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

Stefan Frisch

Department of Linguistics, Northwestern University, 2016 Sheridan Road, Evanston, IL 60208, USA

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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 an not changes from sentence adverb, with a distribution parallel to never, to sentential negator, ne is fast. 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-a (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; Zauner, 1991). These functional projections represent cate-
geries of tense, inflection, negation, and others. In the minimalist program, these projections have increased in importance, as the focus 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 tonverpe da 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 noynt deceive him.
    he ne shall not deceive him
    'he won't deceive him.' (Easly Prose Psalter, 161:131:11)

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

(3) Crist shuld ne have suffered deþ
    'Christ should not have suffered death.' (Wyclifite sermons, 1: 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 rate 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 linguistic 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-
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, NEG, 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 (Huebert, 1991). I make extensive use of the NEG projection in this paper. The basic structure of an ordinary declarative sentence is shown in the tree in (4).

(4)  
AGRP
  \     /
AGR  NEG
  \   /
  NEG' TP
    T' VP

1.2. Verb movement

There are two principal assumptions which I use to determine the structural position of me 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 constituent 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 never of hem, ...
   you know that I took never from them
   'You know that I never took from them, ...' (Wycliffe old testament, XVI: 55)
   b. My wyfe rose not
   my wife rose not
   'My wife did not get up.' (Roberts, 1985: (2b.v))

c. How great and grievous tribulations suffered the Holy Apostles ...
   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 never, which I take to be an adjunct of T in this case. In (5b), the verb raises to a position preceding not, which is in the specifier of NEG, as I show in section 2.3. The movement in (5b) is shown in the tree in (6).

(6)  
AGRP
  \     /
NP  AGR'       NEG
  \   /
My wyfe  NEG' TP
    T' VP

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).
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 NEG.

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 sitting. 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-medical word order in the history of Yiddish and found cases of variation between INFL-final and INFL-medical 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).

$$\frac{d}{dt} = \frac{a^{t+n}}{1 + e^{b+n}}$$

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 $z$ of the logistic function models the rate of change in the use of a form. A larger slope (value of $z$) 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 ($p = 0.5$ at $t = -4k/s$, 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 $z$ 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, $z$ 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 $t = 2$.

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).

$$\ln \frac{p}{1-p} = k + st$$
Logits for the logics 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 downward, 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 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 signs. 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 k or rate of change). This is the case in Fig. 4.
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 NEG. Thus, the 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* (thespecifier of NEG); or it can appear in the same position as *ne* (the head of NEG). Despite thecomplexity of the data, the distinct uses of *not* can be sorted out through a combination ofstructural and quantitative analysis. The result is a clear picture of the change in negators, with a simpleanalysis of the structure of sentential negation in Middle English.

2.1. Ne as head of NEG

Pollock (1989) takes French *ne* to be the head of NEG, based on its participation inverb 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 verbs 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, NEG, 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 nez 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 wilt, ne is, and ne was* become *will, is, and was*, respectively. The change in the vowel of *wilt* 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 NEG, 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

<table>
<thead>
<tr>
<th>Time period</th>
<th>ne</th>
<th>not ... not</th>
<th>not</th>
<th>Total</th>
<th>%ne</th>
<th>%ne ... not</th>
<th>%not</th>
</tr>
</thead>
<tbody>
<tr>
<td>1150-1220</td>
<td>150</td>
<td>82</td>
<td>3</td>
<td>235</td>
<td>64%</td>
<td>35%</td>
<td>1%</td>
</tr>
<tr>
<td>1220-1320</td>
<td>112</td>
<td>67</td>
<td>5</td>
<td>184</td>
<td>61%</td>
<td>36%</td>
<td>3%</td>
</tr>
<tr>
<td>1320-1380</td>
<td>186</td>
<td>191</td>
<td>44</td>
<td>421</td>
<td>44%</td>
<td>45%</td>
<td>10%</td>
</tr>
<tr>
<td>1380-1430</td>
<td>29</td>
<td>110</td>
<td>603</td>
<td>746</td>
<td>4%</td>
<td>15%</td>
<td>81%</td>
</tr>
<tr>
<td>1430-1500</td>
<td>2</td>
<td>0</td>
<td>341</td>
<td>343</td>
<td>1%</td>
<td>0%</td>
<td>99%</td>
</tr>
</tbody>
</table>

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 mighte neuer finde man of so grete chastete.
    he ne might never find man of so great chastity.
    (St. Edmund, 434)

b. ... yt he ne neve rano jing don us.
    "... that he didn't do anything to us" (Ancren Wisse, 118:10)

c. hit max for none gode.
    it was for no good.
    (King Horn, 13:16)

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. Hengeveld and Zaanst, 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 any 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. Postverbally: 

(13) Postverbal *not*:
- a. *pot Jesus *noliht* *ne* wolde* ben bowen nowhwar i ke land* ...
  - *That Jesus not would be born nowhere in the land* (Ormulum: I: 122)
- b. *... & he ne *sald* *nauge* 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 *noliht* in Old English. Old English *noliht* 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 *nære* *ne* beode isceaddes from *heare ece murb*he.
  - *... and she never ne is separated from there each mouth* (Bede: Homilies, 12:126)
- b. *he ne mighe *never* finde man of so grete chastite.
  - *he might never find 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, AGP and TP. Sentence adverbs can be analyzed as phrasal adjuncts of INFL (cf. Roberts, 1993). Preverbal adverbs as in (14a) are left-adjuncts of AGP, and thus appear linearly before *ne* and the inflected verb or modal which are in AGP. Postverbal adverbs as in (14b) are left-adjuncts of TP, and so follow the AGP position.

Early Middle English *not* is always straddled 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 brecc* *ht* *nauge* *ht* *scael* ...
  - *Don't break that seal,; ...* (Hali Meithlid, 134:12)

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

(16) *Ne mui he *nære* mo wigan cume.
  - *ne may he never more again come* (Vives 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 positions in verb-second clauses.

(17) a. *... & *noliht* *ne* stant it still.
  - *... and he never ne stood it still* (The Ormulum, I: 125)
- b. *... swa *nauer* *nulde* he him sugge;* ...
  - *... so never ne-would he him say* (The 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 is not 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-joined *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-adjointed) 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 x 85 tokens
Table 2
The occurrence of pre and postverbal ne in the Helsinki corpus

<table>
<thead>
<tr>
<th>Time period</th>
<th>Preverbal</th>
<th>Postverbal</th>
<th>Total</th>
<th>% Preverbal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1150-1220</td>
<td>5</td>
<td>23</td>
<td>28</td>
<td>18%</td>
</tr>
<tr>
<td>1220-1290</td>
<td>6</td>
<td>22</td>
<td>28</td>
<td>21%</td>
</tr>
<tr>
<td>1290-1360</td>
<td>4</td>
<td>19</td>
<td>23</td>
<td>17%</td>
</tr>
<tr>
<td>1360-1430</td>
<td>9</td>
<td>51</td>
<td>60</td>
<td>15%</td>
</tr>
<tr>
<td>1430-1500</td>
<td>11</td>
<td>66</td>
<td>77</td>
<td>14%</td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>181</td>
<td>216</td>
<td></td>
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</tbody>
</table>

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

A χ²-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 (χ² = 0.50, p > 0.48). The χ²-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.

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

and without ne. Table 3 shows that preverbal not is used without ne. There are instances of preverbal not with 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>
<thead>
<tr>
<th>Time period</th>
<th>With ne</th>
<th>% Preverbal</th>
<th>Without ne</th>
<th>% Preverbal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1150-1220</td>
<td>15</td>
<td>67</td>
<td>82</td>
<td>18%</td>
</tr>
<tr>
<td>1220-1290</td>
<td>7</td>
<td>61</td>
<td>67</td>
<td>10%</td>
</tr>
<tr>
<td>1290-1360</td>
<td>3</td>
<td>188</td>
<td>191</td>
<td>2%</td>
</tr>
<tr>
<td>1360-1430</td>
<td>0</td>
<td>110</td>
<td>110</td>
<td>0%</td>
</tr>
<tr>
<td>1430-1500</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

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 morpho-syntactic 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.

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 variance 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:

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

\[ N(\text{total adverbial not}) = N(\text{preverbal not}) + 0.16. \]

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 token. 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

<table>
<thead>
<tr>
<th>Time period</th>
<th>Actual</th>
<th>Estimated</th>
<th>Estimated</th>
<th>Total</th>
<th>Estimated</th>
</tr>
</thead>
<tbody>
<tr>
<td>With ne</td>
<td>$55%$</td>
<td>82</td>
<td>0</td>
<td>82</td>
<td>100%</td>
</tr>
<tr>
<td>1150–1220</td>
<td>10%</td>
<td>10</td>
<td>23</td>
<td>67</td>
<td>65%</td>
</tr>
<tr>
<td>1220–1290</td>
<td>20%</td>
<td>19</td>
<td>172</td>
<td>191</td>
<td>19%</td>
</tr>
<tr>
<td>1290–1360</td>
<td>0%</td>
<td>0</td>
<td>110</td>
<td>110</td>
<td>0%</td>
</tr>
<tr>
<td>1360–1440</td>
<td>20%</td>
<td>20</td>
<td>0</td>
<td>20</td>
<td>0%</td>
</tr>
<tr>
<td>1430–1500</td>
<td>40%</td>
<td>40</td>
<td>0</td>
<td>40</td>
<td>40%</td>
</tr>
<tr>
<td>Without ne</td>
<td>$55%$</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>100%</td>
</tr>
<tr>
<td>1150–1220</td>
<td>0%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>1220–1290</td>
<td>25%</td>
<td>25</td>
<td>19</td>
<td>44</td>
<td>57%</td>
</tr>
<tr>
<td>1290–1360</td>
<td>0%</td>
<td>0</td>
<td>570</td>
<td>570</td>
<td>0%</td>
</tr>
<tr>
<td>1360–1440</td>
<td>1%</td>
<td>13</td>
<td>329</td>
<td>342</td>
<td>4%</td>
</tr>
</tbody>
</table>

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.

Gives 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 log of that rate, in the two contexts with and without ne. The log 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:

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

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

<table>
<thead>
<tr>
<th>Time period</th>
<th>With ne</th>
<th>Without ne</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated</td>
<td>Logit with ne</td>
</tr>
<tr>
<td>1150–1220</td>
<td>100%</td>
<td>–</td>
</tr>
<tr>
<td>1220–1290</td>
<td>100%</td>
<td>–</td>
</tr>
<tr>
<td>1290–1360</td>
<td>10%</td>
<td>–2.22</td>
</tr>
<tr>
<td>1360–1440</td>
<td>0%</td>
<td>–</td>
</tr>
<tr>
<td>1430–1500</td>
<td>–</td>
<td>–2.57</td>
</tr>
</tbody>
</table>

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. ... that Seint Royes not began his ordre, ... that Saint Rufus not began this order '... that Saint Rufus didn't begin this order, ...' (Capgrave's sermon, 147:1)

b. ... thou not seest... every thyng that thy knowest agayns... that you not cease to show..." (Capgrave's sermon, 147:1)
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>
<thead>
<tr>
<th>Time period</th>
<th>Logit adv</th>
<th>Model adv</th>
<th>%adv ect</th>
<th>Logit ne</th>
<th>Model ne</th>
<th>%ne ect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1150–1220</td>
<td>1.85</td>
<td>3.607</td>
<td>97%</td>
<td>6.087</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>1220–1290</td>
<td>2.55</td>
<td>0.632</td>
<td>66%</td>
<td>3.156</td>
<td>90%</td>
<td></td>
</tr>
<tr>
<td>1290–1360</td>
<td>3.05</td>
<td>−2.218</td>
<td>9%</td>
<td>1.327</td>
<td>35%</td>
<td></td>
</tr>
<tr>
<td>1360–1430</td>
<td>3.95</td>
<td>−5.185</td>
<td>1%</td>
<td>−2.720</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>1430–1500</td>
<td>4.65</td>
<td>−8.116</td>
<td>0%</td>
<td>−5.636</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

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 τ in centuries after 1000 AD. For example, in the first time period with ne, the model logit using Eq. (9) is:

\[ k + \tau = 11.35 - 4.19 \times 1.85 = 3.607 \]

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

\[ \frac{e^{\beta \tau}}{1 + e^{\beta \tau}} = \frac{e^{3.607}}{1 + e^{3.607}} = 0.97 = 97\% \]

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 compute 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 χ²-test. In the compu-
tation of this and later $\chi^2$ values, cells with expected value less than 5 are excluded, as the $\chi^2$-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 $not$

<table>
<thead>
<tr>
<th>Time period</th>
<th>With $ne$</th>
<th>Expected</th>
<th>Estimated</th>
<th>Expected</th>
<th>Estimated</th>
<th>Expected</th>
<th>Estimated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>adverb</td>
<td>negation</td>
<td>adverb</td>
<td>negation</td>
<td>adverb</td>
<td>negation</td>
<td>adverb</td>
</tr>
<tr>
<td>1150-1220</td>
<td>82</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1220-1290</td>
<td>44</td>
<td>23</td>
<td>23</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1290-1360</td>
<td>19</td>
<td>172</td>
<td>173</td>
<td>25</td>
<td>19</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>1360-1430</td>
<td>0</td>
<td>1</td>
<td>10</td>
<td>109</td>
<td>57</td>
<td>369</td>
<td></td>
</tr>
<tr>
<td>1430-1500</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>342</td>
<td>340</td>
</tr>
</tbody>
</table>

$\chi^2=0.11$  
$p=0.73$

$\chi^2=0.06$  
$p=0.81$

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 not 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, we can construct a model 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

<table>
<thead>
<tr>
<th>Time period</th>
<th>Estimated $ne$</th>
<th>Estimated $ne$ ... not</th>
<th>Estimated total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1150-1220</td>
<td>150</td>
<td>0</td>
<td>150</td>
</tr>
<tr>
<td>1220-1290</td>
<td>112</td>
<td>23</td>
<td>135</td>
</tr>
<tr>
<td>1290-1360</td>
<td>19</td>
<td>19</td>
<td>377</td>
</tr>
<tr>
<td>1360-1430</td>
<td>29</td>
<td>110</td>
<td>570</td>
</tr>
<tr>
<td>1430-1500</td>
<td>2</td>
<td>342</td>
<td>344</td>
</tr>
</tbody>
</table>

Table 8 shows that $ne$ is the only sentential negator in early Middle English. As the end of Middle English, not is the only sentential negator available. 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...
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 king of the country?

‘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 standing in the subject-verb inversion in (20).

(20) Non-head not:

[Wyll] he not con 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 laneo stoode de.

‘Christ should not have suffered death ...’ (Wyclifite 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 non ne, ‘nothing’ broadened to non ‘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>
<thead>
<tr>
<th>Time period</th>
<th>With ne</th>
<th>Without ne</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inverted</td>
<td>Stranded</td>
<td></td>
</tr>
<tr>
<td>1150-1220</td>
<td>0</td>
<td>46</td>
<td>48</td>
</tr>
<tr>
<td>1220-1290</td>
<td>0</td>
<td>49</td>
<td>42</td>
</tr>
<tr>
<td>1290-1360</td>
<td>0</td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td>1360-1430</td>
<td>0</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>1430-1500</td>
<td>0</td>
<td>4</td>
<td>11</td>
</tr>
</tbody>
</table>

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 use of not as a head are sentential negation. The rate of use of not as a negator is 1–2/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 × 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

<table>
<thead>
<tr>
<th>Time period</th>
<th>With ne</th>
<th>Without ne</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Head</td>
<td>Specifier</td>
</tr>
<tr>
<td>1150–1200</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>1220–1270</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>1290–1360</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>1360–1430</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>1430–1500</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

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 that all use of not as a head is 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 contexts 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 × 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 not from Table 8 is also included, yielding a total picture of sentential negation.

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

<table>
<thead>
<tr>
<th>Time period</th>
<th>ne alone</th>
<th>ne with not</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>Specifier</td>
<td>Head</td>
<td>Specifier</td>
</tr>
<tr>
<td>1150–1200</td>
<td>150</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1220–1270</td>
<td>112</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1290–1360</td>
<td>166</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1360–1430</td>
<td>79</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1430–1500</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

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 (1270–1980) not is first used as a sentential negator, a function which is closely related to its previous use as a strengthening 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; Pintok, 1991; Fontana, 1993).

In this section I have shown that early uses of ne ... not are uses of not as a sentential adverb, in the INF–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 doubles: they serve the same mor-
phrasystactic 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 not has receded considerably, a third option, the use of not as the head of NEGP, emerges. At this point, there is a 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 licensors 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.

\[\text{(22) Project XP only if XP has content. (Speas, 1994: 186)}\]

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 constraints in the subject agreement system of a language. Languages with many constraints, or no constraints at all, tend to allow null subjects. Languages with only a few constraints do not. I present Speas’s account for each degree of morphological contrast in turn.

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

\[
\begin{align*}
\text{habl-o} & \quad 1s \quad \text{‘I speak’} \\
\text{habl-as} & \quad 2s \quad \text{‘you speak’} \\
\text{habl-a} & \quad 3s \quad \text{‘he speaks’} \\
\text{habl-amos} & \quad 1pl \quad \text{‘we speak’} \\
\text{habl-dos} & \quad 2pl \quad \text{‘you speak’} \\
\text{habl-an} & \quad 3pl \quad \text{‘they speak’ (Speas, 1994: 180)}
\end{align*}
\]

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).

\[
\begin{align*}
\text{speak} & \quad 1-2sg/1-3pl \\
\text{speaks} & \quad 3sg
\end{align*}
\]

‘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).
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.¹

### 4. Independent and redundant licensing of NEGP

In section 2, I presented some evidence that the reappearance 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 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 doubles (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,

\[
P(\text{ne} \text{ is used}) = P(\text{ne is used}) \times P(\text{not is used in Spec(NEGP)})
\]

This hypothesis can be tested using the χ²-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 χ²-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

¹ The use of Economy of Projection for NEGP also accounts for the cyclic changes in negators in the so-called 'esperanto cycle' which is seen in the history of many Indo-European languages (cf. Frisch, 1995). Whether the head position or the specifier position is the position 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.
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 χ²-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

<table>
<thead>
<tr>
<th>Time period</th>
<th>Estimated <em>ne ... not</em></th>
<th>Expected <em>ne ... not</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>1150–1220</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>1220–1290</td>
<td>135</td>
<td>135</td>
</tr>
<tr>
<td>1290–1360</td>
<td>358</td>
<td>377</td>
</tr>
<tr>
<td>1360–1430</td>
<td>139</td>
<td>709</td>
</tr>
<tr>
<td>1430–1500</td>
<td>2</td>
<td>283</td>
</tr>
</tbody>
</table>

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:

\[
\ln \frac{p}{1-p} = \ln \frac{0.95}{0.05} = 2.937
\]

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

<table>
<thead>
<tr>
<th>Time period</th>
<th>Estimated <em>ne</em></th>
<th>Logit <em>ne</em></th>
<th>−Logit <em>ne</em></th>
<th>Estimated specifier <em>not</em></th>
<th>Logit specifier <em>not</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>1150–1220</td>
<td>100%</td>
<td>−</td>
<td>−</td>
<td>0%</td>
<td>−</td>
</tr>
<tr>
<td>1220–1290</td>
<td>100%</td>
<td>−</td>
<td>−</td>
<td>17%</td>
<td>1.572</td>
</tr>
<tr>
<td>1290–1360</td>
<td>95%</td>
<td>2.937</td>
<td>−2.937</td>
<td>51%</td>
<td>0.028</td>
</tr>
<tr>
<td>1360–1430</td>
<td>20%</td>
<td>−1.440</td>
<td>1.440</td>
<td>82%</td>
<td>1.518</td>
</tr>
<tr>
<td>1430–1500</td>
<td>1%</td>
<td>−5.142</td>
<td>5.142</td>
<td>52%</td>
<td>−</td>
</tr>
</tbody>
</table>

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 comparing 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:

\[
-(-5.981) = 5.981.
\]
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:

\[
\frac{e^{\beta_0}}{1 + e^{\beta_0}} = \frac{e^{5.981}}{1 + e^{5.981}} = 1.00 = 100\%
\]

Table 15

<table>
<thead>
<tr>
<th>Time period</th>
<th>Centuries after 1000</th>
<th>-Logit ne</th>
<th>Model</th>
<th>Model</th>
<th>Logit ne</th>
<th>Model</th>
<th>Model</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1150-1220</td>
<td>1.85</td>
<td>-5.981</td>
<td>5.981</td>
<td>100%</td>
<td>-4.599</td>
<td>1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1220-1290</td>
<td>2.55</td>
<td>-3.388</td>
<td>3.388</td>
<td>97%</td>
<td>-2.206</td>
<td>10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1290-1360</td>
<td>2.25</td>
<td>-2.937</td>
<td>2.937</td>
<td>77%</td>
<td>0.028</td>
<td>32%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1360-1430</td>
<td>3.95</td>
<td>-1.410</td>
<td>1.410</td>
<td>23%</td>
<td>1.518</td>
<td>93%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1430-1500</td>
<td>4.65</td>
<td>-5.142</td>
<td>5.142</td>
<td>3%</td>
<td>4.972</td>
<td>99%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intercept</td>
<td>-12.30</td>
<td>Intercept</td>
<td>-10.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slope</td>
<td>3.41</td>
<td>Slope</td>
<td>3.42</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 \times 377 = 290 expected uses of *ne* according to the model. The expected counts differ greatly from our estimates of actual use and

The \( \chi^2 \)-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 is less than 0.01 for both *ne* and specifier *not*. Thus, the model of a single slope can be rejected with confidence.

Table 16

<table>
<thead>
<tr>
<th>Time period</th>
<th>Estimated ne</th>
<th>Expected ne</th>
<th>Estimated specifier ne</th>
<th>Expected specifier ne</th>
</tr>
</thead>
<tbody>
<tr>
<td>1150-1220</td>
<td>159</td>
<td>159</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1220-1290</td>
<td>135</td>
<td>132</td>
<td>23</td>
<td>13</td>
</tr>
<tr>
<td>1290-1360</td>
<td>358</td>
<td>290</td>
<td>191</td>
<td>206</td>
</tr>
<tr>
<td>1360-1430</td>
<td>139</td>
<td>164</td>
<td>581</td>
<td>659</td>
</tr>
<tr>
<td>1430-1500</td>
<td>7</td>
<td>9</td>
<td>283</td>
<td>342</td>
</tr>
</tbody>
</table>

\( \chi^2=20.27 \)

\( p<0.00 \)

\( \chi^2=27.62 \)

\( p<0.00 \)

There is an additional change in negators in Middle English, the introduction of *not* as the head of NEGP. If the use 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 \( \chi^2 \) for the resulting model of the loss of *ne* is 12.71 and the \( \chi^2 \) 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 reflects 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 licenses 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 nega-
tor precedes the loss of the Old English sentential negative, ne, creating a redundant system of negation. This reanalysis was the natural evolution of the semantic broad-
cuing 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 dis-
tinct grammatical construction. The bipartite negation results from the overlap between use of the ne and not systems of negation. In most instances of morphosyn-
tactic change the competitors are mutually exclusive syntactic options. In those cases intermixing of grammatical systems is often seen within a single text, providing evi-
dence that speakers have access to two grammatical systems simultaneously during the change. The change in negators does not necessitate invoking two underlying grammars (I-langong 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 differ-
ent 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 under-
lying cause to the change in the use of not in different contexts. The loss of ne is a sec-
ond 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 gen-
eral significance. First, this change, which is seen throughout the history of the Indo-
European languages (as one part of the Jespersen cycle), is explained syna-
tactically as change from one method of licensing the NegP node Economy of Projection is another (Frisch, 1995). Thus, it provides another instance, in addition to the distri-
bution of null subjects, where Speas’s (1994) Economy of Projection can be used ex-
planatorily 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 param-
eter 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 dou-
blet, 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 unambigu-
ous 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 corre-
sponds 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 com-
petence 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 analysis. 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 func-
tion 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 else-
where in the study of diachrony (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 morphosyn-
tactic 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 

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