known for a short book on theoretical, mathematical, and experimental 84 ecology that he published in English at the age of twenty-four in 1934, The Struggle 85 for Existence, devoted to a lucid exposition of what has come to be called the 86 competitive exclusion principle, starting with the mathematics behind the principle 87 and moving on to experimental verification.

Gause's principle of competitive exclusion (Gause 1934; Levin 1970) states 89 simply that no two species with identical ecological niches can coexist in a stable 90 equilibrium; when two species compete for the same exact requirements, one will be 91 slightly more efficient than the other and will reproduce at a higher rate; the fate of 92 the less efficient species is local extinction. Gause's principle has roots in the earlier 93 mathematical work of Lotka (1925) and Volterra (1926). In Gause's words, "the 94 equation ... does not permit of any equilibrium between the competing species 95 occupying the same 'niche', and leads to the entire displacing of one of them by 96 the other ... One of the species must eventually disappear." (Gause 1934, p. 47) 97 Furthermore, "The process of competition under our conditions has always resulted 98 in one species being entirely displaced by another, in complete agreement with the 99 predictions of the mathematical theory." (ibid., p. 103). 100

³More 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 101 to morphology at some length in Aronoff (2016), showing that this principle covers 102 a variety of well-known types of morphological phenomena in language, from 103 the general absence of synonymy to inflectional classes to aspects of language 104 acquisition. In this article, I will extend the discussion to the traditional concepts 105 of allomorphy and rivalry between derivational affixes. Gausian competition allows 106 us to unify these seemingly distinct phenomena and to explain their differences in 107 terms of the environmental conditions under which competitors thrive.

A word of caution: in human competition, there is often an element of mutual 109 awareness; competitors know that they are competing against each other. Awareness 110 does not figure into biological competition. When two organisms or two species 111 compete for a resource they are simply striving for the same object without being 112 aware that they are doing so or aware of each other. This is the undirected sense of 113 competition that I apply to language, as opposed to competition between conscious 114 agents.

2.1 The Dearth of Synonyms

A simple and sweeping linguistic prediction of Gause's principle is the dearth of 117 exact lexical synonyms, first noted by the Abbé Girard in 1718. Girard's book 118 was a list of sets of apparently synonymous words, with the members of each set 119 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 129 ("that one can use them indifferently on all occasions"). If, as Darwin claims, "The 130 survival or preservation of certain favoured words in the struggle for existence 131 is natural selection" (1871, p. 61), then this struggle among words is subject to 132 Gause's principle. It follows that, when two words happen to have the same exact 133 distribution/meaning, either one of the words will become locally extinct (meaning 134 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 136 (Fradin 2019; Merkuur et al. 2019; Varvara and Zamparelli 2019) deal with the 137 distribution of pairs of affixes. Masini (2019) discusses the competition between 138 a word and a multiword expression, which also follows Gausian principles, as 139 expected. Xu ("Chinese Adjective-Noun Combinations", this volume) treats a case 140 of competition between compounds and phrases. Dressler et al. (2019) show, on the 141

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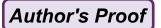
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basis of diminutive suffixes, that competition between affixes is not immediately 142 resolved. In this respect, language follows biology, where resolution usually takes 143 many millennia.

Gause's prediction is true when applied to word meaning and distribution. The 145 divergent distribution of words pervades language. Even near synonyms, which are 146 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 148 locations. The United States National Ocean Service distinguishes them as follows: 149

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 157 last half century (Aronoff 2016). Marchand, in discussing the English suffix pair -ic 158 and -ical, observed the following⁴:

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).

Morpheme Alternants and Niche Differentiation 3

The beauty of the complementary distribution of alternants—allophones, allo- 164 morphs, and other allo- elements in language—lies in its simple systematicity. 165 No more elegant or surprising universal property of human cultures has ever been 166 found. All languages have contrasting phonemes but more strikingly, the phonemes 167 of all languages have allophones and these are distributed complementarily. The 168 same goes for morphemes and allomorphs. The discovery of the complementary 169 distribution of allophones and allomorphs, although much less discussed than the 170 contrast between phonemes or morphemes, was at least as great a milestone in the 171 modern science of language and much more surprising. A communication system 172 without contrast between meaningful elements is impossible but there is no need 173 for each contrasting element to have predictable alternants, which is what makes 174

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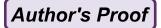
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⁴I follow tradition and cite English affixes by their spelling: -ic, -ical. Sometimes it is important to highlight either spelling, for which I use angled brackets (<ic>), or phonology, for which I use slashes (/ik/). In later sections, I use X as 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. 175 Theoreticians yearn to find one beneath the bustling surface of language.

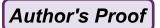
The closest analogue of the distribution of alternants in evolutionary biology 177 is the notion of ecological niche differentiation (also sometimes called niche 178 segregation, or niche separation, or niche partitioning), the process by which natural 179 selection drives competing species into different distribution patterns of resource 180 use. Each distribution pattern of resource use is an ecological niche. There are many 181 ways in which the differential distribution patterns of resource use can occur in 182 nature. The closest analogue to linguistic systems of complementary distribution 183 is resource partitioning (Schoener 1974; Walter 1991), in which two or more 184 competing species divide up the resource (usually what they consume) along some 185 lines, and its subtype, spatial partitioning, in which the resource is a distinct area or 186 habitat that each species occupies.⁵

The special characteristic of the linguistic systems lies in what resources are 188 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 190 allophones of /p/compete for the subparts of the distribution of/p/; the allomorphs of 191 PLURAL compete in the same way to distribute among themselves the realization of 192 all occurrences of PLURAL. The total distribution of all the alternants is determined 193 at the level of the units being realized and the alternant forms partition this overall 194 set of environments. For an alternant, the struggle for existence is the struggle to 195 establish an environment in which it alone is found of all the alternants of its parent, 196 or at least in which it predominates.

Why are the alternants in complementary distribution? In Slobodkin's (1961) 198 formulation of Gause's principle, "[n]o two species can indefinitely continue to 199 occupy the same ecological niche." For the same reason, no two alternants of 200 a single phoneme or morpheme can indefinitely continue to occupy the same 201 phonological or morphological niche. They eventually sort themselves into comple- 202 mentary distribution by means of resource partitioning. English [ph] has found its 203 habitat as the initial consonant of a stressed syllable. Similarly with the aspirated 204 allophones of the other voiceless stops in English. The other allophones of the 205 voiceless stops have been driven to local extinction in this environment, but each 206 survives in another environment because it has struggled and successfully found a 207 unique phonological niche where it predominates. The plain allophones [p,t,k] are 208 scavengers, who scoop up what the others have left over.

Gause's principle predicts that competition between alternants will resolve itself 210 in the end, but that there will always be some indeterminacy somewhere for a time. 211 In most American dialects, the competition between stop allophones has not yet 212 been resolved at the end of a word. Plain [p] and [k] both battle with their unreleased 213

⁵Interestingly, 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.



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counterparts, while plain [t] is losing ground to unreleased [t].⁶ Variation among 214 allophonic sounds in each phonological environment is competition in action; 215 complementary distribution is the resolution of competition.

A Little History

The intense study of the intricacies of the distribution of alternants (of both 218 phonemes and morphemes) followed directly on the heels of the clarification of 219 the status of the phoneme in the 1930s. The phoneme had been a central topic 220 of linguistic research in the quarter century after the posthumous publication 221 of Saussure's Cours, culminating in such classic works as Twaddell (1935) and 222 Trubetzkoy (1938). Much less developed was the study of what Trubetzkoy, in 223 the spirit of Kruszewski, called "merely optional phonetic variants," (ibid., p. 224 46). Indeed, only one five-page section of Trubetzkoy's posthumous masterpiece 225 is devoted to the treatment of these alternants. One of his four "rules for the 226 determination of phonemes" (ibid.), however, provides a classic statement of what 227 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 232 was an inevitable outcome of the discussion of the phoneme, which brought the 233 topic of their alternants to the fore: the first cited use of the term complementary 234 distribution occurs in Morris Swadesh's 1934 article on the phoneme (Dresher 235 2011), published the year after Swadesh's mentor, Edward Sapir (1933), showed 236 so elegantly that speakers can be made aware of the phonemes of their language but 237 not their actual phonetic manifestations, thus providing empirical evidence at last for 238 the psychological reality of phonemes that Baudouin had proposed a half century 239 before. Here I will emphasize the contribution to this discussion of two linguists, one 240 American, one European, both of whom were consumed by abstraction: Benjamin 241 Lee Whorf and Roman Jakobson. Jakobson's role is well known and I will discuss 242 it shortly and briefly: as the champion of invariance, he was driven to explain away 243 all variance. Whorf's role lies largely in his contribution to terminology, is not well 244 known, and makes for a good story.

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⁶In many British dialects, even the most prestigious, word-final [t] has succumbed entirely to [?] 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 247 life of its own in linguistics in the 1950s, "with reference to variation in one 248 particular property among members of a given class" (*Oxford English Dictionary*, 249 henceforth OED), resulting in such novel terms as *allograph*, and *allographic*; 250 *allolog*; *allomorphic* and *allomorphy*; *allophonic* and *allophony*; *alloseme* and 251 *allosemic*; and *allotone*. The prefix and the terms are important, not just because 252 they have a curious history, but because they are testimony to the centrality of the 253 study of complementary distribution in linguistic theory of the period, usurping the 254 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 256 in a short manuscript entitled "Language: plan and conception of arrangement," consisting of an elaborate table and accompanying outline, which he circulated 258 among close colleagues. It was first published in Whorf (1956), the book that made 259 him famous 15 years after his death. The term appears on p. 126 as part of a large 260 table that outlines Whorf's suggested standard format for a language description. 261 Carroll considered this coinage important enough for him to list in his introduction 262 to the book among Whorf's accomplishments that "[h]e was apparently the first 263 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 265 review published in Language only a few weeks before Whorf's death at the age 266 of forty-four in 1941: "... the first allophone (subphonemic alternant) ... of the 267 j phoneme ..." (Trager 1941, p. 170). We meet its earliest explicit definition in 268 a joint article by Trager and Language editor Bernard Bloch published in the next 269 issue, just after Whorf's death: "Sound-types as members of a phonemic class are 270 called allophones" (Trager and Bloch 1941, p. 223). Trager published a one-page 271 obituary note on Whorf in the December 1942 issue of Language, in which he 272 recalls "discussing with him, for long hours that always ended too soon, his daringly 273 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 275 term *allophone*, along with the linguistic use of the analogous term *allomorph*, 276 which is not found in his published writings. The Greek prefix *allo*- 'other' is first 277 attested in scientific use in names of minerals, especially to denote the less stable of 278 structurally distinct but chemically identical isomers or crystals, which were called 279

⁷Lindner (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.

⁹Unlike 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.

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allo-forms or allomorphs. It is still common in chemistry. The first attested use of 280 the term allomorph in linguistics is in an article in Language by Paul Garvin (1945). 281 Throughout the article, Garvin uses the term *morpheme alternant*, until he mentions 282 "the front allomorph of the suffix (the alternant with a front vowel)" (p. 253). He 283 continues to use the term *allomorph* for the rest of the article but only in the phrases 284 front and back allomorph. Garvin's connection with the Yale crowd was indirect, 285 through his mentor at Indiana, Carl Voegelin, who had overlapped with both Whorf 286 and Trager at Yale and had corresponded frequently with Whorf. For neither Trager 287 nor Garvin were the terms allophone and allomorph novel enough to be worthy of 288 comment or attribution. I can only surmise that Whorf had picked up allomorph 289 from chemistry, used it in the linguistic sense of distributional alternant, and coined 290 allophone by analogy; and that he and his Yale friends, Trager and Voegelin and 291 others, had used the two terms often enough in their long hours of conversation 292 to make them part of the normal vocabulary of their scientific discourse. In any 293 case, the prefix allo- in American structural linguistics came to take on the meaning 294 'element in complementary distribution' that was so central to structuralist thinking 295 and remains central today.

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Roman Jakobson and the Search for Invariance 4.2

Saussure and his students are usually credited with promulgating the idea that 298 languages are systems of oppositions of signs, signifiers, and signified. It is to 299 Roman Jakobson, though, that we owe the credo that, at some level of analysis, 300 these oppositions are invariant in both signifier and signified. Once we adopt the 301 ideal of invariance, the linguist's great task is to simultaneously uncover the abstract 302 oppositions that structure the invariant elements and clear away the dross of variance 303 that hides both the structure and the elements. Perhaps the best expression of this 304 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 312 meanings of any case can be reduced to a common denominator. In relation to the 313

¹⁰It 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.

¹¹This 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.

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other cases of the same declensional system each case is characterized by its own 314 invariant general meaning" (ibid., p. 107). Jakobson followed Saussure in observing 315 that the meanings of cases, like those of all (especially grammatical) morphemes. 316 form a system of oppositions, but the credo that these meanings must be invariant 317 is his own. The problem that confronts Jakobson and anyone else who holds such 318 a belief is that "[e]ach case, in its multifarious applications, displays a set of more 319 or less heterogeneous meanings" (ibid., p. 106). Jakobson's solution and task was 320 to reveal that "Itlhe 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 324 invariance applied to all aspects of the linguistic sign, meaning and form. Their most 325 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 327 that they sought to expose to the light of day. 12

The Allophone to Allomorph Analogy and the Beginning of Elsewhere

American structuralist linguistic theory organized language and linguistic analysis 331 into a system of successive levels, each with its own set of contrastive units (Harris 332 1951). Ideally, the analysis proceeded up from the physical signal, beginning with phonetics, following an established set of discovery procedures. ¹³ Bloomfield and ³³⁴ his successors imposed parallelism on the organization of the levels. So, Bloomfield 335 (1933) is filled with such novel technical terms as taxeme, tagmeme, sememe, 336 and episememe, all long forgotten now, each designating the contrastive emic 337 elements at a given level of analysis. 14 This zealous search for parallelism across 338 the organization of levels certainly appeared to gain vindication at the level of 339 morphology: just as the alternant phonetic forms of the phonemes of any language 340 fell into complementary distribution, so too with the alternant forms of morphemes. 341 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

¹²The 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.

¹³These 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.

¹⁴The 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.

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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)

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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 349 contrastive because they were determined by physiology. While we have long since 350 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 353 over the last quarter century by the rise of laboratory phonology and its congeners 354 (Cohn et al. 2012). No one disputes that phonology is grounded phonetically and 355 physiologically. For the structuralists, this grounding took the form of the textbook 356 dictum that allophones must be phonetically similar. This rule of thumb famously ruled out the possibility that [h] and [η] are allophones of one phoneme, despite their 358 complementary distribution in the onset and coda of a syllable, a textbook example 359 (Nida 1949, p. 44, fn. 39). There is no suppletion in phonology.

But suppletion, or at least the absence of phonological relatedness between 361 allomorphs, is the hallmark of morphological alternation. As Nida emphasizes in the 362 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 364 phonological and morphological alternation begins to break down: for the most 365 part, morphological variants are not predictable from physiology or phonetics. Yes, 366 some morphological alternation is directly predictable from phonology: consider the 367 famous case of English {/z/, /əz/, /s/} and {/d/, /əd/, /t/}. But most are not. Either the 368 morpheme alternants are too diverse to be derived one from another phonologically, even when their distribution is predictable from phonology (as demonstrated so 370 memorably by Carstairs 1988), or their distribution is determined morphologically 371 or lexically, and often both. To return to the case of English plural markers, Nida 372 (1949) sets up a morpheme PLURAL for the language, which is realized by the set 373 of allomorphs that he notates as/ $(-\partial z \sim -z \sim -s)$, $\sim -\partial n \sim -\emptyset$ /. And in truth the set becomes larger when we move a little further afield to examples like men, women, 375 geese, people, dice, alumni, antennae, addenda, corpora, genera, criteria, appen- 376 dices, axes, stigmata, rhinocerotes, beaux, cherubim, matzot, attorneys general, 377 analyses, both octopodes and octopi, and the very recent academic abomination, 378 processes with final/iz/. 16 Most of these are clearly lexical, but if we include/-9n/, 379 then we must certainly also include the Latin <-i> plural of <us> words, which is 380 much more common and has a quasi-morphological status. 17

¹⁵Later (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.

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

¹⁷An 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 384 choose one basic, elsewhere, default allomorph per morpheme. For Nida, "[t]he 385 basic allomorph is defined in terms of three characteristics: statistical predominance, 386 productivity of new formations, and regularity of formation" (Nida 1949, p. 45). 387 To these criteria he later adds that of elsewhere or default, which we also find in 388 phonology; the basic allomorph is the default variant. 18 The question that should 389 immediately arise is why these criteria should fall together. On this, Nida is silent, 390 as has been almost everyone since. I will now show that Gause's principle of 391 competitive exclusion provides a simple answer if we turn the system upside-down 392 and treat elements that realize the same values as competitors rather than variants. 393

A Gausian Approach to Morpheme Alternants

What if the analogy between phonology and morphology is simply wrong? What 395 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 397 elements together as variants. What do elements like the various plural markers in English have in common? Setting aside cases where allomorphs are predictable 399 entirely from phonology, as with the $\{-3z \sim -z \sim -s\}$ trio, the criterion that unites 400 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 405 synonyms, considered in a Saussurian fashion. We know from Girard that exact 406 synonyms cannot persist. We know from Gause why: because, when two species or 407 linguistic forms compete for the exact same resources (meaning and distribution in 408 the case of words), the fate of one will be local extinction. The solution for these 409 forms "which have a common semantic distinctiveness" is not semantic differen- 410 tiation, for reasons that we will explore below, but 'habitat' niche differentiation: 411 each of the synonymous competitor 'variants' finds a distributional niche. Gause's 412 principle guarantees that these niches must be complementary if the competitors are 413 each to survive and emerge as 'variants'. Calling them variants is an insubstantial 414 artifact of the analytical disposition that seeks to group the competitors together 415 under a single invariant contrasting element.

If a competitor cannot find a suitable niche it will go extinct altogether, again 417 following Gause. Consider the victory of English third person singular present -s 418

¹⁸Here 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.

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over the now extinct synonymous -eth. In Chaucer's time, -es was confined to the 419 North and stigmatized by southern gentlemen and poets. 19 A couple of centuries 420 later, the carefully edited King James Version strongly favored the conservative 421 Southern -eth but the more cavalier Shakespeare, from the same period, used both 422 forms, indiscriminately or to serve the meter: "Sometime she driveth ore a Souldiers 423 necke, & then dreames he of cutting Forraine throats" (Romeo and Juliet. Liv. 424 82-83).²⁰ Soon after, -eth was gone and later appearances are all deliberately 425 archaizing: "he prayeth well, who loveth well both man and bird and beast" (Coleridge, *The Rime of the Ancient Mariner*, Book 6. 1834). 427

The disappearance of second person singular -est was different. Here the 428 morphosyntactic cell disappeared altogether, taking both pronoun and suffix with it. 429 Another example of extinction from the history of English inflectional morphology 430 is the demise of the present participle suffix -end, driven out by the expansion of 431 the range of the gerund -ing, for mysterious reasons, since the distinction between 432 participle and gerund would seem to be useful.

It is not all death and dying. The English zero plural marker has expanded its 434 lexical range considerably since it acquired the niche of usually large, especially 435 wild, animals (except birds). From originals like sheep, deer, and fish it has moved 436 on to elk, moose, wapiti, tuna, skate, etc. 21 But all this makes sense only if we 437 see the erstwhile allomorphs as independent forms, each vying for a meaning 438 and distribution. The eventual complementary distribution that we see is simply 439 a direct consequence of the competition that synonymy ("a common semantic 440 distinctiveness") triggers. 441

6.1 Elsewhere and Invariance

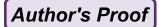
Is calling one apparent variant the elsewhere or default variant simply a matter 443 of convenience or is something deeper at stake? First, we must ask whether there 444 always is an elsewhere variant. In Latin, for example (Matthews 1972), it is difficult 445 to imagine why one would select any one of the first-person-singular active suffixes 446 $-\bar{o}$, -am, and $-\bar{i}$ as either basic or elsewhere or default. Each appears in a specific set 447 of tenses and moods. The one used in dictionary citation forms, $-\bar{o}$, which learners 448 of the language think of as default, appears only in the present indicative and future 449 perfect. -ī appears only in the perfect indicative, leaving -am as the default. The 450 most frequent form, though, is the present $-\bar{o}$. For Classical Greek, the analogous 451 problem is even greater, since there are not only several suffixes depending on tense 452 and aspect, but there is a separate set of athematic verbs with its own morphology. 453

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

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

²¹Compare 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. 454 1995), is also far from the most frequent; -*en* is more frequent and just as productive, 455 but morphologically restricted, and so not a default in the usual sense of the term. 456

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 debelief 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 distribution and forms: the Latin first-person perfect indicative active suffix $-\bar{t}$, 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 else- 485 where/default distribution was not simply a convenience or an accident but that 486 a deep principle lay behind it. Kiparsky named it the *elsewhere principle* and 487 the name stuck, which is why most people forget that Anderson had proposed it 488 some years before. The principle also goes by other names: the *subset principle*, 489 *Panini's principle*, the *proper inclusion principle*. Recently, Bakovic (2013) has 490 shown that the elsewhere condition in phonology is best explained in terms of 491 constraint ranking within Optimality Theory, not some separate principle. Hippisley 492 and Brown (2012) handle elsewhere phenomena in inflectional morphology in a 493 similar fashion. In both cases, the result is the same: different variants find distinct 494

 $^{^{22}}$ Purely morphological features like conjugation class are laid over these and lexical properties laid over the morphological features.

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niches, with most variants being specialized and the apparent elsewhere variant 495 sweeping up the residue. The alternative, as Bakovic emphasizes, would be the 496 obliteration of the locally restricted form, total extinction. 497

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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 500 claim, made explicit in Anderson (1982), is that the difference is in their domains: 501 inflection trades in syntactic features and values, while derivation deals in lexical 502 categories, thus dividing the structural world at zero, with inflection above and 503 derivation (including compounding) below (Aronoff 1994). Everything else should 504 follow from that one difference. In fact, this simple line is sufficient to account for 505 other empirical aspects of the two, once we place the entire system in a Gausian 506 framework. I will concentrate on one difference here, the very different semantics 507 of the two types, as suggested by Kiparsky (2010).

Derivational affixes are notoriously peculiar in their semantics and pragmatics. 509 In English, we have examples like the twentieth-century American suffix -teria, 510 which OED defines as "[a] suffix used commercially to form the names of self- 511 service retail or catering establishments." This usage depended crucially on modern 512 society. Examples of coinages are washeteria and groceteria. The Italian suffix - 513 eria is used, much more productively and widely, to designate 'place where X is 514 sold'. The English suffix -ery is its cognate. Tagalog has several affixes with rather 515 idiosyncratic meaning. Here are two selected from Schachter and Otanes (1972) 516 (Table 1).

The prefix mag- accompanied by reduplication of the first CV of the base 518 noun means 'vendor of the product designated by the base This prefix has many 519 independent uses. For example, as shown in the Table 2, when used alone, it can 520 mean 'two relatives, one of whom bears to the other the relation designated by the 521 base noun'.

In addition, individual words formed by a single derivational process can vary 523 dramatically in their meanings, not just because of semantic drift, but because 524 the process itself is often quite open-ended semantically and pragmatically. For 525 example, as Jespersen warned long ago, "the analysis of the possible sense-relations 526 [of compounds] can never be exhaustive" (1946, p. 138). In Aronoff (1980), I 527

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

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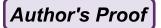


Table 2 Tagalog terms for pairs of relatives

Base	Gloss	Derived form	Gloss
ama	Father	magama	Father and child
asawa	Spouse	magasawa	Husband and wife
ina	Mother	magina	Mother and child
pinsan	Cousin	magpinsan	Two cousins
kapatid	Sibling	magkapatid	Two siblings

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

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

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

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

²³In 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 wellknown 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!"

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in long-discussed but still mysterious ways (Blank 1997), because their denotata 558 change in at least partly non-linguistic ways.

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The semantics of inflection does not work at all in this way. All English past tense 560 forms, regular or irregular, have the same sense, 'V + PAST', where V is the sense 561 of the verb. A given paradigmatic form type may have more than one use, such as 562 irrealis uses of the past tense or historical uses of the present, but these uses extend 563 to all verbs and are not lexically restricted. Occasionally, a single inflected word will 564 acquire a lexical use, as with adjectival uses of individual English past participles, 565 which may then each stray semantically. However, the original participial sense 566 remains as well, which does not usually happen with derivation. In the clearest cases, 567 such as molten or cursèd, the verb will acquire a new regular participle (here melted, 568 and cursed without the schwa) to replace the form that has gone rogue, but most 569 pairs remain homophonous, spawning an entire industry for linguists, beginning 570 with Wasow (1977), on how to deal with the syntax of both uses, one lexicalized, 571 one not.

These rare examples of lexicalization of individual inflected forms of individual 573 lexemes are the exceptions that prove the rule. Unlike derived words, inflected 574 forms do not normally stray semantically, because they map onto meanings that 575 are provided for them ready-made by the morphosyntax of the language (cells in a 576 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 579 (or more) inflectional forms do become available to realize the same cell in an 580 inflectional paradigm. Thornton (2011, 2012a, b, 2019) has named this phenomenon 581 overabundance and shows ("Overabundance: A Canonical Typology", this volume) 582 that it is non-canonical in terms of Corbett's theory of canonical morphology 583 (Corbett 2007). Nowhere does Thornton remark on the absolute synonymy of all 584 the many cases of overabundance that she has unearthed. This makes sense, because 585 the synonymy of rivals is surprising only from a competition-based perspective. 586 In its light, we see why inflectional and derivational affixes compete among one 587 another so differently. The niches for inflectional affixes are pre-determined by the 588 morphosyntax (what Stump 2016 calls the *content paradigm* of the language), with 589 the result that rival affixes have little room for maneuvering, unable to differentiate 590 themselves in their denotation. The affixes within a language variety can find distinct 591 niches only in their phonological or morphological environments.²⁴ Occasionally, 592

²⁴Thornton (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).

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two affixes will find themselves in the same cell, but Gausian competition makes 593 sure that such cases are few and far between.²⁵

As Yang (2016) has convincingly shown, we normally find in inflection a system 595 of rules and lexical exceptions, with the maximum number of exceptions to any 596 given rule equal to the number of cases that the rule can apply to divided by 597 the natural logarithm of that number. Yang's formula can work only when, as in 598 inflection, there is no semantic variance in the outputs of the rule and every lexeme 599 must have a grammatical form for each cell. In derivation, there are no paradigmatic 600 cells to be filled, so there is no way to count how many inputs or outputs there 601 are for a given rule. Furthermore, semantic and pragmatic factors allow competing 602 affixes to differentiate themselves in many ways. Remember the difference between 603 a cyclone, a hurricane, and a typhoon. Similar distinctions can emerge between the 604 individual token outputs of rival derivational affixes, resulting in many doublets 605 but few true instances of overabundance, since the doublets have many pragmatic 606 and semantic options for differentiating among each other. In Aronoff (1983), I 607 showed how foregrounding serves to distinguish the outputs of a less productive rule 608 from those of its more productive rival. Experimental and statistical study (Aronoff 609 and Schvaneveldt 1978; Aronoff and Anshen 1981) reveals that English speakers 610 normally much prefer the suffix -ness to its rival -ity when attached to words ending 611 in -ive. But words of the form Xivity survive because they can be used, for among 612 other purposes, to coin technical terms like productivity, where the use of the less 613 productive rule signals that the word has a special sense. 614

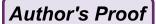
Similarly, not just individual items but synonymous affixes can differentiate 615 among themselves semantically over time. Gause's principle tells us that they must 616 become differentiated in some way. Otherwise, all but one will face extinction (see 617 the discussion above), and semantics is as good a differentiator as any. Sungeon 618 Cho and I explored how the English suffixes -hood and -ship, both descended from 619 lexical words by grammaticalization in earlier stages of the language and originally 620 similar in meaning, have become differentiated over time (Aronoff and Cho 2001). 621 Consider the contrast in (1) below: 622

1.

- airmanship, friendship, penmanship, sponsorship vs. *parentship, (a) *wifeship, *womanship
- (b) *airmainioo., wifehood, womanhood *airmanhood, *friendhood, *penmanhood, *sponsorhood vs. parenthood,

As we showed in detail in our article, -ship attaches to stage-level predicates 624 that do not denote permanent conditions, while -hood has no such restriction and 625 can attach to individual-level predicates (Carlson 1977). Another rival suffix, - 626 dom, also a free noun in Old English, has specialized for 'domain' or 'realm'. 627 Compare kingship (a temporary condition) with kingdom, fanship with fandom, 628

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



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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. 631 Thus, these three suffixes, all derived from free words with similar senses, have 632 survived because over the last millennium they have each found a niche, two 633 specialized and one more general. The cognate suffixes in German, -heit, -schaft, and -tum, have similarly acquired distinct meanings in that language, different from 635 those of the English suffixes, which we do not have space to discuss here. 636

Rivals: Divvying Up the Spoils 8

There are many ways for synonyms to differentiate among each other besides 638 semantics. Aronoff and Lindsay (2014) describe in detail the distribution of the 639 two synonymous English comparative constructions (the suffix -er and the degree 640 modifier *more*), in which we incorporate the detailed findings of earlier researchers 641 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, 643 their distribution is still not completely settled.

Here I will turn to a set of suffixes that I have revisited periodically throughout my 645 career, English suffixes that form abstract nouns from adjectives. The best known of 646 these are -ity and -ness and it was this pair that originally caused me to adopt the 647 term rival affixes (Aronoff 1976). My colleagues and I (Aronoff and Schvaneveldt 648 1978; Aronoff and Anshen 1981; Anshen and Aronoff 1988) used a variety of 649 statistical and experimental techniques to show that, while -ness is more productive 650 overall, -ity is preferred after a small set of suffixes, notably -al (duality is preferred 651 to (>) dualness), -i/able (feasibility > feasibleness), and -ic (telicity > telicness). 652 This is an example of what Plag (1999) calls base-driven productivity ("restrictions 653 imposed by ... the suffix of the base word on the kind of suffix it can take" (ibid., 654 p. 69) and what Williams (1981) call potentiation. This category easily extends to 655 include phonologically-conditioned environments of the sort discussed by Carstairs- 656 McCarthy if we broaden the category to include all aspects of the form of the base.

Quasi-Morphemes

Kristian Berg and I have recently uncovered another phenomenon that falls under 659 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, 661 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 663 the preference for this suffix and signaling a lexical category. With written language, 664 where we have observed it, one may broadly call this an orthographic neighborhood 665

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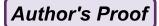


Table 3	Words of th	ne form <i>Xilit</i> v
---------	-------------	------------------------

Stem- final letter string	Number of possible adjective bases of <i>Xility</i> nouns	Number of corresponding <i>Xility</i> 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	t8.1
tile	83	29	t8.1
vile	3	2	t8.1
xile	6	1	t8.1

effect (Coltheart et al. 1977). It is also reminiscent of Goldsmith's (2001) method for 666 inferring morphological structure from words. We have already seen that the output 667 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 669 spelled either *Xable* or *Xible*. ²⁶ I will broaden the scope of inquiry to other words 670 of the form Xility, in which the suffix -ity has been added to words of the form Xile. 671 There is no reason to believe that -il(e) is a suffix in English (though it is in Latin). 672 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 674 ourselves to stem-final strings with more than 25 words, we see that Xbility is 675 productive (700/3400); Xtility is even more so (29/83) and Xphility and Xsility are 676 not productive at all. There may be a threshold effect: to be eligible for potentiation 677 a word-final letter sequence must reach a certain number. In the case of *Xphility*, the 678 rival Xphilia is productive, leaving little for any other suffix to feed on, as Rainer 679 (1988) notes for the corresponding German case: OED lists 25 Xphilia words, 680 corresponding to 58 Xphile words. This all makes sense from a Gausian perspective: 681 a niche must be of sufficient size to be useful as a possible niche and it must not be 682 already occupied by a strong competitor. From the opposite perspective, it may be 683 that anything can serve as a niche, so long as it is sufficiently salient, not just a 684 morpheme.

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

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Table 4	Derivatives	of Xnt	adjectives

Final					Number of	-
neighborhood	Number of	Number of	Number of	Number of	$Xntial_A$	
of adjective	entries in stem	Xntness	Xncy	Xnce	derivatives of	
stem	neighborhood	derivatives	derivatives	derivatives	Xnce/y or Xnt	
Xnt _A	1900	62	600	1200	119	t11.1
Xant _A	700	20	289 (8	500	14 (11 <i>Xstantial</i>)	t11.2
			Xstancy)			
Xent _A	1000	36	300	600	104	t11.3

8.2 Xa/ence/y

The salience of final sequences, especially letter sequences rather than phoneme sequences, is even more striking with abstract nominals derived from adjectives of 688 the forms *Xa/ent*. Neither permits -*ity* at all.²⁷ Table 4 shows that there are also 689 few -*ness* derivatives of these words.²⁸ Instead of either, we find the two adjective 690 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*. 692 Almost 90% of them (1700) end in <ant> or <ent>. There are approximately 2600 693 nouns in English of the form *Xce* or *Xcy*. In 1800 of them <n> precedes <ce> 694 and in almost 1700 of these, the <n> is preceded by <a> or <e>, as the table 695 shows. All words of the form *Xa/entness* listed in OED have rivals of the form 696 *Xa/ence/y: ferventness/fervency*. In these pairs, the member ending in -ness is always 697 less common than the one ending in <ce> or <cy>. For example, while brilliance 698 has a Google visibility score of 200, brilliantness has a score of 0. Words of the 699 form *Xntness* are found when the stem is a monosyllable, usually when <nt> is not 700 preceded by <a/e> > bluntness, faintness, gauntness, quaintness, scantness. In none 701 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 703 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 705 *Xent* words. I have not been able to find any other words that plausibly bear the 706 suffix <-ce>. *Xacy* is the only sizable neighborhood for <-cy> besides *Xncy*: OED 707 lists 207 nouns of this form, of which about half (93) are of the form *Xcracy*. 708 Many, but not all *Xcracy* nouns have corresponding *Xcrat* nouns (e.g., *bureaucrat*, 709 *bureaucracy*) and are therefore not deadjectival. Of the remaining hundred or so 710

²⁷The 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.

²⁸3.3%, 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., 711) obstinate, obstinacy), but getting an accurate count is technically difficult and there 712 are about as many words like fallacy and legacy (with no related free word), and 713 *lunacy*, where the related word is not of the form *Xate*. In short, both suffixes, <-ce> 714 and <-cy>, are remarkably robust in the niche provided by *Xant* and *Xent* adjectives 715 and not productive elsewhere. This is a classic neighborhood effect (Lindsay and 716 Aronoff 2013). Xnt is a large final 2-letter neighborhood. We noted above that 717 Xa/ent constitutes 90% of the final three-letter subsets of Xnt, making the form 718 salient enough to sustain productive affixation on its own. In a nutshell, the two 719 deadjectival abstract nominal suffixes <-ce> and <-cy > are productive only with 720 adjectives in Xa/ent, but in this niche, they have almost completely resisted their 721 rivals, including the powerful -ness. Compare -ity, which is productive in several 722 niches, not only Xbility and Xtility, as we have just shown, but also with -ality, and 723 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 725 light. The distinct suffixes—-ness, -ity, -ce, and -cy—are completely independent 726 actors. Each one struggles to survive, to find one or more distributional niches. 727 The most restricted, -ce and -cy, like pandas, are completely dominant in a tightly 728 circumscribed environment—so much so that none of the others can gain any 729 purchase there—but these two are absent everywhere else. 30 -ity has found a few 730 distinct niches, in some of which it thrives more than in others. Where it is less 731 robust, as in the Xive set of adjectives, it hangs on by specializing (expressivity vs. 732 expressiveness). -ness is the generalist, in part because of the size of its population. 733 It can live off pretty much any adjective, which is why we call it the default, but it is 734 less pervasive (albeit still found to some extent) in places where others thrive. There 735 is no such thing as general productivity, but only productivity of affix/niche pairs, 736 as first noted by Zimmer (1964). We may call -ness a default, but only because it is 737 unrestricted in its distribution.

Xential: A Purely Orthographic Neighborhood

The great majority of the words listed in OED or any other large dictionary of 740 English occur only in writing. It stands to reason that written form may play a role 741 in the morphology of the language of these dictionaries, especially when it comes 742 to those parts of the language that have their roots in written languages, notably 743 French, Classical Latin, and Classical Greek, what we call the learned vocabulary.³¹

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³⁰The 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).

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

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We should expect, then, to find derivational affixes in English (and other long- 745 written languages) whose niches are defined orthographically. In Lindsay and 746 Aronoff (2013), we showed that the English suffix combination -*ical* was productive 747 only in the orthographic neighborhood of surface stems of the form *Xolog*, where 748 it overwhelmed the generally much more productive -*ic*. (e.g. *ontological* vs. 749 *ontologic*). We showed further that *Xolog*- was by far the most dominant set of stems 750 in English with a final neighborhood of length 4, making up 2/3 of all stems of the 751 form *Xg*, exceeding all other final stem neighborhoods of length 4 as a fraction of 752 its superset of length 1 by a wide margin. Its closest competitor is *Xgraph*, which 753 comprises 1/3 of its length-1 superset (stems ending in <h>). We concluded that 754 -*ical* has found its niche with stems of the form *Xolog* and that it is potentiated 755 by the salience of its neighborhood. We now see that the same holds for *Xbility*, 756 *Xtility*, *Xancy*, and *Xency*. In each case, a suffix has found a small, well-defined 757 neighborhood in which it can thrive and outnumber its generally more productive 758 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 761 5. 32 I will show, following the suggestion of Marchand (1969), that *Xntial* words 762 are formed on Xence bases and not on Xance bases, where the final vowel is 763 unstressed.³³ This is notable, since these base sets differ only in the *spelling* of this 764 final vowel, not in its pronunciation: <e > vs. <a>. After we have cleaned the list 765 manually by excluding further derivatives (e.g., inessential from essential), we find 766 a total of 77 Xntial words to work with. About half have been coined in English, 767 most of the rest borrowed from either Latin or French. Table 5 lists the potential 768 bases of these words by their word endings. The results support Marchand's (1969) 769 observation that the only productive pattern is $Xence \rightarrow Xential$. The second column 770 lists the number of words (50 out of 77) for which there is a corresponding 771 Xence word in OED. The other columns list those for which there is no Xence 772 word. Of these 27 words, six have corresponding *Xency* words (e.g., *presidency*, 773 contingency) and ten have Xent correpondents only (e.g., tangent, component). 774 Only three of the Xntial words have corresponding Xance words (concordantial, 775 instantial, protuberantial), and none have only Xancy or Xant words, although we 776 know from Table 3 that there are nearly as many XanY words as there are XenY 777 words in the language. The most remarkable conclusion that we can make from 778 Table 5 is therefore negative: there is no productive pattern deriving *Xantial* words 779 from Xance words. This pattern is remarkable for two reasons. First, the difference 780 between the productive base XenY and the potential but unproductive base XanY lies 781 only in the spelling of the vowel letter. There is no phonological difference. Second, 782

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

³³When 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.

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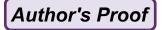


Table 5 Xntial words and their likely bases

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

as Kristian Berg points out to me (p.c.), Xant words are twice as likely as Xent 783 words to be analyzable, making the word ending <ent> more opaque than <ant>, 784 and hence, one would suppose, less salient.

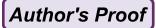
We have shown elsewhere (Berg and Aronoff 2017) that English spelling 786 has evolved to distinguish suffixes from the homophonous endings of simple 787 words (compare gimmick with gnomic). The example here is a little different: 788 two homophonous word endings with different spellings. The closest comparable 789 example that we have found in our previous work are the adjectival suffixes <- 790 y > and <-i>, the latter being restricted to ethnonyms (e.g., *Israeli*, *Pakistani*). Here 791 we have two endings, <-ant> and <-ent>, that appear to differ only in their spellings, 792 but the patterning of *ntial adjectives tells us that the language distinguishes 793 between the two, despite their homophony. We conclude that spelling can constitute 794 a possible niche in a written language with a long and stable history.

Conclusion 796

The story is told of the family tradition of cutting the two ends off a roast before 797 beginning to cook it. No one knew why. Those who followed the tradition reported 798 that their mothers had done the same and when the mothers were questioned, they 799 gave the same response. Finally, the grandmother was asked if she knew why. 800 She responded that her roasting pan was too small to accommodate a full roast. 801 Too often, we follow the practices of our forebears without asking why they did 802 what they did. Here I have shown that what morphologists have long treated as 803 variants are in fact rivals whose distribution is governed by a well-known principle: 804 competitive exclusion. This inverse perspective allows us to unite a variety of 805 previously disconnected phenomena and to understand them better than we had 806 in the past. It also shows that yet another type of pattern that linguists had long 807 cherished as purely linguistic is susceptible to more general explanation.

In this article, I have provided several morphological analogues of ecological 809 niche differentiation, the process by which natural selection drives competing 810 species into different distribution patterns of resource use. In ecology, there is no 811 way to characterize in advance what a possible niche might be. A biological resource 812 need not be biological, but must rather only sustain biological success. So too with 813 the resources on which linguistic patterns thrive. The patterns must be linguistic, not 814 the resources.

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- AQ1. Pike (1947) has been provide in text but not given in the reference list. Please provide the details in the list or delete the citation from the text if applicable.
- AQ2. Please confirm the inserted call-out for Table 1.
- AQ3. Please provide in-text citations for Harris (1942) and Kruszewski (1995) or delete the reference from the list, if applicable.
- AQ4. Please provide page range for Dressler et al. (2019), Fradin (2019), Masini (2019), Merkuur et al. (2019), Rossella and Zamparelli (2019), and Thornton (2019).
- AQ5. Please confirm the updated reference for Dressler et al. (2019), Fradin (2019), Masini (2019), Merkuur et al. (2019), Rossella and Zamparelli (2019), and Thornton (2019).