ASSESSING THE PRODUCTIVITY
OF OLD ENGLISH *-lǣcan*[1]

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1. Introduction

The derivational morphology of Old English has attracted considerable attention for a long time (see, for instance, all the references provided by Lindemann 1970), given the generalized character of this phenomenon in the lexicon, as well as its relative formal transparency and semantic analysability. Recently, this area of morphology has been studied from two main perspectives. Kastovsky (1986, 1989, 1990, 2005, 2006) has dealt with zero derivation, affixation and compounding from the point of view of the typological shift identifiable in Old English from variable base morphology to invariable morphology, to reach the conclusion that by the end of the Old English period morphophonological alternations do not play any role in the formation of new words. Kastovsky (1992) has also offered the most systematic and comprehensive account of Old English word-formation to date. In this study the author insists on the associative character of the lexicon, which is comprised, with very few exceptions, of Germanic lexical items, and on the numerous derivational families that result from the operation of word-formation processes. Martín Arista (2005, 2006, 2008, 2009, 2010a, 2010b, 2010c, 2011a, 2011b, 2011c, fc.-a, fc.-b, fc.-c), in a more theoretical approach, has proposed a model of functional morphology called *Layered Structure of the Word* and has applied it to Old English in order to explain not only the units and processes of

word-formation but also some current topics of debate in morphology such as recursivity, percolation, cumulation, paradigmatic organization, etc.

In spite of the breadth and depth of these works, the question of the productivity of affixes and processes at this stage of the evolution of English remains largely untouched. While productivity has been a constant in morphological debate (see the works by Aronoff 1976; Baayen 1989, 1992, 1993; Baayen and Lieber 1991; Baayen and Renouf 1996; and Bauer 2001, 2005, among others), very few advances have been made in Old English morphological productivity. Kastovsky (1992) and Lass (1994) stress the difficulty of assessing the productivity of the word-formation patterns of an historical language and note the coexistence of productive and unproductive formations in the lexicon of Old English. Kastovsky (1992: 356-358) points out three main problems found when dealing with Old English productivity. First, that there is no direct way of testing productivity, which implies that we have to rely on indirect evidence such as the number of occurrences in a text in a given period or the continuity of a given process of word-formation. Second, productivity and transparency can vary diachronically. In Kastovsky's (1992) words, when one has to deal with a linguistic period such as Old English, stretching over some 600 years, there are bound to have been many changes. Only the output of the patterns recorded in the later documents is available for study. This is in keeping with Lass´s (1994: 193) remark that it is difficult to determine whether a given ocurrence of a derived form represents an institutionalized lexical item or not, or whether it is a new formation. And third, when a given word-formation process loses its productivity, it may leave at least some of its output as part of the vocabulary. As Kastovsky (1992: 356) puts it, the loss of productivity usually increases the tendency towards lexicalisation, with which the notions of transparency and analysability are crucial for a diachronic study.

Given this background, in this article I assess the productivity of the Old English verbal suffix -*lǽcan* and advance an explanation for the productivity of the affix based on a previous analysis of the class status of *lǽcan/-lǽcan* and the lexicalization of the derivatives to which it is attached. For the study of productivity, the possibility of deriving new words is not so central in a historical language as in a living language, the reason being the nature of the evidence that is available rather than the theoretical interest of the notion of productivity. Therefore I concentrate on frequency understood as the number of the existing derivatives and, in order to offer an accurate assessment of the frequency of the affix in question, I consider the lexicographical as well as the textual sources of evidence. In the discussion that follows I use lexicographical evidence to measure type frequency and evidence from a corpus to measure token frequency. The measure of frequency ultimately allows me to assess the productivity of the affix.

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The article is organized as follows. In section 2, I discuss the class status of *lǣcan/-lǣcan* and the lexicalization of its derivatives. In section 3, I measure the productivity of *-lǣcan* through an analysis of the evidence gathered from lexicographical and textual sources and, to close the article, the main conclusions are summarized in section 4.

2. The grammaticalization and lexicalization of *-lǣcan*

Before discussing the questions of the grammaticalization and lexicalization of *-lǣcan,* a morphological and semantic analysis of the affix would clear the ground. The Old English suffix *-lǣcan* produces denominal, deadjectival and deverbal verbs (Jember *et al.* 1975; Kastovsky 1992; Quirk and Wrenn 1994) as can be seen in example (1), which offers a strictly synchronic description of the morphological relation holding between the lexical items:

(1)

a. *winterlǣcan* 'to grow wintry' (< *winter* 'winter')
b. *gemetlǣcan* 'to moderate' (< *gemet* 'fit, proper, apt')
c. *limplǣcan* 'to fall down' (< *(ge)limpan* 'to happen')

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Kastovsky (1992: 391) remarks that "*lǣc(an)* forms deadjectival verbs with the meaning 'be, become, make' and denominal verbs with the meaning 'produce, grow, become'." Additionally, *limplǣcan* 'to fall down' in (1c) is a deverbal derivative, from the strong verb *(ge)limpan* 'to happen' and there is another instance of a deadverbial derivative, namely *gesamodlǣcan* 'to bring together' < *samod 1* 'simultaneously'. Kastovsky (1992: 356) refers to elements that represent bordeline cases between compounding and affixation as affixoids, and includes *-dom*, *-lac* and *-rǣden*, but he does not include *-lǣcan*. Nevertheless, rather than relying on a discrete category such as an affixoid (as opposed, for instance, to an affix), I offer an explanation based on the notion of continuity, both between lexical and grammatical elements (grammaticalization) and between semantic compositionality and non-compositionality (lexicalization).

The affix *-lǣcan* coexists with the weak class 1 verb *lǣcan* 'to spring up, rise, flare up', a zero derivative of the class VIIa strong verb *lācan* 'to move up and down, leap, jump, swing, fly; play (instrument); play upon, delude; fight, contend'. Semantically, the derivation of *lǣcan* from *lācan* is motivated by meaning specialization. The coexistence of the lexeme and the morpheme in the lexicon indicates that grammaticalization is under way. I use the term *grammaticalization* with the value of change from lexical status to grammatical status (Hopper and Traugott 2003: 18). According to Lehmann (2002: 15) "grammaticalization reduces the

autonomy of a unit, shifting it to a lower, more strictly regulated grammatical level". Put in another way, "grammaticalization involves desemanticization of lexical forms, which gain more abstract meanings" (Givón 2009: 301). Focusing on the affix under study, there is a change from a literal meaning of movement 'to spring' to figurative meaning 'to begin a state or an action'. There is also a change from a more specific lexical meaning to more general grammatical meaning, to code inchoative internal aspect (beginning of an action or state) and causative internal aspect (with a secondary predication as second argument). When the affix is attached to nouns, its function is usually to convey inchoative internal aspect, except in the causative formations *gewundorlǣcan* 'to make wonderful' < *wundor* 'wonder' and *gehīwlǣcan* 'to form' < *hīw 1* 'form':

(2)

ǣfenlǣcan 'to grow towards evening' < *ǣfen* 'evening'
fālǣcan 'to be hostile to' < *fāh 2* 'enemy'
(ge)cȳðlǣcan 'to become known' < *(ge)cȳðð* 'knowledge'
(ge)dyrstlǣcan 'to dare' < *gedyrst* 'tribulation'
gemetlǣcan 'to moderate' < *(ge)met* 'moderation'
gewerodlǣcan 'to make sweet or pleasant' < *werod 2* 'sweet'
gewistlǣcan 'to feast, banquet' < *wist* 'feast'
limplǣcan 'to unite, connect' < *gelimp* 'occurrence'
loflǣcan 'to praise' < *lof* 'praise, glory'
sumorlǣcan 'to draw on towards summer' < *sumor* 'summer'
swæðlǣcan 'to search for' < *swæð 1* 'vestige'
winterlǣcan 'to grow wintry' < *winter* 'winter'

When the affix is attached to adjectives, its function is causative in a remarkable number of instances, including:

(3)

(ge)cūðlǣcan 'to make known' < *(ge)cūð* 'known'
(ge)cyrtenlǣcan 'to make elegant' < *cyrten 1* 'fair'
(ge)efenlǣcan 'to be like; make like' < *efen 1* 'even, equal, like'
(ge)rihtlǣcan 'to make straight, put right' < *(ge)riht 2* 'straight; right'
(ge)swǣslǣcan 'to wheedle' < *(ge)swǣs* 'benevolent'
fremedlǣcan 'to alienate' < *fremde* 'alien'
gedrēoglǣcan 'to put in order' < *gedrēog* 'fit'
geswētlǣcan 'to batten' < *swēt* 'sweet'
gesyndlǣcan 'to cause to prosper' < *gesund* 'prosperous'
gewærlǣcan 'to warn' < *wær 1* 'aware of'
nǣlēacan 'to come or draw near; to be near' < *nēah 1* 'near'
wiðerlǣcan 'to deprive' < *wiðer 2* 'hostile'

Exceptions to the causative function of the affix in deadjectival formations include:

(4)

(ge)ðrīstlǽcan 'to dare' < *ðrīst 1* 'daring'
(ge)ðwǣrlǽcan 'to agree' < *(ge)ðwǣre* 'agreeable'
(ge)cneordlǽcan 'to be diligent' < *gecneord* 'diligent'
(ge)lōmlǽcan 'to frequent; be frequent' < *(ge)lōme 1* 'frequent'
geonglǽcan 'to grow up' < *geong 1* young'

Notice that the attachment of the affix to an adverbial base also performs a causative function (*gesamodlǽcan* 'to bring together' < *samod 1* (adv.) 'simultaneously'). More significantly, the exceptions to the inchoative and causative function suggest that there is a certain degree of semantic bleaching or *desemanticization of lexical forms* (Givón 2009: 301), which reinforces the explanation in terms of grammaticalization.

At the same time, lexicalization affects the derivatives of *-lǽcan* to some extent. Fischer (2008: 352) has proposed a criterion for distinguishing grammaticalization from lexicalization. Whereas lexicalization operates at token level, grammaticalization operates both at token level and type level. In the specific case of *-lǽcan*, the grammaticalization process affects the whole morphological process of affixation by means of this suffix, whereas lexicalization affects some of the derivatives obtained by attachment of this suffix. On this phenomenon, Kastovsky (1992: 356) points out that "the principle of transparency/motivation can be impaired by the process of lexicalisation: once formed, a lexeme may adopt additional semantic properties that are not predictable from the meanings of the constituents and the pattern underlying the combination". In this line, I identify the lexicalization of a derived form when the meaning of the resulting form is not predictable from the meaning of its component parts. Moreover, in the same derived form may co-exist analizable and non-analizable or lexicalized meanings. Although for Norde (2009: 14) "all derived words are instances of lexicalization", I draw on Kastovsky (1992: 356) with respect to the fact that "lexicalisation is not an all-or-nothing phenomenon, but a scale, and lexemes may move along this scale in the course of time". At least the following verbs exhibit a certain degree of lexicalization:

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(5)

swæðlǽcan 'to search for, visit' < *swæð 1* 'footprint, track; trace, vestige'
limplǽcan 'to unite, connect' < *gelimpan* 'to happen'
(ge)ðrīstlǽcan 'to presume, dare' < *ðrīst 1* 'daring, rash, bold; audacious, shameless'
gecyrtenlǽcan 'to beautify, make elegant; make sweet' < *cyrten 1* 'fair, comely; intelligent'

(ge)swǣslǣcan 'to wheedle' < *(ge)swǣs* 'intimate, special, favourite, dear, beloved; own; agreeable, gentle, benevolent; sweet, sugary'

geonglǣcan 'to pass one's youth, grow up' < *geong 1* 'young, youthful; recent, new, fresh'

nǣlēacan 'to come or draw near, approach; be near; be like; cling to' < *nēah 1* 'near, nigh, close; late'

wiðerlǣcan 'to deprive' < *wiðer 2* 'hostile'

Recapitulating, *-lǣcan* results from grammaticalization lexeme > derivational morpheme that can be identified on the grounds of a change from specific to general meaning and literal to figurative meaning. At the same time, some derivatives displaying this suffix undergo lexicalization, though in the process the meaning of the derivative is not predictable from the sum of the meanings of base of derivation and affix. Having accounted for the bound status of *-lǣcan*, I turn to the question of the productivity of the affix.

3. The productivity of *-lǣcan*

In this section, I measure the productivity of Old English weak verbs suffixed with *-lǣcan* within a quantitative framework on the grounds of the formulae proposed by Baayen (1989, 1992, 1993). For the analysis of the productivity of *-lǣcan*, I have used two main sources: the lexical database of Old English *Nerthus* and *The Dictionary of Old English Corpus*. The lexical database *Nerthus* (www.nerthusproject.com) contains a total of ca. 30,000 entries, or headwords, taken primarily from Clark Hall's *A Concise Anglo-Saxon Dictionary* (1996), and secondarily from Bosworth and Toller's *An Anglo-Saxon Dictionary* (1973) and Sweet's *The Student's Dictionary of Anglo-Saxon* (1976).[2] *The Dictionary of Old English Corpus* (diPaolo Healey *et al.* 2004) is an *online* text collection comprising ca. 3,060 different texts belonging to different categories, such as prose, poetry, glosses to Latin and inscriptions, with a total of approximately 3 million words. The analysis, therefore, is based on a combination of lexicographical sources, which provide lemmatised forms (types), and textual sources, containing unlemmatised forms (tokens).

For Plag (1999: 6), productivity is defined "as the possibility of coining new complex words according to the word formation rules of a given language, as these rules may predict the existence of forms which are unattested or whose status as well-formed derivatives is more than doubtful". Bauer (2005) has distinguished two different approaches to the study of productivity: a qualitative approach that refers to the property of a given word-formation process or affix to be used to derive new words in a systematic way, and a quantitative approach, whereby the

productivity of an affix can be measured by counting the number of attested types with that affix. In the framework of a historical language, the morphological productivity of a word-formation process has to make reference to the number of attested types and tokens produced by the process in question. Baayen and Lieber (1991) define the global productivity of a word formation process in terms of the number of different V types and the probability of encountering new types. This can be seen in figure 1:

$$I = V / S$$

FIGURE 1: Index of productivity (Baayen and Lieber 1991)

To refine this approach, I have used Baayen's (1989, 1992, 1993) notions of productivity P and global productivity $P*$. For Baayen, productivity is defined as the quotient of the number of hapax legomena n_1 with a given affix and the total number of tokens N of all words with that affix, as is shown by figure 2:

$$P = n_1 / N$$

FIGURE 2: Productivity (Baayen 1989, 1992, 1993)

Concerning the role played by hapax legomena in measuring productivity, there is a certain degree of consensus among theoreticians on the importance of unique formations. For this reason I take hapax legomena into consideration, although I concur with Lass (1994) in the fact that it is not clear whether the existence of a hapax legomenon represents a piece of solid linguistic evidence or simply a question of language survival. The other concept required for the assessment of productivity in this approach is frequency. Frequency can be broken down into dictionary frequency and text frequency. In this respect, I follow Bauer's (2001, 2005) distinction between type and token-frequency. For Bauer (2001) the concept of type frequency refers to the number of items in a dictionary while token-frequency represents the number of occurrences of a particular affix in a corpus or a given text. According to Bauer (2004: 102) "token-frequency of a particular affix is calculated from the number of times that an affix appears in a text […]. Lack of productivity of an affix is said to lead to a high token-frequency of that affix, but a low type frequency". Bauer (2004: 104) goes on to remark that "the type frequency of an affix in a given text is calculated from the number of different lexemes in which the affix occurs […]. Increased productivity is said to lead to a rise in the type frequency of the productive affix, though each type (or lexeme) will have a relatively low token-frequency."

Summarizing, I draw on Bauer (2001, 2005) to measure the frequency of -*lǣcan* derivatives. I apply the formula given in figures 3 and 4 to calculate, respectively, type frequency and token frequency:

$$\text{Type frequency} = \frac{\text{Number of -}\textit{lǣcan}\text{ derivatives}}{\text{Number of headwords}}$$

FIGURE 3: Type frequency (based on Bauer 2001, 2005)

$$\text{Token-frequency} = \frac{\text{Number of -}\textit{lǣcan}\text{ derivatives token}}{\text{Number of words in corpus}}$$

FIGURE 4: Token-frequency (based on Bauer 2001, 2005)

To calculate the productivity of the affix, I have used the formula displayed in figure 5, which is based on Baayen (1991, 1993):

$$\text{Index of productivity} = \frac{\text{Number of hapax legomena of -}\textit{lǣcan}}{\text{Number of -}\textit{lǣcan}\text{ derivative tokens in the corpus}}$$

FIGURE 5: Index of productivity (based on Baayen 1991, 1993)

An assessment of frequency and productivity with lexicographical and textual evidence involves the following analytical steps: (i) measuring the type-frequency of derivatives in *Nerthus*; (ii) calculating the token-frequency and productivity in *The Dictionary of Old English Corpus*; (iii) counting the number of words in *The Dictionary of Old English Corpus*, that is, in the categories of prose, poetry and gloss; and (iv) assessing the global productivity of -*lǣcan*, both in general and by text type. In the remainder of this section, I focus on the details of the analysis.

In the lexical database *Nerthus* there are 32 -*lǣcan* weak verbs, listed under (6):

(6)

ǣfenlǣcan 'to grow towards evening', *fālǣcan* 'to be at enmity with, show hostility to', *fremedlǣcan* 'to alienate', (*ge*)*ðrīstlǣcan* 'to presume, dare', (*ge*)*ðwǣrlǣcan* 'to agree, consent to; reconcile; suit, fit', (*ge*)*cneordlǣcan* 'to be diligent, study', (*ge*)*cūðlǣcan* 'to make known; make friends with', (*ge*)*cȳðlǣcan* 'to become known', (*ge*)*cyrtenlǣcan* 'to beautify, make elegant; (+) make sweet', (*ge*)*dyrstlǣcan* 'to presume, dare', (*ge*)*efenlǣcan* 'to be like; make like, match, imitate', (*ge*)*lōmlǣcan* 'to frequent; be frequent', (*ge*)*rihtlǣcan* 'to make straight, put right, rectify, set in order; direct', (*ge*)*swǣslǣcan* 'to wheedle', *gedrēoglǣcan* 'to put in order, regulate, arrange, attend to', *gehīwlǣcan* 'to form, shape,

fashion', *gemetlǣcan* 'to moderate', *geonglǣcan* 'to pass one's youth, grow up', *gesamodlǣcan* 'to bring together', *geswētlǣcan* 'to batten', *gesyndlǣcan* 'to cause to prosper', *gewǣrlǣcan* 'to warn', *gewerodlǣcan* 'to make sweet or pleasant', *gewistlǣcan* 'to feast, banquet', *gewundorlǣcan* 'to make wonderful, magnify', *limplǣcan* 'to unite, connect', *loflǣcan* 'to praise', *nēlēacan* 'to come or draw near, approach; be near; be like; cling to', *sumorlǣcan* 'to draw on towards summer', *swæðlǣcan* 'to search for, visit', *wiðerlǣcan* 'to deprive', *winterlǣcan* 'to grow wintry'.

If we calculate the type-frequency of these verbs, we get the result in figure 6. The number of headwords in the lexical database *Nerthus* used for the calculation is 30,180.

$$\text{Type-frequency} = 32 \, / \, 30{,}180 \; = \; 0.001060$$

FIGURE 6: Type-frequency of *-lǣcan* in *Nerthus*

For calculating the token-frequency and productivity of *-lǣcan* in *The Dictionary of Old English Corpus*, I have searched the corpus for all the inflectional forms of these weak verbs. The list of inflectional endings found in the texts can be seen in (7):

(7)

-lǣcan, -lican, -licen, -lician, -lǣcean, -lecan, -lecen (**infinitive**); *lǣcenne, -lǣcene, -lǣceanne* (**inflected infinitive**); -lǣcende, -lecende (**present participle**); *-lǣcat, -lǣcet, -licet, -læht, -læhð, -læchð, -leht* (**past participle**); *-læhte, -lǣchte, -lǣcte, -lecte, -læhta, -lehta, -lehte, -leahte, -leohte, -licige, -lǣcige, -lǣce, -leçe, -lece, -lǣcæ, -leche* (**1ˢᵗ person singular present**); *-læhtest, -lǣcst, -lǣcest, -læhst* (**2ⁿᵈ person singular present**); *- lǣceð, -lǣcceð, -lǣced, -lecð, -leaceð, -leceð, -lǣceð, -liceð, -lac, læc, -lec* (**3ʳᵈ person singular present**); *-lacð, -lǣcað, -lǣcð, -licad, -leceað, -lǣceað, -læð, -lǣcad, -lǣciað, -lacað, -lecað, -laecað, -lecæð, -licað* (**plural present**); *-lacde, -locade, -lǣcede, -lacede, -lǣchede, -lecade, -lecde, -licde, -leoht* (**1ˢᵗ and 3ʳᵈ person singular past**); *-lǣcedon, -lecedon, -lecdon, -lecadon, -licadun, -læhton, -læton, -læhtun, -læhtan, -lǣcten, -lǣcton, -lehton, -lecton, lehtan, -lehctun, -lǣcon, -lǣcin, -lǣceon* (**plural past**).

In (8) I offer the queries I have launched on the corpus for each verb suffixed with *-lǣcan*. The results of queries (tokens) appear in italics, while the headwords (types) are rendered in bold face. The number of hits thrown by each query appears between brackets, both for token and type:

(8)

geæfenl-, 1 (*geæfenlǣcan*), æfenl-, 4 (*æfenleoht, æfenlac, æfenlæhð, æfenlæcð*), geefenl-, 96 [*geefenlǣcan* (9), *geefenlǣce* (9), *geefenlǣcað* (21), *geefenleçe* (2), *geefenlǣcð* (4), *geefenlæht* (2), *geefenlæhton* (4), *geefenlǣcon* (2), *geefenlæhte* (5), *geefenlǣcenne*

(2), *geefenlæcende* (9), *geefenlæc* (2), *geefenlæcen* (2), *geefenlæceð* (2), *geefenlæcean* (5), *geefenlicad* (3), *geefenlæcceð*, *geefenlicige*, *geefenlæced* (4), *geefenlæhtest* (2), *geefenleçeað*, *geefenlæceað* (2), *geefenleç*, *geefenlæcin*], efenl-, 3 (*efenlæce*, *efenlicige*, *efenlæcað*), efynl-, 1 (*efynlæht*), geeuenl-, 13 [*geeuenlecð*, *geeuenlæcan* (5), *geeuenlæcende*, *geeuenlæcð* (2), *geeuenlæhton*, *geeuenlæcenne*, *geeuenleç*, *geeuenlæhte*] **(*æfenlæcan, (ge)efenlǣcan,* 123);** fæl-, 1 (*fælæce*) **(*fālǣcan,* 1);** fremedl-,1 (*fremedlæcende*) **(*fremedlǣcan,* 1);** geðristl-, 58 [*geðristlæhte* (10), *geðristlæcan* (3), *geðristlæcen*, *geðristlece*, *geðristlæce* (24), *geðristlæcst* (2), *geðristlæcean* (3), *geðristlæcen*, *geðristlæcað*, *geðristlæcte*, *geðristlæceað* (2), *geðristlæcð* (2), *geðristlæht* (3), *geðristlæc*, *geðristlæc*, *geðristlæceon*, *geðristlæð*, *geðristlæcton*], ðristl-, 1 (*ðristlæcað*) **((*ge)ðrīstlǣcan,* 59);** geðwærl-, 32 [*geðwærlæcan* (5), *geðwærlæhte*, *geðwærlæhð* (2), *geðwærlæce* (8), *geðwærlæcað* (6), *geðwærlæcð* (6), *geðwærlæhton*, *geðwærlehton*, *geðwærlæcst*, *geðwærlæc*], ðwærl-, 1 (*ðwærlæhte*) **((*ge)ðwǣrlǣcan,* 33);** gecneordl-, 11 [*gecneordlæcende*, *gecneordlæhte*, *gecneordlæce* (4), *gecneordlæcon*, *gecneordlæcen*, *gecneordlæcað* (2), *gecneordlæcan*], gecnyrdl-, 4 (*gecnyrdlæcað*, *gecnryrdlæce* (3)) **((ge) cneordlǣcan,** 15);** gecuð-, 2 (*gecuðlæhte* (2)), cuð-, 1 (*cuðlæcan*, 1) **((*ge)cūðlǣcan,* 3);** gecyð-, 3 (*gecyðlæce*, *gecyðlæhð*, *gecyðlæchte*), cyð-, 1 (*cyðlæce*) **((*ge)cȳðlǣcan,* 4);** cyrtenl-, 1 (*cyrtenlæce*), gecertenl-, 2 (*gecertenlæhte* (2)) **((ge)cyrtenlǣcan,** 3);** gedyrstl-, 120 [*gedyrstlæhte* (9), *gedyrstlæce* (63), *gedyrstlæhð*, *gedyrstlæcan* (12), *gedyrstlæcð* (15), *gedyrstlæhst*, *gedyrstlæcende*, *gedyrstlæhtest* (2), *gedyrstlæcean* (2), *gedyrstlæc*, *gedyrstlæcat*, *gedyrstlæht* (2), *gedyrstlæcen* (2), *gedyrstlæcad*, *gedyrstlece* (5), *gedyrstleht*, *gedyrstlecte*], dyrstl-, 10 [*dyrstlæcest*, *dyrstlæhtest*, *dyrstlæcen*, *dyrstlæce* (4), *dyrstlæcæ*, *dyrstlece* (2)], gedurstl-, 1 (*gedurstleche*), durstl-, 1 (*durstlæhte*) **((*ge) dyrstlǣcan,* 132);** geloml-, 19 [*gelomlæcað*, *gelomlæcende* (4), *gelomlican* (7), *gelomlicen*, *gelomlæcan* (2), *gelomlician*, *gelomlæc*, *gelomlæceon*, *gelomlæcð*], loml-, 2 (*lomlæhtan* (2)) **((*ge)lōmlǣcan,* 21);** gerihtl-, 91 [*gerihtlæcan* (26), *gerihtlæcð* (6), *gerihtlæced* (5), *gerihtlæcað* (6), *gerihtlæhte* (16), *gerihtlæhton*, *gerihtlæce* (11), *gerihtlæcende*, *gerihtlæht* (6), *gerihtlæceð*, *gerihtlæcean* (2), *gerihtlece*, *gerihtlæhð*, *gerihtlæc* (6), *gerihtllæhte*, *gerihtlæceað*], rihtl-, 10 [*rihtlæcð* (2), *rihtlæceð*, *rihtlæcan*, *rihtlæce* (3), *rihtlican* (3)] **((*ge)rihtlǣcan,* 101);** geswæsl-, 2 (*geswæslæce*, *gesæslæcð*), swesl-, 1 (*sweslecð*) **((*ge)swǣslǣcan,* 3);** gedreogl-, 1 (*gedreoglæcað*), gedreohl-, 2 (*gedreohlæcan* (2)) **(*gedrēoglǣcan,* 3); (*gehīwlǣcan,* 0);** gemetl-, 2 (*gemetlæcað*, *gemetlecæð*) **(*gemetlǣcan,* 2);** geongl-, 1 (*geonglæce*), gyngl-, 1 (*gynglæhte*), iungl- 2 (*iunglæhte* (2)) **(*geonglǣcan,* 4);** gesamodl-, 1 (*gesamodlæceð*) **(*gesamodlǣcan,* 1);** geswetl-, 6 (*geswetlæhtan* (2), *geswetlæhta*, *geswetlæhte*, *geswetlæht*, *geswetlehta*) **(*geswētlǣcan,* 6);** gesyntl-, 3 (*gesyntlæcan* (3)) **(*gesyndlǣcan,* 3);** gewærl-, 1 (*gewærlæht*) **(*gewærlǣcan,* 1);** gewanedl-, 1 (*geweredlæhð*) **(*gewǣrlǣcan,* 1);** gewistl-, 1 (*gewistlæcan*) **(*gewistlǣcan,* 1);** gewundorl-, 1 (*gewundorlæc*) **(*gewundorlǣcan,* 1);** gelimpl-, 2 (*gelimplæcan* (2)) **(*limplǣcan,* 2);** lofl-, 2 (*loflac*, *loflæcað*) **(*loflǣcan,* 2);** genealæ-, 353 [*genealæceð* (18), *genealæhte* (100), *genealæcan* (25),

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genealæcean (15), *genealæhton* (65), *genealæcð* (33), *genealæcað* (39), *genealæhð* (8), *genealæcende* (6), *genealæce* (16), *genealæht*, *genealæc* (2), *genealæchð*, *genealæceð* (6), *genealæcte*, *genealæceað* (3), *genealæton*, *genealæhtun*, *genealæchte*, *genealæcten*, *genealæcene*, *genealæceanne*, *genealæcen*, *genealæcenne*, *genealæcet*, *genealæhtan*, *genealæciað*, *genealæcton* (2), *genealæcige*], geneala-, 1 (*genealæcde*), genealo-, 1 (*genealocade*), neal-, 93 [*nealæhte* (27), *nealæceð* (17), *nealcte* (5), *nealæcð* (19), *nealæhton* (2), *nealæce* (2), *nealæcan*, *nealæcen*, *nealæhtan*, *nealecte* (2), *nealecan* (2), *nealæcende* (2), *nealehton*, *nealehte* (4), *nealecton* (2), *nealehtan*, *nealecæð*, *nealæcað* (2), *nealehctun*], geneahl-, 5 (*geneahlæhton* (2), *geneahlæce*, *geneahlæhte*, *geneahlæcende*), neahl-, 17 [*neahlæcað* (3), *neahlæhtan*, *neahlæhte* (3), *neahlæcð* (2), *neahlæhton* (2), *neahlæcede*, *neahlæchede* (4), *neahlæcedon*], næl-, 1 (*næleahte*), geneol-, 88 [*geneolecte* (2), *geneolecton*, *geneolaecað*, *geneolaeceð* (2), *geneolecede* (2), *geneolecedon*, *geneolecade*, *geneolecdon* (31), *geneolecde* (34), *geneolecadon*, *geneolecton* (2), *geneolecende*, *geneolacað*, *geneolecað* (3), *geneoleceð*, *geneolaceð*, *geneolicadun*, *geneolæce*, *geneolicde*]; neol-, 5 [*neolecan*, *neoliceð* (2), *neolicet*, *neolicað*] (***nælēacan, 564***); sumorl-, 1 (*sumorlæhð*) (***sumorlǣcan, 1***); swæðl-, 1 (*swæðlæhte*) (***swæðlǣcan, 1***); wyðerl-, 1 (*wyðerlecað*) (***wiðerlǣcan, 1***); winterl-, 8 [*winterlæcð*, *winterlican* (2), *winterlecan*, *winterleahte*, *winterlæhte* (2), *winterleohte*] (***winterlǣcan, 8***).

Interestingly, no tokens of the verb *gehīwlǣcan* have been found in the corpus. An illustration of the queries required for analysing a single verb is offered in Figure 7:

gecneordl- (11 occurences)

ÆCHom I, 30   B1.1.32 [0002 (429.7)] To þysum twam wifmannum awrat se ylca hieronimus menigfealde trahtbec. for þan ðe hi wæron haliges lifes menn & swiðe **gecneordlæcende** on boclicum smeagungum.

ÆCHom II, 9   B1.2.10 [0012 (73.24)] He **gecneordlæhte** æfter wisra lareowa gebysnungum. and næs forgyttol. ac gefæstnode his lare on fæsthafelum gemynde;

HomU 16 (Kluge)   B3.4.16 [0036 (39)] Forþi wiðsac woruldþingum for godes ege and forhafa þe for gode fram woreldcarum **gecneordlæce** þæt þu gode þeowige.

BenR   B10.3.1.1 [0667 (64.121.10)] Hycge he and **gecneordlæce**, þæt hine mon lufian mæge swiþor, þonne ondrædan.

BenRWells   B10.3.3 [0137 (64.120.11)] Hicge he and **gecneordlæce**, þæt hine man lufian mæge, swiðor þonne ondrædan.

BenRW   B10.3.4 [0604 (64.133.11)] Wilnige heo & **gecneordlæce**, þæt me hi lufian mage swiðor þonne ondredæn.

ChrodR 1   B10.4.1 [0618 (62.21)] And swylce hig sceolon beon þæt **gecneordlæcon** þæt hi hi sylfe an Godes bigencge geþeowien, þæt þonne hi æfter wisdomes gewitte deorfað, þæt hi eac þam folce magon wisdomes gife gelæstan.

AldV 1 (Goossens)   C31.1 [0342 (342)] *exercere studere* **gecneordlæcen**.

AldV 1 (Goossens)   C31.1 [1138 (1138)] *scrutamini* **gecneordlæcaþ**.

AldV 13.1 (Nap)   C31.13.1 [0241 (241)] *exercere, .i. studere* **gecneordlæcan**.

AldV 13.1 (Nap)   C31.13.1 [1087 (1086)] *scrutamini* **gecneordlæcaþ**.

gecnyrdl- (4 occurrences)

ÆCHom II, 4   B1.2.5 [0115 (38.273)] Untwylice on ðisum andgite us bið awend þæt fifte wæterfæt to wynsumum wine. gif we **gecnyrdlæcað** hu we þa deofellican babilonian forfleon magon. and becuman to ðære heofenlican hierusalem;

ÆGram   B1.9.1 [1003 (154.3)] Eallswa *tepeo* ic wlacige, *tepui; horreo* ic onðracige, *horrui; candeo* ic scine, *candui; studeo* ic **gecnyrdlæce**, *studui; frondeo* ic growe, *frondui; splendeo* ic scine, *splendui; rubeo* ic <readige>, *rubui; palleo* ic blacige, *pallui; pareo* ic gehyrsumige, *parui; iaceo* ic licge, *iacui; caneo* ic harige, *canui; floreo* ic blowe, *florui; uireo* ic growe, *uirui; areo* ic forsearige, *arui; calleo, ID EST, callidus fio* ic beo pætig, *callui; excelleo* ic oferstige, *excellui* þis word byð eac gecweden *excello, excellis,* þære ðriddan; *stupeo* ic wafige, *stupui; langueo* ic adlige, *langui; uigeo* ic strangige oððe geðeo, *uigui; rigeo* ic stifige, *rigui; egeo* ic wædlige, *egui; indigeo* ic beþearf, *indigui* .

CollGl 22 (Liebermann-Ker)   D22 [0028 (28)] *studeo* ic **gecnyrdlæce**.

CollGl 22 (Liebermann-Ker)   D22 [0090 (90)] *studeo* ic **gecnyrdlæce**.

FIGURE 7: (ge)cneordl can in The Dictionary of Old English Corpus (15 occurrences)

For measuring the index of productivity it is necessary, first of all, to calculate the frequency of tokens and, secondly, to count the hapax legomena. All in all, I have found a total of 1,096 occurrences of the 32 verbs containing the suffix *-læcan*. Therefore, the token-frequency of the affix in the *The Dictionary of Old English Corpus* is as shown in figure (8). The exact number of words in *The Dictionary of Old English Corpus* used for this calculation is 2,952,566 words.

$$\text{Token-frequency} = 1,096 \ / \ 2,952,566 = 0.000371$$

FIGURE 8: Token-frequency of *-læcan* in *The Dictionary of Old English Corpus*

Corpus searches have turned out a total of 10 unique formations or hapax legomena. They are listed under (9). It is important to bear in mind that the concept of hapax legomenon is used here with the sense of a single textual occurrence of a base of derivation to which the affix *-læcan* is attached. In (9) the infinitive of each verb is given between brackets.

(9)

fælæce (fālæcan), fremedlæcende (fremedlæcan),   gesamodlæceð (gesamodlæcan), gewærlæht (gewærlæcan), geweredlæhþ (gewerodlæcan), gewistlæcan (gewistlæcan), Gewundorlæc (gewundorlæcan), sumorlæhð (sumorlæcan), swæðlæhte (swæðlæcan), wyþerlecað (wiðerlæcan).

Given the token-frequency and the figure of hapax legomena I have just presented, the index of productivity of the suffix *-lǣcan* is shown in Figure 9:

$$\text{Index of Productivity} = 10 \; / \; 1{,}096 = 0.009124$$

FIGURE 9: Index of productivity of *-lǣcan* based on *The Dictionary of Old English Corpus*

Summarising, the measures of frequency and productivity obtained so far are displayed in (10):

(10)

a. Type-frequency = 32 / 30,180 = 0.001060
b. Token-frequency = 1,096 / 2,952,566 = 0.000371
c. Index of productivity = 10 / 1,096 = 0.009124

The results in (10) call for some comments. To begin with, type-frequency is higher than token-frequency, that is, *-lǣcan* verbs are more frequent in the dictionary than in the corpus. In general, it can be held that the frequency of *-lǣcan* is significant, while the index of productivity is less relevant. Put in another way, a type-frequency higher than token-frequency is compatible with a rather unproductive affix. As I have pointed out by drawing on Bauer (2005), rather high frequencies coincide with unproductive word-formation processes. Given the relatively low frequency of token, therefore, the affix can hardly be said to be productive. For these reasons, I consider the affix *-lǣcan* relatively productive. This assessment of productivity is reinforced if compared with those proposed by Mateo Mendaza (fc.-a, fc.-b) for the Old English adjectival suffixes *-isc*, *-cund* and *-ful(l)* and the prefix *ful(l)-*, given, respectively, in Tables 1 and 2:

Affix	N	n_1	P
-isc	3,971	256	0.064
-cund	1,021	41	0.04
P = n_1 / N	—	—	1.00000

TABLE 1: index of productivity of -isc and -cund (Mateo Mendaza fc.-a)

Affix	N	n_1	P
-ful(l)	3,887	01	0.05
ful(l)-	748	0	0
P = n_1 / N	—	—	1.00000

TABLE 2: index of productivity of -ful(l) and ful(l)- (Mateo Mendaza fc.-b)

As the comparison with the data in tables 1 and 2 evidences, *-lǣcan* is even less productive than *-isc, -cund* and *-ful(l)*, although it is more productive than the prefix *ful-*, which Mateo Mendaza (fc.-b) considers totally unproductive.

Secondly, it seems advisable to break down the measures of frequency and productivity by text category. Indeed, *-lǣcan* verbs appear in the corpus in prose, glosses and poetry. In prose there are 723 occurrences in 60 different texts, while in glosses there are 360 occurrences in 39 distinct texts and in poetry only 13 occurrences in 6 different texts. The total figure of different texts is 105. This results in a higher frequency of *-lǣcan* verbs in prose and glosses than in poetry. As has been pointed out before, in *The Dictionary of Old English Corpus* there are 2,952,566 words, and, by text category, 2,105,363 words in prose texts, 729,558 in glosses and 117,645 words in poetry. The token-frequency for text type in terms of these figures is displayed in Table 3:

Text type	Affix tokens	Word total	Token-frequency
Prose	723	2,105,363	0.000343
Glosses	360	729,558	0.000493
Poetry	13	117,645	0.000111

TABLE 3: Token-frequency by text type

As the results in Table 3 indicate, glosses have the highest token-frequency, followed by prose and poetry texts, the latter exhibiting the lowest rate of token-frequency. Productivity for text type can be obtained in the same way. In *The Dictionary of Old English Corpus* there are 10 hapax legomena of *-lǣcan* verbs, including 4 in prose, 6 in glosses and none in poetry. Taking these figures into account I have calculated the index of productivity by text type. The results appear in Table 4:

Text type	Hapax legomena	Affix tokens	Index of productivity
Prose	4	723	0.005532
Glosses	6	360	0.016667
Poetry	0	13	0

TABLE 4: Index of productivity by text type

As is shown in Table 4, *-lǣcan* verbs are more productive in glosses than in prose, and not productive at all in poetry. As the index of productivity is relatively higher than token-frequency, glosses turn out to have the highest index of productivity and also the highest token-frequency. Figure 10 relates the types found in *The Dictionary of Old English Corpus* (V) to the index of productivity by text type (P):
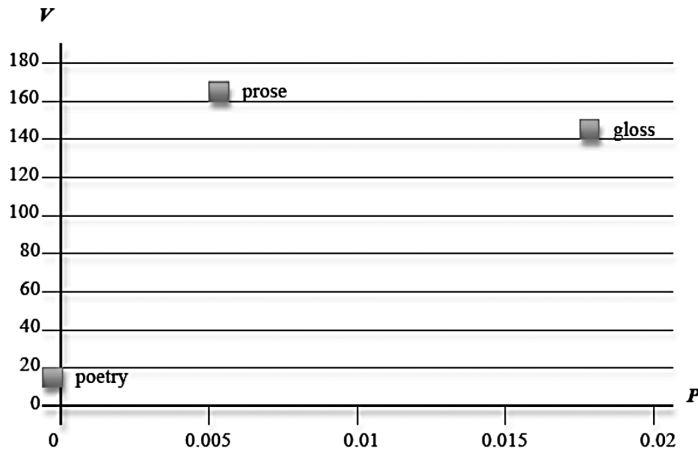
FIGURE 10: Global productivity of *-lǽcan* verbs by text type

In figure 10, V refers to types, that is, not the number of occurrences of each verb but the number of the different kind of tokens found for each verb. There are 163 types in prose, 145 in glosses and only 10 in poetry. It follows that prose texts have the highest index of V, whereas glosses have the highest index of P. In contrast, poetry texts have a very low index of V and no index of P.

4. Conclusion

To round off, I should like to draw some conclusions as well as to offer some tentative explanation for the measure of productivity resulting from the analysis just described.

The first conclusion of this article is methodological. This work contributes to devising a methodology for the assessment of the productivity of a morphological process in a historical language. Against Baayen and Renouf´s (1996: 69) criticism of the combination of lexicographical and textual evidence for the assessment of productivity, both dictionary-based and text-based productivity measures have proved relevant and complementary. Indeed, in this approach, the variable of type-frequency is dictionary-based whereas the variables of token-frequency and hapax legomena are corpus-based. This combined approach may solve some of the problems identified by Fernández-Domínguez *et al*. (2007) in measuring low indexes of productivity.

With this methodology, the analysis has shown that type-frequency in *Nerthus* is higher than token-frequency in *The Dictionary of Old English Corpus* and that the index of productivity of the affix is very low (0.009124). Glosses are the text type that displays the highest rate of token-frequency and also the highest index of productivity, whereas poetry texts have the lowest token-frequency and zero index of productivity. In sum, the suffix *-lǣcan* in the formation of weak verbs seems to be practically unproductive.

Notes

1. This research has been funded through the project FFI2008-04448/FILO.

2. I use numbered predicates, as in *Nerthus,* to account for categorial or morphological oppositions holding between homonymous predicates with the same or similar meaning. For instance, *ābūtan* 1 'on, about, around, on the outside, round about' is an adposition and *ābūtan* 2 'about, nearly', an adverb; while *besēon* 1 'to see, look, look round', is a Class V strong verb, and *besēon* 2 'to suffuse' a Class I strong verb.

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