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The change in negation in Middle English: A NEGP licensing account☆

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Abstract

During the Middle English period (1150–1500 AD), the sentential negator of English changed from the preverbal *ne* to the postverbal *not*. During the transition, there was frequent use of a bipartite *ne ... not* negator. This paper presents a detailed quantitative study of the change. I show that as *not* changes from sentence adverb, with a distribution parallel to *never*, to sentential negator, *ne* is lost. However, the rates of change in the use of *not* and *ne* are significantly different, indicating that these two forms are not in direct, grammatical competition. An account of the indirect connection between *ne* and *not* is given using a licensing condition for the projection of negation, NEGP. I also show that the overlapping use of the two systems of negation, *ne ... not*, does not constitute an independent system. The change in negators shows that both functional and structural considerations are relevant in properly modeling syntactic change, and thus that diachronic change reflects aspects of competence and performance.

1. Introduction

The search for linguistic universals in the Chomskian tradition has led to uniformity of syntactic structure through X-bar syntax and uniformity of derivation through the universal transformation, move-α (Chomsky, 1970, 1986). In taking this search to its limit, first one, then many, functional projections have been proposed to account for the range of possible modal, verb, adverb, and object word orders found in the world's languages (for example, in Chomsky, 1986; Kayne, 1989; Laka, 1994; Pollock, 1989; Zanuttini, 1991). These functional projections represent cate-

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gories of tense, inflection, negation, and others. In the minimalist program, these projections have increased in importance, as the locus of cross-linguistic variation and historical change (Chomsky, 1993; Kroch, 1994).

This paper explores the diachronic behavior of one of these functional categories, sentential negation, during the transition from the preverbal negator *ne* to the postverbal *not* in Middle English. In Old English and early Middle English, *ne* was used immediately before the tensed verb to signal sentential negation, as shown in (1).

(1) Ic *ne toweorpe* ða burg.
I ne destroyed the castle
'I didn't destroy the castle.' (Haeberli, 1991: 53)

Increasingly during the Middle English period, postverbal *not* was added to form a bipartite negator *ne ... not*.

(2) ... he *ne shal nouȝt* deceiue him.
he ne shall not deceive him
'... he won't deceive him.' (Early Prose Psalter, 161:131:11)[1]

The use of *ne* declined rapidly in late Middle English, leaving *not* as the lone sentential negator.

(3) Crist *shulde not* haue suffred deþ
Christ should not have suffered death
'Christ shouldn't have suffered death.' (Wycliffite sermons, I: 415)

I propose an account of this change based on the principle of Economy of Projection outlined in Speas (1994). My account posits an indirect licensing relation between *ne* and *not*. I show that the change in negators is a case of morphosyntactic change which does not involve competition between grammatically incompatible forms. Rather, *ne* and *not* are functional competitors. My results support Kroch's (1994) general claim that morphosyntactic change occurs as a result of competition between functional doublets, but not his more specific claim that competition involves mutually exclusive grammatical options.

Kroch (1989) proposes that syntactically related changes proceed at the same rate. This Constant Rate Hypothesis is supported by one aspect of the change in negators: the change in the use of *not* proceeds at a constant rate in all contexts. By contrast, the change from *ne* negation to *not* negation does not proceed at a single rate. The rise in *not* negation is slower than the loss of *ne*. Thus, I show that the Constant Rate Hypothesis only applies to structurally competing syntactic forms. In the case of functional competition between forms in different structural positions, it does not apply.

The remainder of section 1 introduces my basic theoretical assumptions, which include a separate maximal projection for negation, NEGP, and Kroch's (1989) analysis of historical change as grammar competition, which can be quantitatively modeled using the logistic function. My account adopts the 'exploded-INFL' analysis of clausal structure, as several independent positions within the functional projection hierarchy are needed to differentiate the structural locations of adverbs and sentential negation. I will argue that these positions can be identified based on regular patterns in surface word order. Section 2 introduces the data in more detail and presents the quantitative analysis of the change in negators. In this section, I demonstrate that the old sentential negator *ne* is lost only after the new negator *not* is well established as sentential negator and component of NEGP. The simultaneous availability of both *ne* and *not* as negators creates an unstable functional doublet, and *ne* is lost as a result. Section 3 outlines Speas's proposal for Economy of Projection which posits two licensing positions for an XP in the X-bar schema. Thus, the NEGP has two possible licensing positions. In section 4, these two separate licensing positions are used to explain the existence of bipartite negation, and the particular time course of the change from *ne* to *not*. Quantitative data show that the use of both licensing positions in Middle English NEGP is based solely on the overlapping use of the individual licensing positions. Thus, bipartite *ne ... not* negation is seen to be an epiphenomenon of the change in negators, due to variation in the use of the two negators during the change, and not a separate system of negation. This result suggests a reanalysis of bipartite negation in synchronic grammar as variation and overlap between two licensing systems. Section 5 concludes with a summary and a review of open problems for future research.

1.1. Clause structure

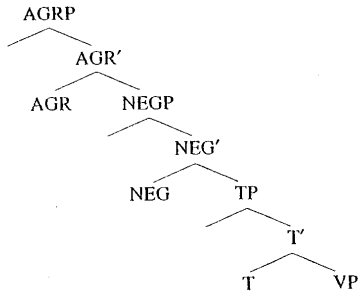
In this paper, I assume a complex syntactic structure for the clause, so-called 'exploded INFL'. Following the X-bar schema for phrase structure, a sentence must be headed by some element. It is commonly assumed that this is an inflectional element, and that a sentence is an inflection phrase (IP, in the notation of Chomsky, 1986). Pollock (1989) first introduced multiple inflectional projections, the 'exploded INFL', like subject agreement (AGR) and tense (T), to account for aspects of French verb movement. In this paper, I assume the modifications to Pollock's pro-

[1] All of the examples from primary sources are from the Helsinki Corpus of English Texts (diachronic part), edited by Matti Ressanan, and available from the Norwegian Computing Centre for the Humanities and the Oxford Text Archive. The text names are taken from the corpus documentation. The Middle English section of the diachronic part of this corpus is also the one used for the quantitative analysis later in the paper. A complete list of the texts used in the study is given in the Appendix.

The texts in the corpus which come from the Northern dialects, the North and the Northeast Midlands, are excluded from the analysis presented below, as Kroch and Taylor (1994) show they behave fundamentally differently with respect to verb movement, a crucial diagnostic in the analysis of the change from *ne* to *not*. In particular, Kroch and Taylor demonstrate that the verb raises to the complementizer position C above AGRP in ordinary declarative clauses in the Northern dialects. Thus, these dialects are so-called 'CP-V2' languages. This additional verb movement eliminates the preverbal use of *not* as a diagnostic for the use of *not* as an adverb (see section 2.2). Kroch and Taylor's conclusions are supported by my analysis of the negation data, as discussed in note 3 below.

posal in Belletti (1990). In this approach to sentence structure, the sentence is an agreement phrase, AGRP, and AGR is a sister of TP. Pollock also included a separate projection for negation, NEGP, to account for word order facts involving French negation. The existence of this projection has been defended for other Romance languages (Zanuttini, 1991), Basque (Laka, 1994) and Old English (Haeberli, 1991). I make extensive use of the NEGP projection in this paper. The basic structure of an ordinary declarative sentence is shown in the tree in (4).

(4)



1.2. Verb movement

There are two principal assumptions which I use to determine the structural position of *ne* and *not* in Middle English. I assume, following Roberts (1985), that Middle English is a language with verb raising (V-to-INFL), and thus that the verb raises overtly from its underlying position as the head of VP to AGR, the highest component of INFL. Second, I assume that subject-verb inversion, as in verb second clauses, and *yes/no* and *wh*-questions, is the result of verb movement to the head of a complementizer phrase (CP), which immediately dominates AGRP.

Roberts (1985) demonstrates that Middle English is a language with main verb movement, like French. Middle English main verbs, as well as auxiliaries and modals, generally appear before sentence adverbs and negation. They also invert with the subject in questions and imperatives. The contrast between Middle and Modern English, which has lost main verb movement, is shown by the following examples.

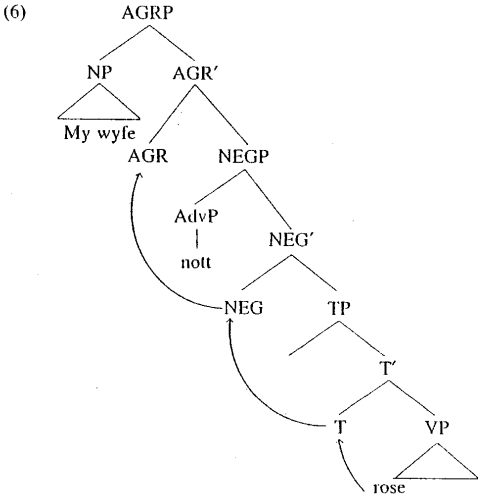
(5) a. thou wost that Y *took neuere* of hem, ...
you know that I took never from them
'You know that I *never took* from them, ...' (Wycliffite old testament, XVI: 55)

b. My wyfe *rose nott*
my wife rose not
'My wife did *not get up*.' (Roberts, 1985: (2b.v))

c. How great and greuous tribulations *suffered the Holy Appostyls* ...?
what great and grievous tribulations suffered the Holy Apostles
'What great and grievous tribulations did *the Holy Apostles suffer* ...?'
(Kroch, 1989: (18a))

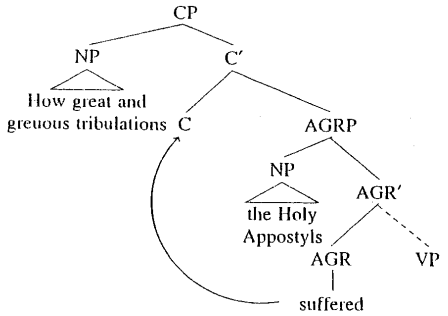
In Middle English, the verb raises from its base position within the VP and adjoins to AGR in the overt syntax. In so doing, the verb adjoins to the intermediate heads T and NEG (cf. the Head Movement Constraint in Travis (1984), and its reformulation under the ECP in Chomsky (1986)). The raising of the verb in (5a) puts it in a position preceding *neuere*, which I take to be an adjunct of T′ in this case. In (5b), the verb raises to a position preceding *nott*, which is in the specifier of NEGP, as I show in section 2.3. The movement in (5b) is shown in the tree in (6).

(6)



Example (5c) is a case of subject-verb inversion, where the verb raises not only to AGR, but further to the head of CP. The specifier of CP contains the fronted *wh*-phrase. The verb thus precedes the subject, as well as any sentence adverbs or sentential negator like *not*. A partial tree of (5c) is shown in (7).

(7)



Subject-verb inversion is an important diagnostic in the analysis which follows. When the verb raises, it adjoins to the intermediate heads AGR, NEG, and T. Thus, for example, verbal inflection which occupies AGR or T becomes a part of the verb complex. In negated clauses, a negative head (NEG) also adjoins to the verb. As a result, the negative head participates in subject-verb inversion, and appears before the subject along with the verb. This is the case for *ne*, and some later examples of *not*, as I show in section 2, indicating that *ne* and some instances of *not* are heads of NEGP.

1.3. Theory of historical morphosyntactic change

I adopt, in part, Kroch's (1989, 1994) model of historical morphosyntactic change. In particular, Kroch claims that variation between incompatible syntactic options in historical change is indicative of grammar competition. Using the principles and parameters model of grammar (Chomsky, 1986), grammar competition can be seen as competition between grammars which differ on a particular parameter sttting. Implicit in this model of morphosyntactic change is the Double Base Hypothesis (Santorini, 1992): speakers in a community undergoing a diachronic change have competence with two separate grammars which can be used together in performance. Santorini studied the change from INFL-final to INFL-medial word order in the history of Yiddish and found cases of variation between INFL-final and INFL-medial word order within a single text by a single author. This interaction of grammatical systems in diachronic change is thus the same model of competence which is independently required to account for diglossia and multilingualism.

The loci of typological variation, and hence the loci of morphosyntactic change, are the heads of the functional projections (the extended projections of V) such as T, AGR, and NEG (Chomsky, 1993; Kroch, 1994). Kroch (1994) further claims that grammar competition is competition between grammatically incompatible morphosyntactic doublets. As mentioned above, I will show that *ne* and *not* are not grammatically incompatible, but rather that they are functionally redundant. The replacement of *ne* by *not* is competition between functional doublets, but they are not morphosyntactically incompatible.

Changes normally begin very slowly, when the use of a new form is rare (Bailey, 1973). Once the new form is somewhat established, the change accelerates until the new form is the more frequent one, and the change slows down again. In addition, morphosyntactic changes are typically categorical: the use of one form in all contexts is completely replaced by the use of another form in all contexts. This fact will be important when we examine the use of *not* in early Middle English below.

1.4. Quantitative model of historical morphosyntactic change

Following Kroch's (1989) analysis of syntactic change, I will assume the Constant Rate Hypothesis, and that a particular mathematical function, the logistic, can be used as a model for linguistic change. I will summarize the main points here, beginning with the logistic model, and returning to the Constant Rate Hypothesis below.

The equation of the logistic function is given in (8).

$$(8)\quad p = \frac{e^{k+st}}{1+e^{k+st}}$$

In this equation, p is a variable for the percentage of use of a form, and t is a variable for time. The values for k and s are constants which determine the precise shape of the logistic function. In general, different syntactic changes will be modeled with different values for k and s. Fig. 1 shows the graph of the logistic function with $k = -5$ and $s = 1$. The S-shaped curvature of the logistic models the characteristic pattern of language change over time. The slope s of the logistic function models the rate of change in the use of a form. A larger slope (value of s) models a form which changes rapidly, and a smaller slope models a more gradual change. The intercept k determines the mid-point of the change (p is 0.5 at $t = -k/s$, which is $t = -(-5)/1 = 5$ in Fig. 1). Thus, the value of k determines the center of the logistic model of a historical change in time. Together, the two parameters k and s specify the rate of replacement and precise time-span of a historical change.

The logistic models the loss of a form as well as the rise in a new form. For the loss of a forms, s will be negative, reversing the rates of use at the starting and ending points. Fig. 2 shows a logistic model of the decline in the use of a form ($k = 4$ and $s = -1$). The midpoint of the change, where $p = 0.5$ is $t = 4$.

In order to analyze the distributions of syntactic phenomena with the logistic, we consider the different rates of use of a form over time, and determine the values for k and s which provide the best fitting logistic model. A function equivalent to the logistic, called the logit, is more suited for this task. The logit is given in (9).

$$(9)\quad \ln \frac{p}{1-p} = k + st$$

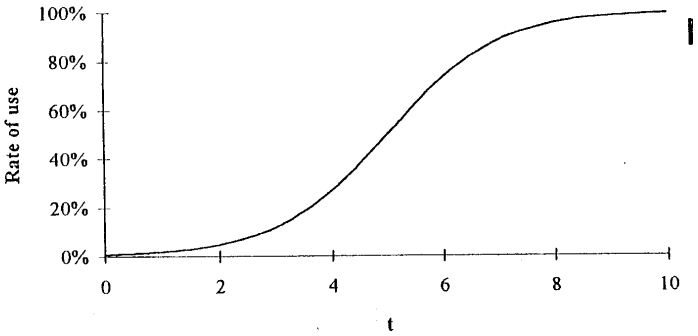


Fig. 1. The logistic function with intercept $k = -5$ and slope $s = 1$.

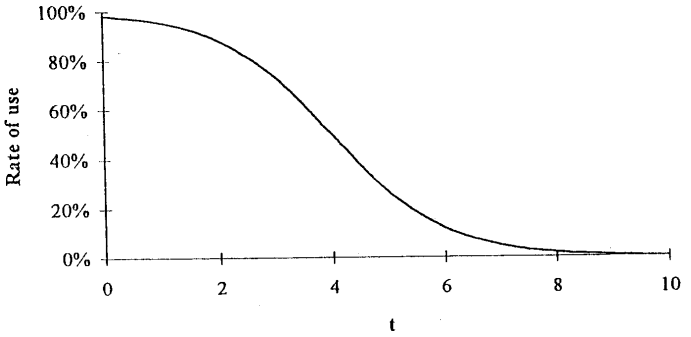


Fig. 2. The logistic function with intercept $k = 4$ and slope $s = -1$.

Logits for the logistics in Figs. 1 and 2 are shown in Fig. 3. We can see that the logit is a linear function in t (time). Logits for rates of use above 50% are positive. Logits for rates of use below 50% are negative. The logit for Fig. 1 slants upward, since Fig. 1 models the increase in the use of a form. The logit for Fig. 2 slants down, since Fig. 2 models the loss of a form.

Using the logit form instead of the equivalent logistic is a mathematical convenience. When actual data are modeled, simple linear regression can be used on the

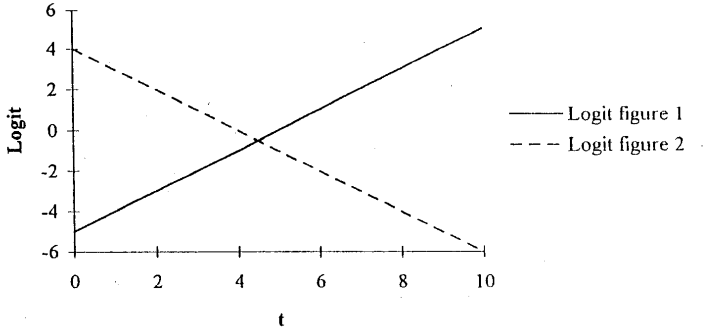


Fig. 3. Logits of the logistics in Figs. 1 and 2.

logits to determine the best fitting slope and intercept for the data. Thus, assuming the logistic model of historical morphosyntactic change, graphing the logits of the percentages of use of a form over time should produce a straight line. This line will have the slope constant s, and the intercept constant k. The logistic model (and the equivalent logit) will be used below to model the loss of the Old English negator *ne* and the change in the use of *not* to become the new sentential negator.

The Constant Rate Hypothesis claims that changes which are related by a change in a single underlying grammatical parameter proceed at the same rate. Thus, the change in use of a particular form in different contexts proceeds at the same rate in all contexts. When these changes are analyzed using the logit function, they should produce lines with the same slope s (Kroch, 1989, 1994). In other words, they have the same rate of change, since the slope of the logistic represents how rapidly the rate of use changes. Note that the same rate of change in different contexts does not mean the same rate of use in those contexts. Different changes in different contexts may reach their midpoints at different times and be modeled with different k parameters (see Kroch (1989) for discussion).

The Constant Rate Hypothesis also predicts that the loss of use of one grammatical option should occur at the same rate as the gain in use of its morphosyntactic competitor. In terms of the logistic model, the two changes should have the same magnitude of slope s with opposite sign. For example, Figs. 1 and 2 could represent the rise in use of a form and the decline in its competitor. We can see that the rates of change in these cases are the same by reversing the signs on the logits in Fig. 2. Fig. 4 shows graphs of the logits for the logistic in Fig. 1, and the logits for the logistic in Fig. 2 with the signs of the logits reversed. When the logits of the rise in one form and the loss of its competitor are graphed in this way, the Constant Rate Hypothesis predicts that if the forms are in morphosyntactic competition, the lines will be parallel (i.e. have the same slope s or rate of change). This is the case in Fig. 4.

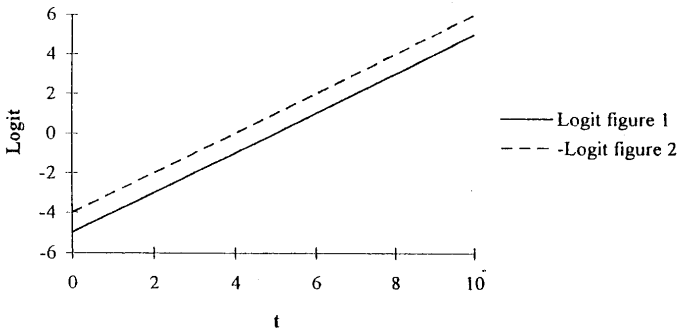


Fig. 4. The logit for Fig. 1 and the negative logit for Fig. 2.

The Constant Rate Hypothesis will be exploited in two ways below. First, I show that the rise in the use of *not* as the sentential negator occurs at the same rate whether or not *ne* is present. This indicates that the use of *not* as a sentential negator is independent of the presence or absence of *ne*. Second, I show that the rate of the rise in the use of *not* as a sentential negator is different from the rate of the loss of *ne* as a sentential negator. Thus, the change in negators from *ne* to *not* is not the result of a change in a single underlying grammatical parameter. In other words, *ne* and *not* are not competitors for the same syntactic position. Rather, *ne* and *not* are related more indirectly. I claim this relation is based on a licensing principle for sentential negation which allows *ne* and *not* to license the NEGP projection in different ways. My proposal models the functional relation between *ne* and *not* as sentential negators, but also allows for the use of redundant *ne* ... *not* negation. I return to this proposal in more detail in sections 3 and 4.

2. The data

The basic pattern of the change from *ne* negation to *not* negation was presented above in (1) through (3). The pattern actually observed in the data is somewhat more complicated. In particular, *not* appears with *ne* fairly frequently in both Old English and early Middle English. I present evidence below that these early uses of *not* do not constitute early instances of bipartite negation, but rather that *not* is used in these cases in the syntactic position of a sentential adverb like *never*. This position is syntactically distinct from the structural positions of sentential negation, which are within the NEGP. In most cases, however, there is no difference in the linear order between the adverb use and the negation use, so quantitative methods must be used

to estimate the actual use of *not* as sentential negation. In addition, there is evidence of another structural use for *not*, parallel to the use of *ne*, as a syntactic head of NEGP. Thus, I claim that *not* occupies no less than three distinct syntactic positions during the Middle English period: it can appear as a sentence adverb, like *never*; it can appear as a sentential negator in a different position than *ne* (the specifier of NEGP); or it can appear in the same position as *ne* (the head of NEGP). Despite the complexity of the data, the distinct uses of *not* can be sorted out through a combination of structural and quantitative analysis. The result is a clear picture of the change in negators, with a simple analysis of the structure of sentential negation in Middle English.

2.1. Ne *as head of NEGP*

Pollock (1989) takes French *ne* to be the head of NEGP, based on its participation in verb movement, as in subject-verb inversion (10).

(10) N'est-il pas venu?
ne-is-he not come
'Hasn't he come?'

Since both *ne* and the verb invert with the subject, *ne* and the inflected verb form a single constituent which raises to C, inverting the inflected verb, including *ne*, with the subject. Thus, the behavior of *ne* is parallel to that of the other inflectional heads. As a result, Pollock assumes that *ne* is the head of the functional projection, NEGP, located between the agreement and tense projections.

Like its French cognate, Middle English *ne* participates in subject-verb inversions along with the verb, as shown in (11).

(11) a. Ne canstu me noȝt know?
ne can-you me not know
'Can't you recognize me?' (King Horn, 55)

There is additional evidence that *ne* behaves like an inflectional head. *Ne* can cause unpredictable allomorphy in the verb it adjoins to. For instance, *ne wille*, *ne is*, and *ne was* become *nulle*, *nis*, and *nas*, respectively. The change in the vowel of *wille* is idiosyncratic and thus needs to be stored in the lexicon like an irregular inflectional paradigm. Also, there were no instances in the corpus (0 out of 1418 possible instances, 0%) where some other word intervened between *ne* and the tensed verb. Thus, there is clear evidence that *ne* is the head of NEGP, which is picked up by the moving verb on its way to the AGR position.

Table 1 shows the use of *ne* alone, *ne* with *not*, and *not* alone in declarative clauses over five times periods in the Helsinki Corpus. I will focus the majority of the quantitative analysis on declarative clauses as they are the most frequently occurring in the corpus. In addition, declarative clauses provide unambiguous evidence of the early use of *not* as an emphatic sentence adverb, which I turn to below. What is

immediately relevant in Table 1 is the high use of *not* with *ne* even in the first time period (1150–1220). I show below these early uses of *not* are not as a constituent of NEGP, but instead are instances of a more generic use of *not* as a sentence adverb.

Table 1
Use of *ne* alone, *ne ... not*, and *not* alone in declaratives

Time period	*ne*	*ne ... not*	*not*	Total	*%ne*	*%ne ... not*	*%not*
1150–1220	150	82	3	235	64%	35%	1%
1120–1290	112	67	5	184	61%	36%	3%
1290–1360	186	191	44	421	44%	45%	10%
1360–1430	29	110	607	746	4%	15%	81%
1430–1500	2	0	341	343	1%	0%	99%

The oddity in the initial rates of use of *ne* and *ne ... not* can be seen more clearly in a chart of the rates of use in Table 1. Fig. 5 is a chart of the rates of use of *ne*, *ne ... not*, and *not* in Table 1. The rise in the use of *not* alone follows the familiar S-shaped pattern which is modelled by the logistic. Notice that the use of *ne ... not* does not follow the usual pattern of historical change. The curve for the use of *ne ... not* is not S-shaped. The *ne ... not* form is used frequently even in the first time period, but it is never fully established as the sole form of sentential negation. In addition, the *ne* data are odd, as the rate of use of *ne* is apparently level around 65% in stable variation with *ne ... not* in early Middle English and then falls to disuse. In the next section, I explain these oddities by showing that *ne* is the only sentential negator in early Middle English, and that it is categorically replaced by *not* by the end of the Middle English period. The early use of *not* is as an emphatic sentential adverb, an optional intensifier for *ne* and not as a sentential negator. Structurally, the early use of *not* is an adjunct of INFL'. Only later does *not* act as a negator and occupy a position within NEGP.

There is a major complication in the analysis of *ne* as a negator. In addition to being used with *not*, *ne* also appears in negative concord constructions with other negative elements. For example, *ne* is used with *never* (12a), with negative quantifiers like *nothing* (12b) and with negated NPs (12c).

(12) a. he ne miȝhte neure finde man of so grete chastete.
he ne might never find man of so great chastity
'he might never find a man of such great chastity,' (St. Edmund, 434)
b. ... þt he ne mei na þing don us.
that he ne may nothing done us
'... that he didn't do anything to us' (Ancrene Wisse, 118:10)
c. hit nas for none gode.
it ne-was for no good
It wasn't for any good.' (King Horn, 13:16)

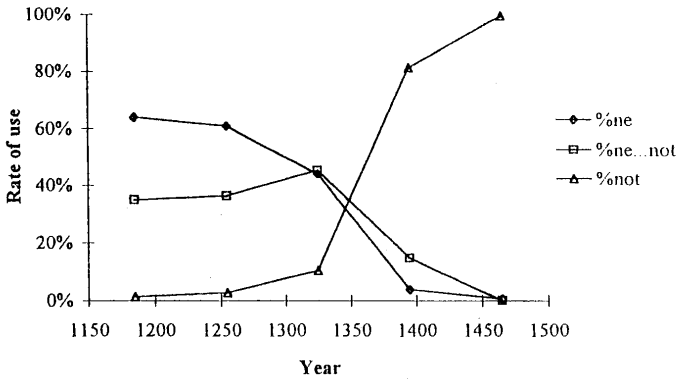


Fig. 5. The use of *ne* alone, *ne* with *not*, and *not* alone in declarative clauses.

These uses of *ne* in negative concord situations are excluded from the quantitative analysis. In other words, these tokens were not considered to be uses of *ne* as a sentential negator for the purpose of determining the rate of *ne* as sentential negation. I claim that the use of *ne* in a negative concord construction is not a use of *ne* in its function as a sentential negator. The use of *ne* in these cases is apparently not as a true sentential negator, to express the negation of a proposition, but instead as a necessary component of the negative concord construction. While I believe the syntactic use of *ne* in these cases is as the head of NEGP, the function of *ne* is quite different. In this respect, the use of the negative head in negative concord is similar to the inflectional heads of agreement and tense. *Ne* in these instances is 'negative agreement' (cf. Haegeman and Zanuttini, 1991).

Since the analysis presented in this paper pertains only to sentential negation, I feel these cases are rightly excluded as a different construction involving the head of NEGP *ne*. One additional complication is that *ne* is lost from negative concord constructions as it is from sentential negation constructions in Middle English. I have not systematically examined the data for all negative concord constructions, but my impression is that the decline in the use of *ne* is concurrent with a decline in the use of negative concord in general. While the exclusion of negative concord cases from the quantitative analysis of sentential negation is relevant to the grammatical analysis of sentential negation and negative concord in general, the theoretical consequences will not be pursued further here. I return to this point in the conclusion as an open problem for future research.

2.2. *The early use of* not

In Old English and early Middle English, *ne* is always used to express sentential negation. In some cases, *not* is found with *ne*. When *not* is present, it can be found either preverbally, before the tense verb or modal, or postverbally.

(13) Preverbal *not*:
a. Þat Jesuss ***nohht*** ne *wollde* ben boren nowwhar i þe land, ...
that Jesus not ne would be born nowhere in the land
'That Jesus did not want to be born anywhere in the land, ...' (Ormulum, I: 122)

Postverbal *not*:
b. ... & he ne *shal* ***nouȝt*** deceiue him.
and he ne shall not deceive him
'... and he shall not deceive him.' (Psalter, 161:131:11)

Kroch (1989) and Roberts (1993) conclude that *not* is a sentence adverb in early Middle English. Since *not* is always used together with *ne*, this analysis of *not* fits well with the semantic analysis of *noht* in Old English. Old English *noht* is an optional reinforcer of the Old English sentential negator *ne* with the interpretation 'not at all' or 'not in any way' (Jespersen, 1917; Mitchell and Robinson, 1992). Evidence for the status of *not* as a sentence adverb in Middle English comes from the parallel syntactic distribution of *not* and *never* during the first 70 years of the Middle English period (1150–1220).

Like *not* in early Middle English, *never* can appear both preverbally and postverbally.

(14) Preverbal adverb:
a. ... & heo ***næfre*** ne *beoð* isceadde from þare ece murhðe.
... and she never ne is separated from there each mirth
'... and she never is separated from each joy.' (Bodley Homilies, 12:126)

Postverbal adverb:
b. he ne *miȝhte* ***neure*** finde man of so grete chastete.
he ne might never find man of so great chastity
'he might never find a man of such great chastity.' (St. Edmund, 434)

Structurally, the two distinct linear positions for sentence adverbs can be unified under the assumption that there are two INFL projections, AGRP and TP. Sentence adverbs can be analyzed as phrasal adjuncts of INFL′ (cf. Roberts, 1993). Preverbal adverbs as in (14a) are left-adjuncts of AGR′, and thus appear linearly before *ne* and the inflected verb or modal which are in AGR. Postverbal adverbs as in (14b) are left-adjuncts of T′, and so follow the AGR position.

Early Middle English *not* is always stranded by subject-verb inversion (48 out of 48 potential instances in the corpus, 100%), as in (15). Thus, we can conclude that early *not* is not a head of a functional projection, which is consistent with the analysis of early *not* as an adjunct of INFL′.

(15) ne *brec* þu ***nawt*** þt seil; ...
ne break you not that seal
'Don't break that seal; ...' (Hali Meidhad, 134:12)

Other Middle English sentence adverbs are also stranded by subject-verb inversion, as shown here for *never*.

(16) Ne *mai* he ***nauere*** mo aȝean cumen?
ne may he never more again come
'Can't he ever come again?' (Vices and Virtues, 13:14)

There is additional structural evidence that *not* is a phrasal projection, like an adverb, in early Middle English: both *not* and *never* can occupy clause initial position in verb-second clauses.

(17) a. ... and [nohht ne stannt it still].
... and not ne stood it still
'... and it didn't stand still.' (The Ormulum, I: 125)
b. ... swa [nauer nulde he him sugge]; ...
... so never ne+would he him say
'... so he would never tell him; ...' (Layamon, II: 732)

The final piece of evidence that *not* is used solely as a sentence adverb in early Middle English is a quantitative comparison of the use of *not* and *never* in the preverbal and postverbal positions in declarative clauses. I assume that the sentence adverbs are adjuncts of either AGR′ or T′, and further that the relative rate of use of the AGR′ and T′ positions is constant. In other words, the use of the two positions for adverbs are in stable variation. In the Helsinki corpus, *never* appears preverbally in 16% of ordinary declarative clauses (35 out of 216 potential instances in the total corpus), a rate identical to the 16% rate of preverbal use of *never* during Middle English found in Kroch (1989). This rate is reasonably constant across time periods in the corpus, as shown in Table 2. Table 2 shows the number of preverbal and postverbal tokens of *never* in declarative clauses in the Helsinki corpus. The rate of preverbal *never* is shown in the rightmost column. These rates are reasonably near the overall rate of 16%. In addition, the rate of pre-auxiliary *never* in Modern English is estimated at 10% in Kroch (1989), indicating that the use of AGR′-adjoined *never* has been in fairly stable variation for quite some time.

I assume that if *not* has the same distribution as *never*, as an ordinary sentence adverb, then it too should exhibit the same pattern of stable variation between preverbal and postverbal (AGR′ and T′-adjoined) positions. Thus, it should appear preverbally in 16% of all instances with *not*. Under this assumption, in the first time period (1150–1220) we would expect 14 instances of preverbal *not* (0.16 × 85 tokens

Table 2
The use of pre and postverbal *never* in the Helsinki corpus

Time period	Preverbal	Postverbal	Total	%Preverbal
1150–1220	5	23	28	18%
1220–1290	6	22	28	21%
1290–1360	4	19	23	17%
1360–1430	9	51	60	15%
1430–1500	11	66	77	14%
Total	35	181	216	

with *not*).[2] In fact, there are 16 tokens of preverbal *not* in the first time period in the corpus.

A χ^2 test on the actual distribution of preverbal *not* versus the expected distribution assuming a rate of preverbal use of 16% shows that the actual distribution does not differ significantly from the expected distribution ($\chi^2 = 0.50$, $p > 0.48$). The χ^2-test is commonly used to determine the relative deviation between a sample distribution and the expected distribution under some hypothesis. In this case, the hypothesis is that *not* is used preverbally at a rate of 16%, and thus that *not* is a sentence adverb. The resulting $p > 0.48$ indicates that there is more than a 48% chance that the variation between the actual distribution of *not* and the expected distribution is due to chance. Since the standard criterion for a χ^2-test is that a hypothesis is rejected when $p < 0.05$ (i.e., when the probability that the actual distribution differs from the expected distribution only as a result of random variation is less than 5%) the distribution of *not* in the first 70 years is consistent with the analysis that *not* is used solely as a sentence adverb, and not as the sentential negator, during this period.[3]

The simplest model of the change in negators in Middle English is the change in *not* from adverb to negator directly replaces the use of *ne* as negator. The use of *ne* in this model represents the old grammar, and *not* should be used only as a sentence adverb in the old grammar. The use of *not* as a sentential negator without *ne* represents the new grammar. This model predicts that the rate of use of preverbal *not* in the presence of *ne* should remain unchanged at a constant rate of 16% throughout Middle English. By contrast, in this model the use of *not* in the absence of *ne* should reflect the new use, always postverbally as a sentential negator, and never preverbally. Table 3 shows the use of preverbal and postverbal *not* in two contexts: with

[2] Tables and numerical data in this paper are presented as follows. Numbers which correspond to actual occurrences of the data are reported exactly. Estimates of the distribution of the data will be rounded to the nearest whole number, though all calculations are performed to 16 place precision. Percentages are rounded to the percent.

[3] The exclusion of the Northern dialects based on the results of Kroch and Taylor (1994) discussed in note 1 above is supported by the data on the use of preverbal *not*. In the Northern dialects there were only two instances of preverbal *not* among 305 tokens with *not*, as compared to 35 out of 1450 in the other dialects. The lack of preverbal *not* in the Northern dialects makes estimation of the use of *not* as a sentential adverb extremely difficult in those texts.

and without *ne*. Table 3 shows that preverbal *not* is used without *ne*. There are instances of preverbal *not* without *ne* in almost every time period. We also find that preverbal *not* is lost in the presence of *ne*. The rate of use of preverbal *not* with *ne* drops from 18% in the first time period to 0% in the fourth time period. Thus, the simple model does not appear to hold.

Table 3
The use of preverbal *not* in declaratives

Time period	With *ne*			%preverbal	Without *ne*			%preverbal
	Preverbal	Postverbal	Total	with *ne*	Preverbal	Postverbal	Total	without *ne*
1150–1220	15	67	82	18%	1	2	3	33%
1220–1290	7	60	67	10%	0	5	5	0%
1290–1360	3	188	191	2%	4	40	44	9%
1360–1430	0	110	110	0%	6	601	607	1%
1430–1500	0	0	0	–	2	339	341	1%

There is some irregularity in Table 3 for the early time periods where *ne* is absent due to the low number of tokens without *ne* at this time. Since *ne* is used in almost all cases, there are very few cases without *ne*. In the second time period (1220–1290), there are no instances of preverbal *not* without *ne* among the 5 tokens. Given that there are only 5 tokens, the rate of use of adverbial not cannot be reliably determined. The estimated 16% of 5 is less than 1, so the absence of preverbal *not* is consistent with the analysis that all tokens in this time period are instances of adverbial *not*. This analysis is more consistent with the standard model of gradual morphosyntactic change than the alternative hypothesis that these are all instances of sentential negation *not*. Thus, I assume that these 5 tokens represent the use of adverb *not* with *ne*.

We can estimate the loss of the adverbial status of *not* and the subsequent rise of *not* as a sentential negator during Middle English using the distribution of *never* as an independent estimate, as was done for the first time period above. If the use of *not* as a sentence adverb exhibits stable variation between preverbal and postverbal position, then the loss of preverbal position for *not* indicates the loss of the use of *not* in the adverb position. For each time period:

$$\text{N(preverbal } not\text{)} = 0.16 \times \text{N(total adverbial } not\text{)}$$

so

$$\text{N(total adverbial } not\text{)} = \text{N(preverbal } not\text{)} \div 0.16.$$

Table 4 gives the results of this calculation for the five 70 year time periods, based on the %preverbal use of *not* taken from Table 3. For example, there are 15 preverbal tokens of *not* in the first time period with *ne*:

N(adverbial *not* with ne) = 15 ÷ 0.16 = 93.75.

Thus, all 82 actual tokens are estimated to be instances of adverbial *not* in the first time period. I assume that tokens which are not adverb tokens are sentential negation, so the estimated number of negation tokens are computed by taking the total number of tokens for each time period in each context from Table 3 and subtracting the estimated adverb tokens. In the second time period with *ne*, 44 out of 67 tokens are estimated to be adverbial *not*, so 67 – 44 = 23 tokens are estimated to be *not* used as a sentential negator.

Examining the change in the estimated use of adverb *not* over time clearly reveals a change in the distribution of *not* between early and late Middle English. The preverbal position is lost whether or not *ne* is present. The results in Table 4 are consistent with the analysis of Middle English sketched above: *not* is originally a sentence adverb, but it loses that function and becomes the sentential negator.

Table 4
Estimates of the use of adverbial *not* and negation *not* in declaratives

Time period	Actual %preV	Estimated adverb	Estimated negation	Total	Estimated %adverb
With *ne*					
1150–1220	18%	82	0	82	100%
1220–1290	10%	44	23	67	65%
1290–1360	2%	19	172	191	10%
1360–1430	0%	0	110	110	0%
1430–1500	–	0	0	0	–
Without *ne*					
1150–1220	33%	3	0	3	100%
1220–1290	0%	5	0	5	100%
1290–1360	9%	25	19	44	57%
1360–1430	1%	38	570	607	6%
1430–1500	1%	13	329	341	4%

Table 4 shows that the use of *not* without *ne* is actually more conservative of the use of *not* as a sentential adverb than the use of *not* with *ne*. The use of *not* as an adverb without *ne* is categorical throughout the first two time periods. By contrast, the use of *not* with *ne* shows variation between adverbial and negation uses in the second time period. It cannot be the case that the use of *not* as a sentential negator directly replaces the use of *ne*, since *not* is used relatively less as an adverb with *ne* than it is without *ne*.

Given that the presence of *ne* does not directly influence the loss of adverbial *not*, we might wonder what effect it has at all. In fact, I will show the rates of change for the loss of adverbial *not* are the same, whether or not *ne* is present. This indicates that the change of *not* from sentence adverb to sentential negator is unaffected by

the presence of *ne*, and thus that there is no direct grammatical competition between the two.

To determine the rate of change of *not* from sentence adverb to sentential negator, the data is analyzed with the logistic model, as discussed in section 1.4. Table 5 shows the rate of use of adverbial *not*, taken from Table 4, along with the logit of that rate, in the two contexts with and without *ne*. The logit is computed by the formula in (9). For example, in the second time period with *ne*, where the estimated rate of use of adverbial *not* is 65%, the logit is:

$$\ln \frac{p}{1-p} = \ln \frac{0.65}{1-0.65} = 0.63$$

Since the logit is not defined for rates of use of 0% or 100%, the logit is only given for time periods with a rate of use strictly greater than 0% and strictly less than 100%. According to the logistic model and the Constant Rate Hypothesis, the graphs of these logits should produce parallel straight lines. Fig. 6 shows the graphs of the logits in Table 5.

Table 5
Logits of the use of adverbial *not* in two contexts

Time period	With *ne*		Without *ne*	
	Estimated %adverb	Logit with *ne*	Estimated %adverb	Logit without *ne*
1150–1220	100%	–	100%	–
1220–1290	65%	0.63	100%	–
1290–1360	10%	–2.22	57%	0.27
1360–1430	0%	–	6%	–2.72
1430–1500	–	–	*4%*	*–3.27*

Notice that the logits for the without *ne* case in Fig. 6 do not line up particularly well along a single straight line, as predicted by the logistic model and the Constant Rate Hypothesis. Since the two lines represent uses of the same form in different contexts, we would expect to see two parallel lines emerge from this data. Instead, it appears that the point for the final time period (1430–1500) without *ne*, corresponding to the italicized values in Table 5, is too high in Fig. 6. This logit is based on 2 tokens of the use of preverbal *not* without *ne*. These tokens are given in (18).

(18) a. … þat Seint Ruffus not began þis ordr, …
that Saint Rufus not began this order
'… that Saint Rufus didn't begin this order, …' (Capgrave's sermon, 147:1)
b. … that thou not seas to shewe every thyng thu knowist ageyns oure
that you not cease to show everything you know against our

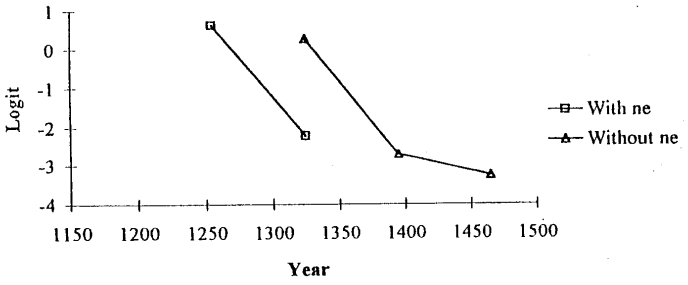


Fig. 6. Logits of the use of adverb *not* with and without *ne*.

reuerence!
Reverence
'... that you don't cease to tell everything you know against our Reverence!' (Digby Plays, 99:7)

I believe that these anomalous tokens of preverbal *not* are not instances of the use of *not* as an adverb. Rather, I claim they are instances where verb movement has failed to occur. Notice that both of these tokens contain a main verb and not a modal or auxiliary. The last time period in the corpus, from 1430–1500, is within the very early stages of the loss of main verb movement in Middle English. Ellegård (1953) shows that the use of periphrastic *do* in place of main verb movement at this time is around 2%. Thus, there is some evidence for the loss of main verb raising at this time. In this time period, there are 77 instances of main verbs used with *not* in declarative clauses in the Helsinki corpus. The estimated rate of failure of verb movement is thus 3% (2 out of 77), which is comparable to the rate of use of periphrastic *do*. I therefore assume that these two instances of preverbal *not* are instances of the use of *not* as sentential negation where the main verb has failed to raise and not instances of the use of *not* as a sentence adverb.

Assuming that the use of adverbial *not* is thus 0% in the final time period, there are only two time periods in each context for which logits can be calculated (as the logit is undefined for a rate of use of 0% or 100%). A simple slope can be computed for each case, as an estimate of the rate of change in each environment. The loss of adverb *not* with *ne* has a slope of −4.07, and the loss of adverb *not* without *ne* has a slope of −4.28 (in logits per century). These slopes are very close, indicating that the rate of loss of adverb *not* is the same regardless of the presence of *ne*, as predicted by the Constant Rate Hypothesis. Table 6 gives the estimated slope, intercept, and rate of use of adverbial *not* if a single slope is fitted to both sets of data simultaneously using linear regression. These coefficients represent a best fit model of the data based on the Constant Rate Hypothesis.

Table 6
Logistic model of the use of adverbial *not* in two contexts

Time period	Centuries t after 1000	With *ne*			Without *ne*		
		Logit adverb	Model logit adverb	Model %adverb	Logit adverb	Model logit adverb	Model %adverb
1150–1220	1.85		3.607	97%		6.087	100%
1220–1290	2.55	0.632	0.677	66%		3.156	96%
1290–1360	3.25	−2.218	−2.254	9%	0.274	0.225	56%
1360–1430	3.95		−5.185	1%	−2.720	−2.705	6%
1430–1500	4.65		−8.116	0%		−5.636	0%
		Intercept (k)	11.35		Intercept (k)	13.93	
		Slope (s)	−4.19		Slope (s)	−4.19	

The best fit common slope is −4.19 and a different intercept is fitted for each context. The model's predicted logit is computed using the slope, intercept, and value of t in centuries after 1000 AD. For example, in the first time period with *ne*, the model logit using Eq. (9) is:

$$k + st = 11.35 - 4.19 \times 1.85 = 3.607$$

The model's predicted rate of use of *not* as an adverb, using Eq. (8) is:

$$\frac{e^{k+st}}{1+e^{k+st}} = \frac{e^{3.067}}{1+e^{3.067}} = 0.97 = 97\%$$

The model of the loss of adverb *not* given by the Constant Rate Hypothesis can be tested for goodness of fit against the observed data. To test the model fit, we must compare the estimated token counts of the actual distribution of the data (from Table 4) with the expected distribution under the model. Expected values are obtained by multiplying the total number of uses of *not* from Table 3 by the rates of use predicted by the model in Table 6. For example, in the first time period with *ne*, there are 82 tokens of *not* with *ne*. The model predicts that 97% of these are uses of *not* as an adverb. 82 × 0.97 = 80 expected tokens of adverb *not* based on the model. Based on the use of preverbal *not*, we estimated 82 uses of adverb *not* in the corpus, as shown in Table 4. The model predicts 82 − 80 = 2 uses of *not* as a negator, and we estimated 0 uses of *not* as a negator in the corpus, based on the use of preverbal *not*.

Table 7 shows the estimated uses of adverb and negation *not* from Table 4 compared to the expected values of the model based on the Constant Rate Hypothesis. The model fit is assessed in each context separately through a χ^2-test. In the compu-

tation of this and later χ^2 values, cells with expected value less than 5 are excluded, as the χ^2-test becomes unreliable when there are very few tokens in a cell. The p values of 0.73 and 0.81 indicate that the model fits each set of data quite well. I conclude that the rates of change in both cases are the same, and therefore the presence of *ne* does not directly influence the rate of change of *not* from adverb to sentential negator.

Table 7
Goodness of fit of model of the use of adverbial and negation *not*

Time period	With *ne*				Without *ne*			
	Estimated adverb	Expected adverb	Estimated negation	Expected negation	Estimated adverb	Expected adverb	Estimated negation	Expected negation
1150–1220	82	80	0	2	3	3	0	0
1220–1290	44	44	23	23	5	5	0	0
1290–1360	19	18	172	173	25	24	19	20
1360–1430	0	1	110	109	38	38	570	569
1430–1500	0	0	0	0	0	1	342	340
		χ^2=0.11						
		p>0.73						
						χ^2=0.06		
						p>0.81		

To summarize so far, I have shown that *not* in early Middle English is a sentence adverb, based on its parallel distribution with *never*. An estimate of the change in use of *not* over time can be made by considering the instances of preverbal *not* in the corpus to be a constant fraction of the total number of uses of *not* as an adverb. The remaining tokens are uses of *not* as a sentential negator. The change of *not* from sentence adverb to sentential negator takes place at a constant rate, regardless of the presence or absence of *ne*. This is the first piece of evidence that the relation between *ne* and *not* is indirect, as *ne* does not influence the rate of rise in the use of *not* as a sentential negator. Contrary to the usual case of diachronic morphosyntactic change, *ne* and *not* do not appear to be in *grammatical* competition. I confirm this observation in section 4, by showing that the rate of the rise in sentential negation *not* is different from the rate of loss of *ne*. Assuming the Constant Rate Hypothesis, these two changes cannot be linked to a change in a single morphosyntactic parameter. I will present an account of the change from *ne* to *not* which posits an indirect syntactic link between the two, via licensing. This link mirrors the functional link between the two as sentential negators.

With the estimates of the use of *not* as a sentential negator in Table 4, we can construct a total picture of the change in use of sentential negators with the adverb uses of *not* factored out. Table 8 shows the revised estimates for the use of *ne*, *ne* with sentential negation *not*, and sentential negation *not* alone. The number of instances of *ne* are taken from Table 1. The estimate for the use of *ne ... not* as sentential negation comes from the top half of Table 4, column 4. The estimate for the use of *not* as sentential negation comes from the bottom half of Table 4, column 4.

Table 8
Estimated use of *ne*, *ne ... not*, and *not* as sentential negation

Time period	Estimated *ne*	Estimated *ne ... not*	Estimated *not*	Estimated total	Estimated *%ne*	Estimated *%ne ... not*	Estimated *%not*
1150–1220	150	0	0	150	100%	0%	0%
1220–1290	112	23	0	135	83%	17%	0%
1290–1360	186	172	19	377	49%	46%	5%
1360–1430	29	110	570	709	4%	16%	80%
1430–1500	2	0	342	344	1%	0%	99%

Table 8 shows that *ne* is the only sentential negator in early Middle English. At the end of Middle English, *not* is the only sentential negator available.[4] The estimated rates of use of the sentential negators are charted in Fig. 7. Comparing Fig. 7 to Fig. 5 shows that the elimination of the adverb cases gives a clear picture of the change in negators from *ne* to *not*. The loss of *ne* as sentential negator follows a classic S-shaped curve, from total use to disuse. The rise in *not* follows the reverse pattern. The use of *ne ... not* still appears quite eccentric, however. Just when the use of *ne ... not* is becoming well established, and the rate of increase of its use is peaking, its use suddenly drops again, and *ne ... not* is lost. This oddity in the rate of use of *ne ... not* is not genuine. The apparent oddity comes from treating the use of bipartite negation *ne ... not* as a single grammatical option. I show in section 4 that the use of *ne ... not* is the result of the simultaneous use of *ne* and *not* individually as sentential negators. Thus, the rise in the use of *ne ... not* in the early time periods is caused by the rise in the use of *not* as a sentential negator in general, while *ne* is still in use. Similarly, the loss of *ne ... not* is a result of the overall loss of *ne*, after *not* is in frequent use as a sentential negator.

2.3. Not *as sentential negator*

We saw above that in later Middle English, *ne* is lost, and *not* loses its preverbal position. I claim that this is a consequence of the reanalysis of *not* as a sentential negator, and hence as a component of NEGP. If *not* is a component of NEGP, it will

[4] There are two anomalous instances of the use of *ne* alone in the final time period. One occurs in the following passage in the Digby Plays.

(i) Be thi trouthe, Watkyn, woldest thu be made a knyght?
Thu hast be my seruaunt and messangere many a day,
But thu were neuer provid in bataile nor in fight,
Ant therfor to avaunce the so sodeynly I ne may.

Clearly, this token uses *ne* to take advantage of its preverbal word order and preserve the rhyme.

The second token, shown in (ii), occurs in the Fitzjames sermon within a long quote from the first chapter of the Corinthians.

(ii) yet he ne erre abowte the ende.

This sentence is likely reported verbatim from the biblical text used in the sermon. In both of these cases it seems unlikely that the use of *ne* represent the contemporary grammar from the time period. Thus, I claim *not* is the only sentential negator in use.

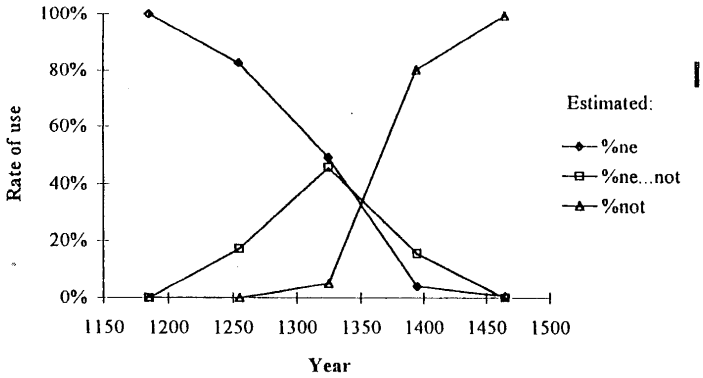


Fig. 7. The estimated rate of use of *ne*, *ne* ... *not*, and *not* sentential negation in declarative clauses.

no longer be able to exhibit positional variation with respect to the inflected verb and will always appear postverbally. In this section, I present structural and quantitative evidence that *not* is a component of NEGP and has assumed the role of sentential negator in late Middle English.

First, there is evidence in late Middle English that *not* can be used as a head, as shown by its participation in the subject-verb inversion in (19).

(19) Head of NEGP *not*:
[Am *not*] I lord and kyng of the cuntre?
'Aren't I lord and king of the country?' (Digby Plays, 100)

However, even when *ne* is absent, *not* is not required to be a head, as shown by its stranding in the subject-verb inversion in (20).

(20) Non-head *not*:
[Wyll] he *not* com here?
'Won't he come near?' (Mankind, 162)

If *not* is stranded by inversion, and is not an instance of adverbial *not* (which cannot be structurally determined in a single case, but can be estimated over the entire data set), then I assume that *not* occupies the specifier of NEGP. This is the position used by Pollock (1989) for French *pas*, as well as for Modern English *not*.

One of the difficulties in analyzing Middle English negation is that the majority of uses in declarative clauses during the change are structurally ambiguous.

(21) Crist shulde not haue suffred deþ.
'Christ should not have suffered death ...' (Wycliffite sermons I: 415)

If we allow the possibility that a sentence like (21) can be generated without any elements in NEGP, as in the sentence adverb case, there are three possible positions for *not*:
- The lower sentence adverb position, adjoined to T′.
- The head of NEGP.
- The specifier of NEGP.

In each case, *not* would appear postverbally. As pointed out by a reviewer, this structural ambiguity may be a contributing factor in the instigation of the diachronic change. Early uses of adverb *not* postverbally (as an adjunct of T′) could be misanalyzed as constituents of NEGP. This potential for syntactic reanalysis was enhanced by the semantic broadening of *not* (Frisch, 1994). Originally, Old English *nawiht* 'nothing' broadened to *noht* 'not at all', which further broadened to ordinary *not* (Jespersen, 1917).

We have already used the preverbal use of *not* to estimate the number of instances of the use of *not* as a sentence adverb. A similar estimate is needed for the use of *not* as a head. As mentioned above, the use of *not* as a head in declarative clauses cannot be separated from the use of specifier *not*. An estimate can be made for the use of not as a head in interrogatives, based on the participation of *not* in subject-verb inversion. Table 9 shows the use of the head of NEGP position in interrogatives, which involve subject-verb inversion. This table is divided into two contexts, with and without *ne*. Notice that the structural analysis of *ne* as a head, and the use of *not* as a head when it participates in subject-verb inversion is supported by the quantitative data. Since the presence of *ne* in the head position should block the use of *not* in the head position, we would expect to find no instances of *not* participating in subject-verb inversion when *ne* is present, and in fact, none are found.

Table 9
Use of *not* in interrogatives

Time period	With *ne*		Without *ne*		Total
	Inverted	Stranded	Inverted	Stranded	
1150–1220	0	46	0	2	48
1220–1290	0	40	0	2	42
1290–1360	0	41	0	21	62
1360–1430	0	7	11	48	66
1430–1500	0	0	4	19	23

I assume that, just as in the declarative case, some of the uses of *not* tabulated in Table 9 are uses of *not* as a sentence adverb. Since we are interested in the rate of use of sentential negation *not* as a head, the adverb instances of *not* must be factored out. There can be no direct estimate of the rate of use of adverb *not* in interrogatives.

as both AGR′-adjoined and T′-adjoined positions for adverb *not* are postverbal after subject-verb inversion. Therefore, I assume that the estimates of the rates of use of *not* as an adverb in declaratives in Table 4 can be used to estimate the number of instances of *not* as an adverb in interrogatives. I assume the remaining non-head cases are sentential negation, and are thus the use of *not* in the specifier of NEGP. I assume that all uses of *not* as a head are sentential negation. The rate of use of *not* as a negator is 1-%adverb from Table 4, and is shown in Table 10 for each context. For example, in the second time period with *ne*, the are 40 cases of stranded *not*. $0.35 \times 40 = 14$ estimated negation tokens of *not*. Table 10 shows the resulting estimate for the use of sentential negation *not* in interrogatives, and the estimated rate of use of *not* as a head in the absence of *ne*. The rate of use of *not* as a head is rather low, indicating that the majority of the uses of *not* as a sentential negator are in the specifier of NEGP.

Table 10
Use of *not* sentential negation in interrogatives

Time period	With *ne*				Without *ne*				
	Head	Estimated %negation	Estimated specifier	Estimated total	Head	Estimated %negation	Estimated specifier	Estimated total	Estimated %head
1150–1220	0	0%	0	0	0	0%	0	0	–
1220–1290	0	35%	14	14	0	0%	0	0	0%
1290–1360	0	90%	37	37	0	43%	9	9	0%
1360–1430	0	100%	7	7	11	94%	45	56	17%
1430–1500	0	–	0	0	4	100%	19	23	17%

I assume that the use of *not* as a head in inversion constructions provides an estimate of the overall use of *not* as a head in declarative clauses. Thus, based on the estimates of the rate of use of *not* as a head in Table 10, we can estimate the number of tokens of sentential negation *not* as a head of NEGP in declarative contexts. Since *not* is only used as a head when the competing head *ne* is absent, there are 0 estimated instances when *ne* is present. The number of uses of *not* as a head is based on the percent of use of *not* as a head in Table 10 multiplied by the total number of uses of *not* as a sentential negator (in the appropriate context) from Table 8. For example, in the fourth time period without *ne*, there are 570 tokens of *not* used as a negator. So there are $0.17 \times 570 = 99$ estimated uses of *not* as a head. The remainder of instances of sentential negation *not* are instances of *not* in the specifier of NEGP. For example, there are $570 - 99 = 471$ estimated tokens of *not* used in the specifier of NEGP position. Table 11 presents the estimated use of *not* as a head and as a specifier in declarative clauses. The number of uses of *ne* from Table 8 is also included, yielding a total picture of sentential negation.

Table 11 reveals the true time course of the change in negators. The use of *ne* is obligatory for the first two time periods (1150–1290). Recall that *ne* is, syntactically, the head of the negation phrase, NEGP. There are no instances of sentential negation

Table 11
Estimated use of *ne* and *not* as sentential negation in declaratives

Time period	*ne* alone	*ne* with *not*		*not* alone		Total
		Head	Specifier	Head	Specifier	
1150–1220	150	0	0	0	0	150
1220–1290	112	0	23	0	0	135
1290–1360	186	0	172	0	19	377
1360–1430	29	0	110	99	470	709
1430–1500	2	0	0	59	283	344

without *ne* in the first two time periods. Thus, the head of NEGP position is filled in all cases of sentential negation. Starting in the second time period (1220–1290) *not* is first used as a sentential negator, a function which is closely related to its previous use as a strengthener or emphatic adverb. These early uses of *not* negation are in the specifier of NEGP. There is no evidence of the use of *not* as a head at this time. The use of *not* in the specifier of NEGP does not directly compete with the use of *ne* in the head of NEGP position. Both forms can be used simultaneously. In the third time period (1290–1360), *not* is used increasingly in the specifier of NEGP position; nearly half of the instances of sentential negation use *not* with *ne*. In this period, the first uses of sentential negation without *ne* appear, showing that *not* is becoming established as a negator independent of *ne*. In the fourth time period (1360–1430), the use of *ne* drops sharply. Most instances with *ne* also have *not*. The majority of instances of negation involve the use of *not* alone in the specifier of NEGP position. With the use of *ne* dwindling, the head of NEGP position is now unoccupied in many cases. This period shows the first evidence that another option is becoming available for *not*, as the head of NEGP. The final time period (1430–1500) shows the loss of *ne* going to completion, with the use of *not* as sentential negator becoming exclusive.

Thus we see a pattern where the original negator *ne* is used while a new negator *not* (in the specifier of NEGP) becomes established. Once *not* is well established, but not before, the use of *ne* declines. Once the decline in *ne* begins, a directly competitive use of *not*, as a head of NEGP like *ne*, begins. In the change in negation in Middle English, the emergence of a new structural option for *not* is the precursor to syntactic variation and change in the use of *ne*. The reanalysis of *not* is the beginning, rather than the endpoint, of syntactic change (contra Lightfoot, 1991). Many other quantitative historical studies have revealed similar time courses (Kroch, 1989; Santorini, 1989; Taylor, 1990, 1994; Pintzuk, 1991; Fontana, 1993).

In this section I have shown that early uses of *ne ... not* are uses of *not* as a sentence adverb, in the INFL′-adjoined position. This position shows stable variation between preverbal (AGR′-adjoined) and postverbal (T′-adjoined) placement of *not*. This position is structurally distinct from later uses of *ne ... not*, where *not* is in the specifier position of NEGP. These later uses are always postverbal. The use of *not* as a sentential negator makes *ne* and *not* functional doublets: they serve the same mor-

phosyntactic and semantic function. Over time, *not* becomes the preferred form and *ne* recedes. Since they occupy different syntactic positions *ne* and *not* do not appear in complementary distribution. Instead, some overlap is observed. Later, after *ne* has receded considerably, a third option, the use of *not* as the head of NEGP, emerges. At this point, there is three way competition between *ne*, specifier *not*, and head *not* as sentential negators.

3. Economy of Projection

The lag in the loss of *ne* until after the establishment of *not* as a sentential negator suggests that there is an indirect, rather than direct, competition between the uses of *ne* and *not*. I claim that this indirect connection between *ne* and *not* is through their mutual use as syntactic licensers of the NEGP projection. In the spirit of the minimalist program of Chomsky (1993), I assume that notions of structural economy restrict the generation of maximal projections to those which are necessary in a clause. The principle of Economy of Projection, which I adopt here, is proposed in Speas (1994) to account for the long standing problem of the cross-linguistic distribution of null subjects. In this section, I briefly review Speas's account of null-subject phenomena and the formal machinery of economy of projection. I then apply Economy of Projection to NEGP to give an account of the change in Middle English negators.

Speas introduces the principle of Economy of Projection, shown in (22), to constrain the generation of superfluous maximal projections.

(22) Project XP only if XP has content. (Speas, 1994: 186)

A maximal projection has content when it contributes some phonological or semantic material beyond that contained in its complement. When applied to AGRP in the tree given in (4), Economy of Projection forces AGRP to contain semantic or phonological material distinct from that which is dominated by NEGP. In particular, either the head of AGRP or the specifier of AGRP must be filled by phonological or semantic material.

3.1. The distribution of null subjects

Speas proposes that this two option licensing condition accounts for cross-linguistic variation in the distribution of null subjects. Jaeggli and Safir (1989) note that the availability of null subjects is generally predictable from the number of morphological contrasts in the subject agreement system of a language. Languages with many contrasts, or no contrasts at all, tend to allow null subjects. Languages with only a few contrasts do not. I present Speas's account for each degree of morphological contrast in turn.

Languages with many contrasts, with so-called 'rich' agreement, tend to allow null subjects. Two examples are Italian and Spanish. A Spanish verbal paradigm is shown in (23).

(23)

habl-o	1sg	'I speak'
habl-as	2sg	'you speak'
habl-a	3sg	'he speaks'
habl-amos	1pl	'we speak'
habl-áis	2pl	'you speak'
habl-an	3pl	'they speak' (Speas, 1994: 180)

Informally, Speas's proposal is that 'rich' agreement gives content to the head of the AGRP position, making the information dominated by AGRP distinct from that within NEGP. Consequently, the AGRP is licensed by the AGR head. In this case, the specifier of AGRP can be left empty without violating Economy of Projection for AGRP, and thus null subjects are permissible.

Languages with some subject agreement, so-called 'poor' agreement languages, like Modern English, require overt subjects. Modern English has only a single agreement contrast, between 3sg and all other forms, as shown in (24).

(24)

speak	1–2sg/1–3pl
speaks	3sg

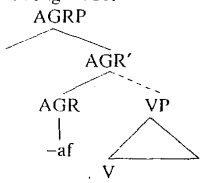
'Poor' agreement is insufficient to give content to the head of AGRP position, and thus the specifier of AGRP must be filled by a subject to avoid a violation of Economy of Projection for AGRP. Null subjects are therefore barred in poor agreement languages.

Finally, languages with no subject agreement at all, like Chinese, are assumed by Speas to have no AGRP. In this case, null subjects are possible as there is no AGRP to license, and thus no specifier position to be filled, in contrast to poor agreement languages.

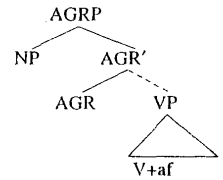
3.2. Strong and weak AGR

The formal machinery for Economy of Projection is based on proposals of Rohrbacher (1993). He claims that there is cross-linguistic variation in the syntactic realization of the AGR head. One type of AGR, 'strong' AGR, dominates an independent inflectional affix, which is inserted from the lexicon directly into the AGR position. By contrast, 'weak' AGR does not dominate an independent affix. Instead, in languages with weak AGR, the verb is inflected in the lexicon and inserted fully inflected into the V position. In this case, the AGR head is empty. The structural contrast is shown in the partial trees in (25).

(25) a. 'strong' AGR



b. 'weak' AGR



Speas suggests that the distinction between strong and weak AGR can be used to account for the cross-linguistic distribution of null subjects. In (25a), the AGR head dominates the affix, and thus the AGR head licenses AGRP. The head has content, so the specifier of AGRP can remain empty. In (25b), on the other hand, the AGR head is empty, so an overt subject is required in the specifier of AGRP to satisfy the licensing condition, as shown.

3.3. Economy of Projection and NEGP

I adopt Speas's proposal for Economy of Projection, and apply it here to NEGP. In particular, the NEGP can be licensed either through its head or through its specifier position. Thus, the change in negation from *ne* to *not* can be seen as a change in licensing strategies for NEGP. *Ne*, in the head position, acts like 'strong' inflection and licenses NEGP. When *not* is used as a sentential negator, in the specifier of NEGP, it also licenses NEGP. Note, however, that there is no prohibition on having both licensing positions filled, as is the case with bipartite *ne ... not*. Since *ne* and *not* occupy different structural positions, they are not in direct grammatical competition. Rather, their relationship is indirect. If *not* is present, *ne* is not required, as the NEGP is licensed. This accounts for the relative delay in the loss of *ne* after *not* is established as a sentential negator. The presence of *not* does not inhibit the use of *ne*, it merely makes *ne* redundant.[5]

4. Independent and redundant licensing of NEGP

In section 2, I presented some evidence that the reanalysis of *not* occurred independently of the loss of *ne*. In this section, I present evidence that the use of *not* in the specifier of NEGP and the use of *ne* are independent in the statistical sense. Consequently I claim that the bipartite negation *ne ... not* constitutes redundant licensing

[5] The use of Economy of Projection for NEGP also accounts for the cyclic changes in negators in the so called 'Jespersen cycle' which is seen in the history of many Indo-European languages (cf. Frisch, 1995). Whether the head position or the specifier position is used to license NEGP, the other position is available for the innovation of a new sentential negator. Over time the position which is used to license NEGP fluctuates from head to specifier to head again.

of NEGP by two separate sentential negators. Redundant licensing is allowed under Economy of Projection, as there is no principle which prevents the use of both the head and specifier positions of a projection. In addition, I show that the rates of change of the loss of *ne* and the rise in the use of *not* as a sentential negator are different in the logistic model. Thus, the change from *ne* to *not* is not based on a single underlying grammatical parameter which chooses between the two. Rather, since their rates of change are different, the relation between the two must be indirect. Their relationship is clearly functional rather than structural. I claim *ne ... not* negation is diachronically unstable as *ne* and *not* are functional doublets (Kroch, 1994).

In order to determine whether or not the two different methods for licensing NEGP are independent, we must show that the use of bipartite negation *ne ... not* is simply the simultaneous use of *ne* and *not*, and not some special, independent system of negation. Thus, we must test the hypothesis that the probability that bipartite negation is used is equal to the probability that *ne* is used in the head of NEGP at the same time as *not* is used in the specifier of NEGP. That is,

P(*ne ... not* is used) = P(*ne* is used) × P(*not* is used in Spec(NEGP))

This hypothesis can be tested using the χ^2-test.

The number of instances where *ne* is used in the corpus is given in the first column of Table 12 for each time period. This includes the use of *ne* alone from Table 11, plus the instances of *ne ... not* from Table 11, both of which are instances where *ne* is used. For example, in the third time period we have estimated that *ne* is used alone in 186 tokens and *ne ... not* is used in 172 tokens. Thus we estimate there are 186 + 172 = 358 total tokens which use *ne* as a sentential negator. In a similar manner, the number of instances where *not* is used in the specifier position is the number of instances where *not* is used in the specifier position whether *ne* is present or not. This is the sum of the specifier with *ne* and specifier with *not* alone columns of Table 11, which appears in the fourth column of Table 12. For example, in the third time period we estimated 172 tokens of *ne ... not* negation and 19 tokens which use *not* alone in the specifier of NEGP. The uses of *not* as a head from Table 11 are repeated in Table 12.

On the right side of Table 12 are the percentage of instances of sentential negation which use *ne* (whether or not *not* is used) and the percentage of instances of sentential negation which use *not* in the specifier position (whether or not *ne* is used). The expected use of *ne ... not* under the independence model is the product of these two percentages. For example, in the third time period 358 + 377 = 0.95 = 95% of the tokens use *ne*. 191 + 377 = 0.51 = 51% of the tokens use *not* in the specifier of NEGP. So 0.95 × 0.51 = 0.48 = 48% of the tokens are predicted to use *ne ... not* negation. The predicted rate of *ne ... not* use is given in the final column of Table 12.

We can test the goodness of fit of this model using a χ^2-test. Expected uses of *ne ... not* under the model can be computed by multiplying the expected %*ne ... not* from Table 12 by the total instances of sentential negation for each time period from Table 12. For example, in the third time period, 48% of the tokens are predicted to

Table 12
Model of the use of *ne ... not* as redundant licensing

Time period	*ne*	Estimated head *not*	Estimated specifier *not*	Estimated total	*%ne*	%specifier *not*	Expected *%ne ... not*
1150–1220	150	0	0	150	100%	0%	0%
1220–1290	135	0	23	135	100%	17%	17%
1290–1360	358	0	191	377	95%	51%	48%
1360–1430	139	99	581	709	20%	82%	16%
1430–1500	2	59	283	344	1%	82%	0%

be *ne ... not* negation. 0.48 × 377 = 182 tokens are expected to be *ne ... not* negation under the model. Table 13 contains the results of the χ^2-test on the expected number of uses of *ne ... not* as compared to the estimated number of uses from Table 11. Comparing the estimates for the actual data with the values predicted by the model finds the fit of the model is excellent. The probability of the estimates differing from the expected values by random variation is greater than 73%.

Table 13
Goodness of fit of the model of the use of *ne ... not* as redundant licensing

Time period	Estimated *ne ... not*	Expected *ne ... not*
1150–1220	0	0
1220–1290	23	23
1290–1360	172	182
1360–1430	110	114
1430–1500	0	2
	χ^2=0.62	
	p>0.73	

Given the result in Table 13, I have shown that the use of the head position and the specifier position in NEGP are statistically independent. The bipartite negation during the change in negators in Middle English is a by-product of the independent use of *ne* in the head position and *not* in the specifier position, redundantly licensing NEGP. The only constraints on the use of *ne* and *not* are that the head position cannot be doubly occupied (e.g. simultaneously by *ne* and by *not* when it is used as a head) and that the NEGP must be licensed in a syntactically negated sentence, so either *ne* or *not* must be used in the NEGP.

Additional evidence for the indirect relation between *ne* and *not* comes from examining the rates of change of the loss of *ne* and the rise of *not* as a sentential negator used in the specifier of NEGP. The competition between *ne* and specifier *not* as functional doublets is the primary change in sentential negation in Middle English (I deal with the additional case of the use of *not* as a head below). If these two options are structurally incompatible competitors, they should change at the same

rate according to the Constant Rate Hypothesis. Table 14 shows the rates of use of *ne* and use of *not* in the specifier position from Table 12. Logits are computed for the use of *ne* and for the rise in specifier *not* using Eq. (9). For example, *ne* is used in 95% of the clauses in the third time period, so the logit is:

$$\ln \frac{p}{1-p} = \ln \frac{0.95}{1-0.95} = 2.937$$

A logit is not computed for the final time period (1430–1500) for the use of specifier *not*, italicized in Table 14 as the rate of use of *not* as a specifier levels off in the final time period due to the additional complicating factor of the use of *not* as a head. In order to compare the loss of *ne* with the rise in *not*, the signs of the logits for *ne* are reversed (as discussed in section 1.4). These values are given in the fourth column of Table 14. Fig. 8 charts the negative logit for *ne* and the logit for *not* from Table 14. If these two changes are structurally linked to a single underlying cause, they should change at the same rate, and have parallel logits. Clearly, the two sets of logits are changing at different rates. The best fit slope by linear regression on the loss of *ne* is 5.81, and the best fit slope for the rise in specifier *not* is 2.44.

Table 14
Logits for the use of *ne* and *not* negation

Time period	Estimated *%ne*	Logit *ne*	–Logit *ne*	Estimated specifier *not*	Logit *not*
1150–1220	100%	–	–	0%	–
1220–1290	100%	–	–	17%	–1.572
1290–1360	95%	2.937	–2.937	51%	0.028
1360–1430	20%	–1.410	1.410	82%	1.518
1430–1500	1%	–5.142	5.142	*82%*	–

We can fit a single slope to the data in Table 14, in the same manner as was done previously for the loss of adverb *not* in Table 6. The best fit common slope is 3.42, as shown in Table 15. The model based on this slope can be tested for goodness of fit, by computing expected uses of *ne* and specifier *not* based on the model parameters. First, model logits are computed using the model slope and intercept in Eq. (9). For example, in the first time period the negative logit for the use of *ne* is:

$$k + st = -12.30 + 3.42 \times 1.85 = -5.981$$

so the logit for *ne* is:

$$-(-5.981) = 5.981.$$

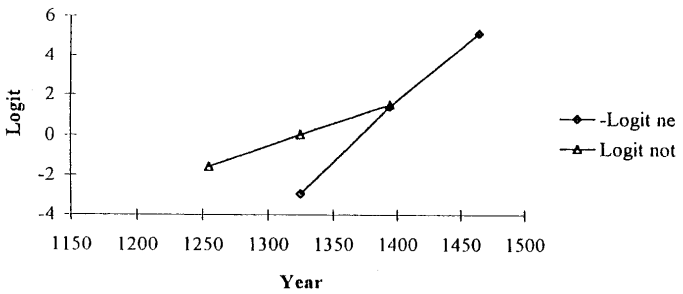


Fig. 8. The negative logit of the use of *ne* and the logit of the rise in specifier *not*.

The expected use of *ne* and use of *not* in the specifier are determined from the logit using Eq. (8). For example, the use of *ne* in the first time period is:

$$\frac{e^{k+st}}{1+e^{k+st}} = \frac{e^{5.981}}{1+e^{5.981}} = 1.00 = 100\%$$

Table 15
Logistic model of the use of *ne* and specifier *not*

Time period	Centuries *t* after 1000	−Logit *ne*	Model −logit *ne*	Model logit *ne*	Model %*ne*	Logit *not*	Model logit *not*	Model %*not*
1150–1220	1.85		−5.981	5.981	100%		−4.599	1%
1220–1290	2.55		−3.588	3.588	97%	−1.572	−2.206	10%
1290–1360	3.25	2.937	−1.195	1.195	77%	0.028	0.128	55%
1360–1430	3.95	−1.410	1.198	−1.198	23%	1.518	2.580	93%
1430–1500	4.65	−5.142	3.590	−3.590	3%		4.972	99%
		Intercept	−12.30			Intercept	−10.92	
		Slope	3.42			Slope	3.42	

Table 16 compares the estimates for the use of *ne* and *not* from Table 12, with the expected number of uses from the single slope model. The expected uses are computed by multiplying the model rates of use in Table 15 by the total instances of sentential negation in Table 12. For example, in the third time period, the model predicts *ne* is used in 77% of 377 cases. 0.77 × 377 = 290 expected uses of *ne* according to the model. The expected counts differ greatly from our estimates of actual use and

the χ^2-values are very large. The chance that random variation would provide deviations from the expected values that are as great as those found in the data are less than 0.01 for both *ne* and specifier *not*. Thus, the model of a single slope can be rejected with confidence.

Table 16
Goodness of fit of model of the use of *ne* and specifier *not*

Time period	Estimated *ne*	Expected *ne*	Estimated specifier *not*	Expected specifier *not*
1150–1220	150	150	0	1
1220–1290	135	132	23	13
1290–1360	358	290	191	206
1360–1430	139	164	581	659
1430–1500	2	9	283	342
	χ^2=20.27		χ^2=27.62	
	$p>$ 0.00		$p>$ 0.00	

There is an additional change in negators in Middle English, the introduction of *not* as the head of NEGP. If the uses of *not* as a head are included in the computations in Tables 14–16, thus modeling syntactic grammar competition between the use of *ne* negation against the use of *not* negation of any type, the predictions of the model do not improve significantly. The slope for the rise of use in *not* as either a head or specifier is 3.32, as compared to the slope of 5.81 for the loss of *ne*. If a single slope is fitted to the loss of *ne* and the rise of *not* as either a head or a specifier, the resulting best fit common slope is 3.77. The χ^2 for the resulting model of the loss of *ne* is 12.71 and the χ^2 for the model of the rise in *not* as either a head or a specifier is 13.39. The fit of the model is improved, but is still poor. The probabilities that the differences between the models and the actual data are due to random chance is still less than 0.01 for both cases.

The rates of change for the loss of *ne* and rise in *not* as a sentential negator, as modeled by the logistic function, are significantly different, indicating that these changes are not reflexes of a single underlying grammatical parameter change. However, the use of *not* does replace the use of *ne* as the sentential negator over time. The uses of the two forms are functionally related, but not in direct syntactic competition. The relation between the two is an indirect one rather than a direct one. The licensing explanation for the change accounts for the differences in the rate of the loss of *ne* and the rise in the use of *not* as a sentential negator. Since these forms are not in direct grammatical competition, the changes in their use are not linked to a single underlying grammatical choice, and thus there is no reason to expect these changes to proceed at the same rate. Since they both serve the same function, as syntactic licensers of NEGP which signal sentential negation, the use of one does replace the other over time.

5. Conclusion

The evidence in this paper demonstrates that the change in negators in Middle English is a change in which reanalysis was not forced upon language learners as a result of syntactic constraints. In this case, the reanalysis of *not* as a sentential negator precedes the loss of the Old English sentential negator, *ne*, creating a redundant system of negation. This reanalysis was the natural evolution of the semantic broadening of the meaning of *not* over time. The redundant system of negation had both *ne* and *not* as functional doublets. *Ne* is eventually lost from this redundant system.

The change is shown to be one involving only two types of sentential negation, *ne* and *not*. The superficial bipartite negation, *ne ... not*, is the result of simultaneous independent uses of the individual sentential negators and does not constitute a distinct grammatical construction. The bipartite negation results from the overlap between use of the *ne* and *not* systems of negation. In most instances of morphosyntactic change the competitors are mutually exclusive syntactic options. In those cases intermixing of grammatical systems is often seen within a single text, providing evidence that speakers have access to two grammatical systems simultaneously during the change. The change in negators does not necessitate invoking two underlying grammars (I-languages in the sense of Chomsky, 1986), as the old and new systems do not vary on a particular parameter. The rise in the use of *not* as a negator supports the Constant Rate Hypothesis (Kroch, 1989): the change in the use of *not* in different contexts occurs at a constant rate. The Constant Rate Hypothesis and the logistic model are thus extended to include cases beyond parametric variation and grammar competition. The structural reanalysis of *not* as a sentential negator is a single underlying cause to the change in the use of *not* in different contexts. The loss of *ne* is a second change which is linked to, but not structurally forced by, the change in *not*.

The analysis of the change in negators in Middle English has three facets of general significance. First, this change, which is seen throughout the history of the Indo-European languages (as one part of the 'Jespersen cycle'), is explained syntactically as change from one method of licensing the NEGP under Economy of Projection to another (Frisch, 1995). Thus, it provides another instance, in addition to the distribution of null subjects, where Speas's (1994) Economy of Projection can be used explanatorily as a general principle of the grammar. Principles of economy have received recent attention as driving forces in synchronic grammar (Chomsky, 1993) and these forces should be apparent in diachronic grammar as well.

In addition, the detailed study of this change has shown that there are instances of morphosyntactic change where Kroch's (1989) Constant Rate Hypothesis does not apply. The loss of *ne* and rise of sentential negation *not* are clearly related, but the change does not involve the change in a single underlying morphosyntactic parameter setting (contra Kroch, 1994). This change should not be treated as an instance of grammar competition based on parametric variation. Instead the change involves the syntactic and semantic properties of particular lexical items which are not in direct morphosyntactic competition. The two forms of negation do form a functional doublet, and are thus expected to be unstable diachronically (Kroch, 1994). Third, the data presented here reinforce the value of using quantitative data analysis hand-in-hand with structural analysis. In the case of the use of *not* in declarative sentences, there is little structurally unambiguous data.

The use of quantitative estimates based on relatively few structurally unambiguous cases served to divide up the ambiguous cases, and the result was a clear picture of the ambiguous data that revealed the true nature of the change in negators. These conclusions could not have been reached without the detailed quantitative analysis. Conversely, a detailed structural analysis, involving three extended projections of the verb, is needed to adequately model the variation in word order seen during the change. Without such a detailed structural representation of the clause, the different cases of word order involving *not* could not be adequately differentiated from the different structural positions for *not*. Each facet of the quantitative analysis corresponds to a facet of the structural analysis. The close correspondence seen here is desirable since the goal of linguistics as a science is to explain patterns in both competence and performance. In particular, the analysis here suggests that competence must include knowledge of the rate of use of different structural options for an adverb like *never*. The rate of use of preverbal *not* is crucial in providing evidence for the use of *not* as an adverb rather than as a negator.

The results in this paper suggest two related problems for future research. Recall that the use of *ne* in negative concord situations was excluded from the quantitative anlaysis. If these tokens are included, the model of the use of *ne ... not* as redundant licensing fails to provide an adequate fit. Without the analysis of redundant licensing, the other results in this paper are difficult to explain. The syntactic use of *ne* in these cases is as the head of NEGP, but the function of *ne* is quite different. Additional cases where there are not 1-to-1 but many-to-many mappings between syntactic function and syntactic structure should be explored. The interplay between structure and function is quite relevant in the change in negators, and it is likely to be relevant elsewhere in the study of diachronic (as well as synchronic) grammar.

The difference between structure and function emerges quite clearly when further research on the general model of historical morphosyntactic change is considered. The change in negators studied here supports the Constant Rate Hypothesis. The change in the use of *not* had a constant rate across contexts, as expected. The replacement of *ne* by *not*, however, did not follow the usual pattern. I argued that the lack of a constant rate for the loss of *ne* and rise of *not* showed that the forms did not directly compete for a single structural position. The overall model of morphosyntactic change which emerges is more complex than that proposed by Kroch (1994). Kroch proposes that morphosyntactic change is the result of competition between grammatically incompatible morphosyntactic doublets. In this case, *ne* and *not* are functional, but not structural, doublets. Additional work is needed to investigate other cases of historical syntactic change between functional, but not structural, competitors. The change studied here is in some sense more like a simple lexical shift, but it showed several properties of the model of grammar competition. Further research will illuminate not only the possible mechanisms of diachronic change, but also the fundamental issues concerning the nature of the interaction between the grammar and the lexicon. Further exploration of both of these issues will surely be relevant to the general study of competence and performance.

Appendix

Names of the text samples included in this study are given below. The list consists of all texts in the Helsinki corpus which are not marked as from the northern dialect. The entries are divided into the five time periods used in the quantitative study and are alphabetized by author and text name within each time period. The Helsinki corpus filename abbreviation is included in parentheses. The information given here is derived from the file *hmanual2.txt* in the Helsinki corpus documentation. The following abbreviations are used:

BIB The Holy Bible, Containing the Old and New Testaments, with the Apocryphal Books, In the Earliest English versions Made from the Latin Vulgate by John Wycliffe and His Followers, Vol. I. Ed. J. Forshall and F. Madden. Oxford: University Press, 1850.

CE An Anthology of Chancery English. Ed. J.H. Fisher, M. Richardson and J.L. Fisher. Knoxville, TN: the University of Tennessee Press, 1984.

EETS Early English Text Society (volume and editors included in individual listings).

HUM Middle English Humorous Tales in Verse. Ed. G.H. McKnight. New York: Gordian Press, 1971 (1913).

KG The Katherine Group. Edited from Ms. Bodley 34. Bibliothèque de la Faculté de Philosophie et Lettres de L'Université de Liège, CCXV. Ed. S.T.R.O. D'Ardenne. Paris: Société D'Edition 'Les Belles Lettres', 1977.

LE A Book of London English 1384–1425. Ed. R.W. Chambers and M. Duant. Oxford: Clarendon Press, 1967 (1931).

A.1. Period 1: 1150–1220.

Bodley Homilies. Twelfth-Century Homilies in Ms. Bodley 343 (cmbodley). EETS, o.s. 137. Ed.A.O. Belfour. London, 1962 (1909), pp. 40.3–48.29 (V); pp. 96.5–106.25 (X); pp. 124.1–134.5 (XII).

Hali Meidhad (cmhali). KG, pp. 127.1–165.19.

History of the Holy Rood-Tree (cmrood). EETS, o.s. 103. Ed. A.S. Napier. London, 1894, pp. 2.1–34.33.

Juliane (cmjulia). KG, pp. 94.17–127.23.

Katherine (cmkathe). KG, pp. 17.1–28.20, pp. 38.3–47.4.

Margarete (cmmarga). KG, pp. 62.8–73.14.

Orm. The Ormulum, Vols. I–II. With the Notes and Glossary of R.M. White (cmorm). Ed. R. Holt. Oxford: Clarendon Press, 1878, I, II. 1–342 (Dedication); I, II. 1–106 (Preface); I, II. 1–108 (Introduction); I, pp. 4.197–18.622 (Homilies); I, pp. 117.3426–137.3977 (Homilies); II, pp. 224.16608–229.16755 (Homilies).

Peri Didaxeon. Leechdoms, Wortcunning, and Starcraft of Early England, Vol. II (cmperidi). Rolls Series, 35. Ed. O. Cockayne. London, 1866, pp. 84.16–144.4.

The Peterborough Chronicle, 1070–1154 (cmpeterb). Ed. C. Clark. London: Oxford University Press, 1958, pp. 54.1–60.19.

Sawles Warde (cmsawles). KG, pp. 165.20–183.24.

Vespasian Homilies. Early English Homilies from the Twelfth Century Ms. Vesp. D. XIV (cmveshom). EETS, O.S. 152. Ed. R.D.-N. Warner. New York, 1971 (1917), pp. 88.15–89.31 (XXXII), pp. 89.33–91.7 (XXXIII), pp. 129.4–134.4 (XLII), pp. 146.16–148.9 (XLVIII), pp. 3.13–7.33 (III).

Vices and Virtues, Part I. (cmvices 1). EETS, o.s. 89. Ed. F. Holthausen. London, 1888, pp. 3.1–23.4, pp. 63.13–81.10, pp. 107.26–127.24.

A.2. Period 2: 1220–1290

Ancrene Wisse (cmancre). EETS, 249. Ed. J.R.R. Tolkien, pp. 29.2–35.13, 43.22–48.30, 86.6–92.19, 116.24–121.32, pp. 162.15–168.21, 213.18–216.19.

Bestiary. An Old English Miscellany Containing a Bestiary, Kentish Sermons, Proverbs of Alfred, Religious Poems of the Thirteenth Century (cmbestia). EETS, o.s. 49. Ed. R. Morris. London, 1872, pp. 1.1–25.802.

Kentish Sermons (cmkentse). Selections from Early Middle English 1130–1250, Part I. Ed. J. Hall. Oxford: Clarendon Press, 1963 (1920), pp. 214.1–222.284.

King Horn. King Horn, Floriz and Blauncheflur, the Assumption of Our Lady, Vol. I (cmhorn). EETS, o.s. 14. Eds. J.R. Lumby and G.H. McKnight. London, 1962 (1866), pp. 1.1–69.1651 (Cambr. Univ. Ms Gg. 4.27.2).

Lambeth Homilies. Old English Homilies and Homiletic Treatises of the Twelfth and Thirteenth Centuries. First Series (cmlambet). EETS, o.s. 29, 34. Ed. R. Morris, New York, 1969 (1868), pp. 3.1–11.7 (I), pp. 25.19–41.7 (III), pp. 41.8–47.11 (IV), pp. 73.1–77.27 (VII), pp. 79.1–85.32 (VIII), pp. 139.6–145.6 (XIV), pp. 145.7–149.30 (XV).

Layamon. Layamon's Brut, Vols. I, II (cmbrutl). EETS, 250, 277. Eds. G.L. Brook and R.F. Leslie. London, 1963, 1978. B.I. Ms Cotton Caligula A.IX: I, pp. 74.1450–96.1874; I, pp. 378.7311–402.7767; II, pp. 732.13971–756.14403.

The Proclamation of Henry III (cmdocu2). Early Middle English Texts. Eds. B. Dickins and R.M. Wilson. London: Bowes and Bowes, 1956 (1951), pp. 8.1–9.35.

Trinity Homilies. Old English Homilies of the Twelfth Century. Second Series (cmtrinit). EETS, o.s. 53. Ed. R. Morris. London, 1873, pp. 25.1–31.16 (V), pp. 67.16–75.31 (XII), pp. 117.1–121.4 (XX), pp. 131.23–141.8 (XXIII).

A.3. Period 3: 1290–1360

Dame Sirith (cmsirith). HUM, pp. 1.1–20.450.

The Earliest Complete English Prose Psalter (cmearlps). EETS, o.s. 97. Ed. K.D. Buelbring. London, 1891, pp. 50.25–55.24, pp. 66.9–75.19, pp. 118.12–171.6.

The Fox and Wolf in the Well (cmfoxwo). HUM, pp. 25.1–37.295.

Havelok (cmhavelo). Ed. G.V. Smithers. Oxford: Clarendon Press, 1987, pp. 19.545–31.949, pp. 35.1118–41.1353, pp. 46.1715–58.2120, pp. 63.2291–78.2856.

Historical Poems (Harley 2253) (cmpoemh). Historical Poems of the XIVth and XVth Centuries. Ed. R.H. Robbins. New York: Columbia University Press, 1959, pp. 9.1–13–136 (3), pp. 14.1–21.233 (4), pp. 21.1–24.92 (5).

Interlude. Appendix to Dame Sirith (cmsirith). HUM, pp. 21.1–24.85.

Kyng Alisaunder, Vol. I (cmalisau). EETS, 227. Ed. G.V. Smithers. London, 1952. Bodleian Ms Laud Misc. 622 (B), pp. 45.753–71.1238, pp. 211.3772–239.4282, pp. 286.5447–310.5927, pp. 399.7352–423.7776.

The Life of St. Edmund. The Early South-English Legendary or Lives of Saints (cmseleg). EETS, o.s. 87. Ed. C. Horstmann. London, 1887, pp. 431.1–449.613 (Bodleian Ms Laud Misc. 108).

Man in the Moon (cmmoon). Early Middle English Verse and Prose. Eds. J.A.W. Bennett and G.V. Smithers. Oxford: Clarendon Press, 1968 (1966), pp. 127.1–128.40.

Mannyng, Robert. Robert of Brunne's 'Handlyng Synne', Part I (cmhansyn). EETS. o.s. 119. Ed. F.J. Furnivall. London, 1901, pp. 7.171–13.338, pp. 63.1741–69.1916, pp. 116.3353–122.3552, pp. 158.4739–161.4862, pp. 182.5573–194.6000, pp. 317.10159–321.10319.

Michel, Dan. Dan Michel's Ayenbite of Inwyt or Remorse of Conscience, Vol. I (cmayenbi). EETS, o.s. 23. Eds. R. Morris and P. Gradon. London, 1965 (1866), pp. 98.31–118.13, pp. 249.31–260.14.
Robert of Gloucester. The Metrical Chronicle of Robert of Gloucester. Part II (cmrobglo). Rolls Series, 86. Ed. W.A. Wright. London, 1887, pp. 720.10730–767.11783.
The Romance of Sir Beues of Hamtoun, Vols. I–III (cmbevis). EETS, e.s. 46, 48, 65. Ed. E. Koelbing. New York, 1973 (1885–1894), pp. 1.1–21.474, pp. 81.1535–105.2146.
Satire on the Consistory Courts (cmpoems). Historical Poems of the XIVth and XVth Centuries. Ed. R.H. Robbins. New York: Columbia University Press, 1959, pp. 24.1–27.90 (6).
Satire on the Retinues of the Great (cmpoems). Idem, pp. 27.1–29.40 (7).
Song of the Husbandman (cmpoems). Idem, pp. 7.1–9.72 (2).
The Thrush and the Nightingale (cmthrush). English Lyrics of the XIIIth Century. Ed. C. Brown. Oxford: Clarendon Press, 1932, pp. 101.1–107.192.

A.4. Period 4: 1360–1430

Aelred of Rievaulx's De Institutione Inclusarum (cmaelr3). EETS, 287. Eds. J. Ayto and A. Barratt. London, 1984, pp. 32.270–39.532. (Ms Vernon).
The Brut or the Chronicles of England, Part I (cmbrut3). EETS, o.s. 131. Ed. F.W.D. Brie. London, 1960 (1906), pp. 16.18–28.8, pp. 217.6–228.16.
Chaucer, Geoffrey. Boethius (cmboeth). The Riverside Chaucer. Third Edition. General Editor L.D. Benson. Based on the Works of Geoffrey Chaucher, Edited by F.N. Robinson. Boston, MA: Houghton Mifflin Company, 1987, pp. 429.C1.1–431.C1.195, pp. 431.C2.1–434.C1.250, pp. 434.C2.–436.C2.230, pp. 446.C2.1–449.C2.300, pp. 460.C2.1–454.C2.376.
Chaucer, Geoffrey. The General Prologue to the Canterbury Tales (cmctvers). Idem, pp. 24.C2.89–35.C1.746.
Chaucer, Geoffrey. The Merchant's Tale (cmctvers). Idem, pp. 155.C1.1311–156.C2.1450
Chaucer, Geoffrey. The Parson's Tale (cmctpros). Idem, pp. 290.C1.18–292.C1.20, pp. 296.C1.27–298.C2.16, pp. 300.C1.37–301.C2.37.
Chaucer, Geoffrey. The Summoner's Tale (cmctvers). Idem, pp. 133.C1.2036–135.C1.2175.
Chaucer, Geoffrey. The Tale of Melibee (cmctpros). Idem, pp. 219.C1.17–222.C1.2, pp. 231.C2.47–235.C1.12.
Chaucer, Geoffrey. A Treatise on the Astrolabe (cmastro). Idem, pp. 662.C1.1–673.C2.(15.)7.
Chaucer, Geoffrey. The Wife of Bath's Prologue (cmctvers). Idem, pp. 107.C2.193–109.C2.335.
The Cloud of Unknowing and the Book of Privy Counselling (cmcloud). EETS, 218. Ed. P. Hodgson. London, 1859 (1944), pp. 13.8–29.6, pp. 71.11–90.10, pp. 112.22–133.7.
The Cyrurgie of Guy De Chauliac (cmchauli). EETS, 265. Ed. M.S. Ogden. London, 1971, pp. 56.26–65.7, pp. 576.1–583.2.
English Wycliffite Sermons, Vol. I (cmwycser). Ed. A. Hudson. Oxford: Clarendon Press, 1983, pp. 236.1–239.90 (S.4), pp. 283.1–286.84 (S.16), pp. 313.1–316.88 (S.23), pp. 335.1–339.97 (S.28), pp. 355.1–359.104 (S. 32), pp. 373.1–377.99 (S.36), pp. 412.1–417.2 (S.43), pp. 475.1–480.141 (E.S.1), pp. 521.1–524.93 (E.S.1), pp. 588.1–592.3 (E.S.27), pp. 643.1–647.4 (E.S.40).
The Equatorie of the Planetis (cmequato). Ed. D.J. Price. Cambridge: Cambridge University Press, 1955, pp. 18.1–44.39.
Gower, John. Confessio Amantis (cmgower). The English Works of John Gower. Vols. I, II. EETS, e.s. 81, 82. Ed. G.C. Macaulay. London, 1957 (1900), 1957 (1901), I, pp. 175.1678–181.1889; I, pp. 316.557–322.770; II, pp. 71.4573–77.4775; II, pp. 221.2013–226.2209.
Henry V. Letter(s) (cmoffic3). LE, pp. 71.1–72.40 (XI), pp. 82.1–83.35 (XXI).
Hilton, Walter. Walter Hilton's Eight Chapters on Perfection (cmhilton). Ed. F. Kuriyagawa. Tokyo: The Keio Insitute of Cultural and Linguistic Studies, 1967, pp. 1.1–33.2. Judgements, London (cmdocu3). LE, pp. 94.1–95.32 (IV), pp. 95.1–96.30 (V), pp. 100.1–101.26 (X), pp. 233.1–234.38 (III).
Julian of Norwich. Julian of Norwich's Revelations of Divine Love. The Shorter Version (cmjulnor). Ed. From B.1. Add. Ms 37790. Middle English Texts. Ed. F. Beer. Heidelberg: Carl Winter, 1978, pp. 48.21–62.24.
A Latin Technical Phlebotomy and its Middle English Translation (cmphlebo). Transactions of the American Philosophical Society, 74, Part 2. Eds. L.E. Voigts and M.R. McVaugh. Philadelphia, 1984, pp. 37.1–53.30.
Letter(s), London (cmoffic3). LE, pp. 68.1–70.55 (IX), pp. 72.1–73.29 (XII), pp. 74.1–76.70 (XIV), pp. 79.1–80.43 (XVIII).
Mandeville's Travels, Translated from the French of Jean D'outremeuse, Vol. I (cmmandev). EETS, o.s. 153. Ed. P. Hamelius. London, 1919, pp. 28.19–37.12, pp. 140.3–145.17.
The New Testament (cmntest). The New Testament in English According to the Version by John Wycliffe about A.D. 1380 and Revised by John Purvey about A.D. 1388. Eds. J. Forshall and F. Madden. Oxford: Clarendon Press, 1879, John I.1–XI.56.
The Old Testament (cmotest). BIB. Genesis I.1–III.24, Genesis VI.1–IX.29, Genesis XII.1–XIV.20, Genesis XXII.1–XXII.19, Numbers XIII.1–XIV.45, Numbers XVI.1–XVII.13.
Paston, William. Letter(s) (cmoffic4). Idem, pp. 4.1–5.39 (3), pp. 8.1–12.182 (5), pp. 13.1–14.28 (6).
Petitions, London (cmdocu3).CE, pp. 194.1–197.7 (161), pp. 198.1–204.28 (163).
Petitions, London (cmdocu3). LE, pp. 226.29–227.75 (I).
Proclamations, London (cmdocu3). LE, pp. 31.1–33.10 (I–III), pp. 97.2–98.30 (VII), pp. 99.1–100.51 (IX).
Purvey, John. The Prologue to the Bible (cmpurvey). BIB, pp. 56.1–60.14.
Returns, London (cmdocu3). LE, pp. 41.1–44.99 (I), pp. 50.1–53.91 (IV), pp. 53.1–57.140 (V).
Testaments and Wills, London (cmdocu3). LE, pp. 209.1–210.31 (I), pp. 211.1–212.34 (III), pp. 214.1–215.51 (VII).
Trevisa, John. Polychronicon Ranulphi Higden, Monachi Cestrensis, Vols. VI, VIII (cmpolych). English Translations of John Trevisa and of an Unknown Writer of the Fifteenth Century. Rolls Series, 41. Ed. J.R. Lumby. London, 1876, 1882. VI, pp. 209.14–231.7; VIII, pp. 83.1–111.19, VIII, pp. 347.1–352.13.
Usk, Thomas. Appeal(s) (cmdocu3). LE, pp. 23.31–30.234.

A.5. Period 5: 1430–1500

Aelred of Rievaulx's De Institutione Inclusarum (cmaelr4). EETS, 287. Eds. J. Ayto and A. Farratt, 1984, pp. 13.522–17.679 (Ms Bodley 423).
The Book of Vices and Virtues. A Fourteenth Century English Translation of The Somme Le Roi of Lorens D'Orleans (cmvices4). EETS, 217. Ed. W.N. Francis. London, 1942, pp. 97.8–116.25.
Capgrave, John. John Capgrave's Abbreuiacion of Cronicles (cmcapchr). EETS, 285. Ed. P.J. Lucas. Oxford, 1983, pp. 209.16–217.30, pp. 238.21–249.19.

Capgrave, John. John Capgrave's Lives of St. Augustine and St. Gilbert of Sempringham, and a Sermon (cmcapser). EETS, o.s. 140. Ed. J.J. Munro. New York, 1971 (1910), pp. 143.1–148.28.

Caxton, William. The History of Reynard the Fox (cmreynar). Translated from the Dutch Original by William Caxton. EETS, 263. Ed. N.F. Blake. London, 1970, pp. 6.1–14.19, pp. 51.20–62.26.

Caxton, William. The Prologues and Epilogues of William Caxton (cmcaxpro). EETS, 176. Ed. W.J.B. Crotch. London, 1956 (1928), pp. 10.25–15.37, pp. 35.1–36.12, pp. 36.13–37.31, pp. 64.1–68.33, pp. 70.C1.1–70.C2.24, pp. 76.17–78.33, pp. 88.1–89–9, pp. 90.1–91.35.

The Late Medieval Religious Plays of Bodleian Mss Digby 133 and E Museo 160 (cmdigby). EEts, 283. Eds. D.C. Baker, J.L. Murphy and L.B. Hall, Jr. Oxford, 1982, pp. 96.1–109.388.

Fitzjames, Richard. Sermo Die Lune in Ebdomada Pasche (cmfitzja). Westminster, Wynkyn De Worde (1495). Ed. F. Jenkinson (Facsimile). Cambridge: Cambridge University Press, 1907, pp. A2R.1–C1R.20.

Caytryge, Dan Jon. Dan Jon Gaytryge's Sermon (cmgaytry). Religious Pieces in Prose and Verse. EETS, o.s. 26. Ed. G.G. Perry. New York, 1969 (1914), pp. 1.1–15.4.

Gregory, William. Gregory's Chronicle (cmgregor). The Historical Collections of a Citizen of London in the Fifteenth Century. Camden Society, n.s. XVII. Ed. J. Gairdner. Westminster, 1876, pp. 112.28–120.30 (Author Unknown), pp. 187.19–197.8 (by William Gregory).

In Die Innocencium. Two Sermons Preached by the Boy Bishop, at St. Paul's Temp. Henry VII, and at Gloucester, Temp. Mary (cminnoce). Camden Society Miscellany, VII. Camden Society, n.s. XIV. Ed. J.G. Nichols. London, 1875, pp. 1.1–13.4.

Kempe, Margery. The Book of Margery Kempe, Vol. I (cmkempe). EETS, 212. Eds. S.B. Meech and H.E. Allen. London, 1940, pp. 47.15–60.17, pp. 221.1–233.12.

A Late Middle English Treatise on Horses (cmhorses). Stockholm Studies in English, XLVII. Ed. A.C. Svinhufvud. Stockholm: Almqvist and Wiksell, 1978, pp. 85.1–129.576.

The Life of St. Edmund (cmedmund). Middle English Religious Prose. York Medieval Texts. Ed. N.F. Blake. London: Edward Arnold, 1972, pp. 163.1–173.313.

Ludus Coventriae or the Plaie Called Corpus Christi. Cotton Ms. Vespasian D. VIII (cmludus). EETS, e.s. 120. Ed. K.S. Block. London, 1960 (1922), pp. 173.129–177.284, pp. 200.1–209.296.

Malory, Thomas. Morte Darthur (cmmalory). The Works of Sir Thomas Malory. Ed. E. Vinaver. London: Oxford University Press, 1954, pp. 44.31–53.37, pp. 198.31–208.31, pp. 657.23–667.4.

Mankind. The Macro Plays (cmmankin). EETS, 262. Ed. M. Eccles. London, 1969, pp. 154.1–167.412.

Metham, John. Days of the Moon. The Works of John Metham Including the Romance of Amoryus and Cleopes (cmmetham). EETS, o.s. 132. Ed. H. Craig. London, 1916, pp. 148.1–156.5.

Metham, John. Physiognomy (cmmetham). Idem, pp. 124.5–132.31.

Middle English Sermons, Edited from British Museum Ms. Royal 18 B. XXIII (cmroyal). EETS, 209. Ed. W.O. Ross. London, 1940, pp. 9.3–12.17 (2), pp. 16.2–1934 (4), pp. 251–22–261.21 (41).

Mirk, John. Mirk's Festial: A Collection of Homilies, by Johannes Mirkus (John Mirk), Part I (cmmirk). EETS, e.s. 86. Ed. T. Erbe. London, 1905, pp. 1.4–5.36 (1), pp. 82.9–85.10 (19).

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