

Which-hunting in Medieval England

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Abstract

Many of the first headed *which*-relatives in English have an NP complement of *which*. We demonstrate that presence of an NP complement forces a nonrestrictive interpretation of the relative, while ‘bare’ *which*-relatives may be restrictive or nonrestrictive. We relate this to Elbourne’s (2001) account of E-type anaphora as NP-deletion: the NP complement in a *which*-relative is an overt counterpart of Elbourne’s deleted NP. In this way, insights from contemporary formal semantics help us make sense of an otherwise puzzling split in the behaviour of *which*-relatives.

1 Introduction

There is an unusual disconnect between formal semantics and diachronic semantics. Formal semantics, like other areas of theoretical linguistics, is primarily concerned with ‘hidden’ aspects of grammatical representations: everyday discourse doesn’t immediately reveal constraints on scope relations, or anaphora, or other core semantic topics, so our theoretical understanding is advanced through the painstaking elaboration of a model of meaning that is constructed on the basis of systematic, controlled manipulation of crucial test sentences, judgements of acceptability, and intuitions about valid and invalid inferences. Direct negative evidence is crucial, and freely available: we know when a given utterance is infelicitous in context, or when S cannot mean *P*.

As an example, nonrestrictive relatives are discourse anaphors, which have to have accessible antecedents; therefore, their antecedents cannot be nonreferential quantifiers, as in (1a). On the other hand, *some person* in (1b) makes a perfectly good antecedent for a discourse anaphor such as a nonrestrictive relative: although classically considered to be a quantifier, it introduces a discourse referent which can serve as antecedent (Kamp 1981; Heim 1982). None of this is obvious, and carefully constructed contrasts like those in (1) are central to the understanding of these topics that we have.

- (1) a. *No person, who left.
b. Some person, who left.

Diachronic semantics, for the most part, has been different: as a discipline, it has no choice but to rely on observation of naturalistic data. The various kinds of introspective judgement available to synchronic formal semanticists are unavailable, as a matter

of principle, to diachronic semanticists, and negative evidence has to be inferred from absence of positive evidence. This means that the weapon of choice for classical diachronic semantics is the collocation, and diachronic semantics is typically practiced as a form of distributional semantics. If a word is characterized by the company it keeps, then changes in word meaning are characterized by changes in the company a word keeps. For instance, in the grammaticalization literature (e.g. Traugott & Dasher 2002) contains several examples like (2).

- (2) a. I am going to London (to Marry Bill).
b. I am going to marry Bill.
c. If interest rates are going to climb, we'll have to change our plans.
d. *If interest rates will climb, we'll have to change our plans.
(Hopper & Traugott 2003)

In (2b), *Marry Bill* is not a place you can go to; and in (2c,d) *interest rates* are not the kind of things that can go. From collocational changes like these, we can infer a change in denotation: the meaning of *go* is no longer restricted to literal motion.

A consequence of this is that formal semantics and diachronic semantics often simply talk past each other. The different methods available favour different views of what is surely a single underlying phenomenon. Fortunately, though, the two approaches are usefully complementary. Take the examples in (1): insights like these from formal semantics allow us to make precise statements about possible distributions, which in turn allow us to draw nonobvious distributional predictions, which can be leveraged to provide insight into distributional changes in the historical record.

The virtues of this approach extend beyond precision and objectivity, the usual benefits attributed to formalism. Approaching semantic change through the lens of synchronic formal theories can *tell us where to look*. That is to say, we can potentially develop accounts of changes which are otherwise resistant to insightful analysis.

In this paper, we develop an in-depth example of this kind of formal, hypothesis-led investigation of semantic change, concerning the emergence of headed relative clauses with *which* in Middle English. *Which* appears in three types of relative in Present-Day English: free relatives like (3a), nonrestrictive relatives like (3b), and restrictive relatives like (3c).

- (3) a. I know [which he bought].
b. The University of Edinburgh, [which is in Scotland].
c. The jewellery [which he chose] was always vulgar.

Free relatives are most clearly syntactically distinct: they are not adjoined to any overt antecedent. Distinguishing free relatives from headed relatives is therefore often (though not always) straightforward.

The distinction between nonrestrictive and restrictive relatives is harder to reduce to distributional terms. In some cases, there is a clear syntactic distinction (for instance, only nonrestrictive relatives can modify clauses), but other examples like (4) are structurally ambiguous between restrictive and nonrestrictive analyses. A restrictive analysis of *which I enjoyed* restricts the set of books to a subset of books which I enjoyed, while a nonrestrictive analysis adds a parenthetical remark that I enjoyed the

relevant member of the set of books. Either way, (4) could be talking about the same book.

(4) A book(,) which I enjoyed

In PDE, the most robust cue to the restrictive/nonrestrictive distinction is prosodic: comma intonation in (4) indicates a nonrestrictive relative, and its absence indicates a restrictive relative. This correlates with a semantic (and perhaps a syntactic) distinction, but the semantic distinction, in cases like (4), frequently has few if any truth-conditional consequences.

In Old English and Early Middle English, *which* was only used in free relatives. Headed *which*-relatives are first robustly attested in the mid-14th century. A natural and intuitive hypothesis is that this spread of *which*-relatives follows a pathway from appositive free relative, to nonrestrictive relative, to restrictive relative, a gradual and incremental increase in syntactic and semantic integration into the host clause. We proposed essentially this in Truswell & Gisborne (2015), building on a well-established literature (see already Curme 1912; Johnsen 1913) demonstrating that at least some free relatives are semantically similar to nonrestrictive relatives in that the analysis of both constructions crucially involves definiteness.¹

The problem with this hypothesis, and the starting point for this paper, is that it just doesn't work. We adapt ideas from Sells (1985) in particular to recast the denotational differences between restrictive and nonrestrictive relatives in distributional terms. The crucial test is that the *wh*-phrase in a nonrestrictive relative is a discourse anaphor, and discourse anaphors can take certain types of referential DP as antecedents (for instance, indefinites), but not nonreferential DPs (for instance, universals).² If we find a *which*-relative modifying a nonreferential DP, we know it's restrictive.

Using this test, we uncover a split in the behaviour of headed *which*-relatives, depending on whether determiner *which* takes an NP complement. Restrictive and nonrestrictive 'bare' *which*-relatives (with no NP complement) emerge simultaneously, as far as we can see in the textual record. As for *which*-relatives with an NP complement, like (5), they are always nonrestrictive. That is to say, they always modify referential antecedents, so there is no distributional evidence that they are restrictive, and there is enough data to make this absence statistically highly significant. In neither subcase is there a gradual progression from free to nonrestrictive to restrictive.

(5) the bifore knowing of God, which bifore knowing of God biholdith so
the before knowing of God which before knowing of God beholds so
without fayling thingis to comynge
without failing things to come
'the foresight of God, which beholds so infallibly things to come'
(Late 14th century, PPCME2, cmpurvey-m3,I,55.2216)⁴

¹De Vries (2002, 2006), among others, has claimed that they are also *syntactically* similar in that nonrestrictive relatives are syntactically a type of free relative. It turns out that the Middle English data actually argue against this claim, but we won't go into the details here.

²In this paper we adopt the DP hypothesis, that noun phrases are DPs and NPs are complements of D, for terminological consistency with the literature that we build on. Nothing important rests on this decision.

Examples like (5) are puzzling in other respects (we will put examples without NP complements aside for now). The near-immediate repetition of *bifore knowing of God* appears redundant, beyond the level of redundancy normally present in language. However, recent work by Elbourne (2001 *et seq.*) gives us a way of simultaneously understanding this repetition and the obligatorily nonrestrictive semantics of such examples. Elbourne analyses E-type anaphora as instances of deletion of the NP complement of D. In other words, (5) just shows overtly the kind of structure which, on Elbourne’s analysis, all discourse anaphors have covertly. Both the existence of such examples and their nonrestrictive interpretation therefore makes sense, as the *wh*-phrase in a nonrestrictive relative is an E-type anaphor.

The paper is structured as follows. Section 2 gives a brief review of the diachrony of *which*-relatives, and *wh*-relatives more broadly. Section 3 introduces the synchronic semantic analyses, and outlines the diachronic hypotheses they imply. Finally, Section 4 revisits the diachrony of *which*-relatives in the light of these hypotheses.

2 The diachrony of *wh*-relatives

The diachrony of *which*-relatives can be viewed as a special case of the diachrony of *wh*-relatives (we will return presently to distinctive features of *which*). In Old English, the only *wh*-relatives were free relatives. We refer the reader to Truswell & Gisborne (2015) for a full account of OE free *wh*-relatives; for the purposes of this paper, the crucial points are that free *wh*-relatives could occur either clause-initially or clause-finally (modulo other elements in the left and right peripheries of the clause), and that a clause initial *wh*-relative obligatorily occurred with braced *swa . . . swa*, while this was optional in clause-final position.

- (6) a. [Swa hwylc eower swa næfð nane synne on him], awyrpe
 So which you.GEN.PL so NEG.have no sin in him, cast.out.SBJ
 se ærest ænne stan on hy
 he first one stone on her
 ‘He that is without sin among you, let him first cast a stone at her.’
 (c.1000, YCOE, coaelhom,+AHom_14:214.2117)
- b. he him aþas swor & gislas salde, þæt he him gearo wære [swa
 he them oaths swore and pledges gave that he them ready be.SBJ so
 hwelce dæge swa hie hit habban wolden]
 which day so they it have want.PST.SBJ
 ‘He swore oaths and pledged to them that he would be ready whenever they
 wanted it.’ (c.900, YCOE, cochronA-1,ChronA_[Plummer]:874.5.844)

⁴For corpus examples like (5), we give an approximate date, the acronym for the corpus from which the example was taken, and the ID of the sentence token. This information can be used to find the precise selection — for instance, ‘cmpurvey’ identifies (5) as coming from Purvey’s *General Prologue to the Bible*. The corpora used in this paper are as follows: YCOE (York–Toronto–Helsinki Parsed Corpus of Old English Prose, Taylor et al. 2003), PPCME2 (Penn–Helsinki Parsed Corpus of Middle English, 2nd edition, Kroch & Taylor 2000), PPCEME (Penn–Helsinki Parsed Corpus of Early Modern English, Kroch et al. 2004), PCMEP (Parsed Corpus of Middle English Poetry, Zimmermann 2015), and PLAEME (Parsed Linguistic Atlas of Early Middle English, Truswell et al. 2018).

- c. Sunnandagum rædan þa gebroðra halige bec, butan [hwylcum
 Sunday.DAT read the brethren holy book except which
 þenuncg betæht sy].
 service delivered be.SBJ
 On Sunday, the brethren read the holy book, except for the service that is
 delivered (that day). (c.1000, YCOE, cobenrul, BenR:48.75.1.904)

In Truswell & Gisborne (2015), we claimed that *swa* ... *swa* was semantically equivalent to PDE *-ever*, and adopted an analysis of free relatives with *swa hw* ... *swa* as modal definite descriptions, based directly on the analysis for PDE developed in Jacobson (1995); Dayal (1997); von Stechow (2000). In this paper, little hinges on the accuracy of that claim. The more important (and less controversial) claim is that bare free *wh*-relatives are straightforward definite descriptions.

Early Middle English saw a breakdown of the OE free *hw*-relative system. There was a gradual erosion of the *swa* ... *swa* marker: the initial *swa* quickly disappeared, and the final *swa* was most often realized as *se* or *sum* (later *so*). This was later reinforced by *-ever*, giving the *what(so)ever* forms that survive today.

- (7) a. teʒʒ inn heoffness blisse A follʒhenn ure Laferrd Crist [Whatt gate
 they in Heaven's bliss forever follow our lord Christ what way
 summ he ganngēþþ];
 so he goes
 'They follow our lord Christ in Heaven's bliss forever, whichever way he
 goes.' (c.1200, PPCME2, cmorm-m1,I,285.2358)
- b. and [what so euer þu do or þenke], hit is open biforn his eʒen.
 and what so ever thou do or think it is open before his eyes
 'And whatsoever you do or think, it is open before his eyes.'
 (c.1400, PPCME2, cmaelr3-m23,29.79)

At the same time, the positional conditioning of *swa* ... *swa* became weaker. Specifically, bare free *wh*-relatives began to be found in the left periphery, in some cases apparently with the kinds of interpretations perviously associated with *swa* ... *swa*. For instance, (8) is a translation of the same bible passage as OE (6a), but only the earlier translation has *swa* ... *swa*.

- (8) wuch of eou echon \ Is clene withoute sunne : þrowe þene furste ston
 which of you each.one is clean without sin throw the first stone
 'Which of you is clean without sin may cast the first stone.'
 (c.1300, PLAEME, laud108alife.473)

Concurrently, *wh*-phrases began to appear in headed relatives. Romaine (1982) showed that the first headed *wh*-relatives were confined to the bottom of the Keenan & Comrie (1977) DP Accessibility Hierarchy. A fuller account must make reference to the fact that Early Middle English headed *wh*-relatives typically relativize PPs or adverbials rather than DPs, but these very early headed *wh*-relatives are complex to analyse, and data is scarce. For instance, there are several apparently semantically equivalent forms for a PP-gap relative, with *through what*, *through which*, and *wherethrough* all attested

in different texts at roughly the same time.

- (9) a. he sei auair welle \ [Of wan al þe wat(er)es comþ an eorþe]
 he saw a.fair well of what all the waters come on Earth
 ‘He saw a fair well from which all the waters on Earth come.’
 (Early 14th century, PLAEME, corp145selt.70)
- b. Ne let vs no lenger(e) þis peyne se \ [In weche we hauen longe ybe]
 NEG let us no longer this pain see in which we have long been
 ‘Do not let us see this pain any more, in which we have been for a long
 time.’ (Late 13th century, PLAEME, adde6bxvsigns.75)
- c. For þe eareste Pilunge [hwer of al þis uuel is] nis buten of prude.
 for the first stripping where of all this evil is NEG.is but of pride
 ‘For the first stripping, where all this evil comes from, is but of pride.’
 (Early 13th century, PPCME2, cmancriw-1-m1,II.119.1513)

Although such examples clearly form part of the story concerning the rise of headed *wh*-relatives, we put them aside in this paper and concentrate on DP-gap relatives. Gisborne & Truswell (2017) demonstrate that DP-gap headed relatives spread from lexeme to lexeme, with *which*-relatives emerging in the mid-14th century (initially with both animate and inanimate antecedents), followed by *whom*-relatives and then *who*-relatives in the 15th century.⁵

- (10) a. he is emperour of him-zelue. þet is of his bodye: and of his herte.
 he is emperor of himself that is of his body and of his heart
 [huiche he demþ and halt ine guode payse] huerof he deþ his wyl.
 which he deems and holds in good weight whereof he does his will
 (1340, PPCME2, cmayenbi-m2,85.1658, 1340)
- b. But he [whom God hath sent], spekith the wordis of God
 but he whom God hath sent speaks the words of God
 (Late 14th century, PPCME2, cmntest-m3,3,20J.234)
- c. This declaryth the Mayster of the storyes [who so lyste to se it].
 this declares the master of the stories who so wants to see it
 (Late 15th century, PPCME2, cmfitzja-m4,A5R.71, 1495)

Early headed *which*-relatives do not have the same syntax as they do today. Specifically, they can occur with determiner *the*, and more importantly for this paper, they can also take NP complements.

- (11) a. Þis synful wrecche hadde remissioun of his synnes, [þe whiche
 this sinful wretch had remission of his sinnes the which
 outwardly he ne askede nouȝt, ne duely ne hadde not deseruyd];
 outwardly he NEG asked not nor duly NEG had not deserved
 ‘This sinful wretch was absolved of his sins, which he had not outwardly
 asked for nor duly deserved.’ (c.1400, PPCME2, cmaelr3-m23,43.508)

⁵Although forms like *through what* appear in Early Middle English PP-gap relatives, bare *what* in DP-gap headed relatives is infrequent throughout the history of English. Prior to the emergence of relatives with *whom* and *who*, *which* commonly took animate antecedents.

- b. More gratter uayrhede ne may by: þanne to by him arizt ylich.
 more greater fairhood NEG may be than to be him truly alike
 [Huych uayrhede is zuo grat: þet hit paseþ þoꝛt of man / and of
 which fairhood is so great that it passes thought of man and of
 angle].
 angel
 ‘There may be no greater splendour than to be true alike to him, which
 splendour is so great that it surpasses the thought of man and of angel’
 (1340, PPCME2, cmayenbi-m2,100.1965)

The status of these NP complements will be a major focus in Section 4.

This much is reasonably well-known. We have described a spread of *wh*-forms from free to headed relatives, with *which* having a special status as the first *wh*-form to spread in this way. However, the picture is incomplete in that ‘headed relative’ is a cover term for two constructions, namely restrictive and nonrestrictive relatives. These are uncontroversially semantically distinct, and since at least Jackendoff (1977) have often been taken to be syntactically distinct, too. This raises immediate questions about the diachrony of *wh*-relatives, the most basic of which is whether both restrictive and nonrestrictive relatives emerged at once or in series. Section 3 will sharpen this question, before we return to corpus data in Section 4.

3 Semantics of relative clauses

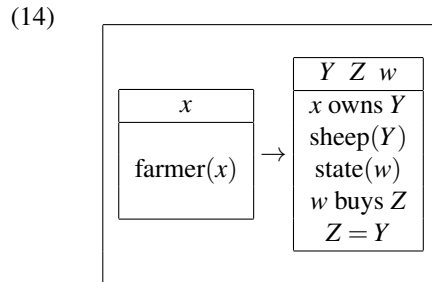
We adopt standard models of the semantics of restrictive and nonrestrictive relatives. Specifically, we assume with Heim & Kratzer (1998) and many others that a restrictive relative denotes a 1-place predicate. The restrictive relative composes with its NP sister by conjoining the predicates that each denote. The relative restricts the extension of the NP, in that $|\{x : P(x) \wedge Q(x)\}| \leq |\{x : P(x)\}|$. Compositionally, the restrictive relative is ‘transparent’: adding a restrictive relative does not affect the type of NP, so the constituent derived can combine with any determiner or other material that NP can normally combine with.

- (12) a. $\llbracket \text{book} \rrbracket = \lambda x. \text{book}'(x)$
 b. $\llbracket \text{which Sally wrote} \rrbracket = \lambda x. \text{write}'(s, x)$
 c. $\llbracket \text{book which Sally wrote} \rrbracket = \lambda x. \text{book}'(x) \wedge \text{write}'(s, x)$
 d. $\llbracket \text{the book which Sally wrote} \rrbracket = \iota x. \text{book}'(x) \wedge \text{write}'(s, x)$

For nonrestrictive relatives, we adopt the analysis of Sells (1985). According to Sells, a nonrestrictive relative is propositional, with the *wh*-phrase interpreted as an E-type anaphor. Sells’ analysis is supported by the fact that *wh*-phrases in nonrestrictive relatives are maximizing, like other E-type anaphors (Evans 1980). In (13a) but not (13b), the state necessarily buys all the sheep that each farmer owns.

- (13) a. Each farmer owns some sheep, which the state buys in the Spring.
 b. Each farmer owns some sheep that the state buys in the Spring.

Within the framework of DRT, Sells (p.26) proposes the following representation of (13a), where $Z = Y$ expresses the anaphoric relation between *which* and *some sheep*.



Sells' analysis implies a first distributional test. The antecedent of a nonrestrictive relative, like any other E-type anaphor, must be referential, in a sense that includes those indefinites that introduce discourse referents (Kamp 1981; Heim 1982). There is no such requirement for restrictive relatives. The contrasts in (15) show how these facts can give a distributional diagnostic of restrictiveness.

- (15) a. The/some/few/no sheep that the state buys are happy.
 b. The/some/#few/#no sheep, which the state buys, are happy.

Therefore, searching for patterns of the form $QNP \dots RC$,⁶ where Q is a quantifier such as *few* or *no* and RC is a *which*-relative modifying QNP , can inform our understanding of the diachrony of *which* relatives: on Sells' analysis, the relatives in such strings simply cannot be nonrestrictive, because *which* as E-type anaphor wouldn't have the antecedent that it needs.

In Section 4, we will investigate the interactions between this straightforward test and a second test, based on Elbourne's (2001) analysis of E-type anaphora. Elbourne addresses a problem known as the *formal link condition*: E-type anaphors need overt antecedents in the discourse, not just referents that could be inferred from context. With other E-type anaphors, this accounts for contrasts like (16); a parallel example with *wh*-relatives is (17).

- (16) a. Someone who has a guitar should bring it.
 b. #Some guitarist should bring it.
- (17) a. A musician played a guitar, which had a string missing.
 b. #A guitarist played, which had a string missing.

Elbourne's analysis relies on a parallel between E-type anaphora and VP-deletion. Specifically, Elbourne proposes that anaphors like those in (16)–(17) contain a covert copy of the NP restriction in the antecedent. The relevance of this for *which*-relatives is that we have seen that early headed *which*-relatives often contain an overt NP complement of D . We expect that such *which NP*-relatives will favour nonrestrictive inter-

⁶Extrapolation of relative clauses is common in Middle English, so string-adjacency cannot be relied on to determine the antecedent of a relativizer. However, the parsed corpora used in this paper indicate where a relative clause was extraposed from.

pretations, on the grounds that an overt NP is easier to relate to an antecedent than a covert NP. Given that the semantics of restrictive modification involves coordination of 1-place predicates, there is no corresponding advantage to an overt NP in a restrictive relative.

In the following section, we use these two guiding tests to uncover the fine details of the diachrony of *which*-relatives.

4 Back to *which*-relatives

4.1 Materials

We rely exclusively on data from parsed corpora in our analysis, as the only tools available for this kind of fine-grained quantitative diachronic investigation, specifically the corpora listed in fn. 4. The major parsed corpora for the relevant period of English are the York–Toronto–Helsinki Parsed Corpus of Old English Prose, the Penn–Helsinki Parsed Corpus of Middle English, and the Penn–Helsinki Parsed Corpus of Early Middle English. However, as will become apparent, a period of particular interest in the history of *wh*-relatives is the late 13th and early 14th centuries, the ‘M2’ period in PPCME2. This is the most poorly represented period in the above corpora, in part because of the scarcity of surviving written English from this period. Accordingly, we supplement the above resources with two smaller corpora, the Parsed Corpus of Middle English Poetry (PCMEP, Zimmermann 2015) and the Parsed Linguistic Atlas of Early Middle English (PLAEME, Truswell, Alcorn, Donaldson & Wallenberg 2018). PLAEME, in particular, is designed to fill this gap in the textual record, being composed entirely of texts from 1250–1325. PCMEP and PLAEME are composed almost entirely of verse texts, while PPCHE is almost entirely prose. We have made no attempt to control for this in what follows, because we do not see a clear reason why metre would affect the choice between monosyllabic *that*, *which*, and *what*.

4.2 Broad diachrony of *wh*-relatives

Figure 1 shows the change in global frequency of *wh*-relatives over time, as a proportion of all relative clauses. Although *wh*-relatives are present throughout the history of English, they are very much a minority strategy in Old English: as mentioned above, they are confined to free relatives in Old English (which are much less frequent than headed relatives: only c.8% of relatives in the corpora are free relatives), and indeed they are a relatively infrequent form of free relative.

The top half of Figure 1 reveals that the spread of *wh*-relatives from this point occurs in three main bursts. A sharp increase in the frequency of ‘other’ *wh*-relatives (to c.10% of all relatives) occurs c.1150–1250, followed by an increase in *which*-relatives to c.30% of all relatives c.1250–1500, and a second increase in ‘other’ *wh*-relatives (also to c.30% of all relatives) c.1450–1550. Although our figure collapses all ‘other’ *wh*-relatives, the first of these increases is driven by use of *wh*-PPs in headed relatives, and the last by the use of *whom* and then *who* in NP-gap relatives.

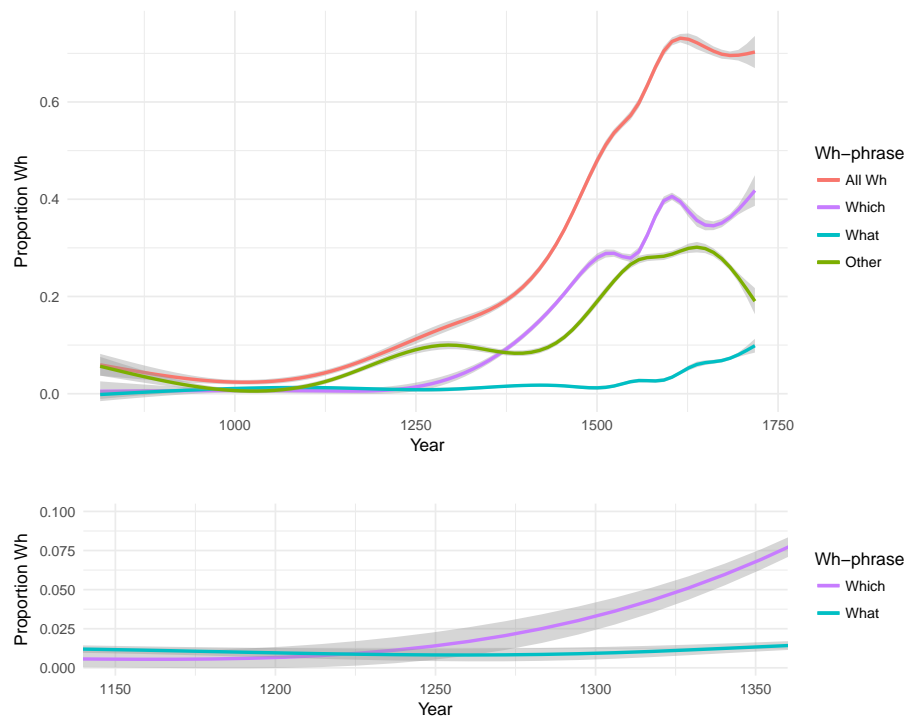


Figure 1: Frequency of *wh*-relatives over time, as a proportion of all relative clauses (top), and close-up of *which*- and *what*-relatives in Early Middle English (bottom)

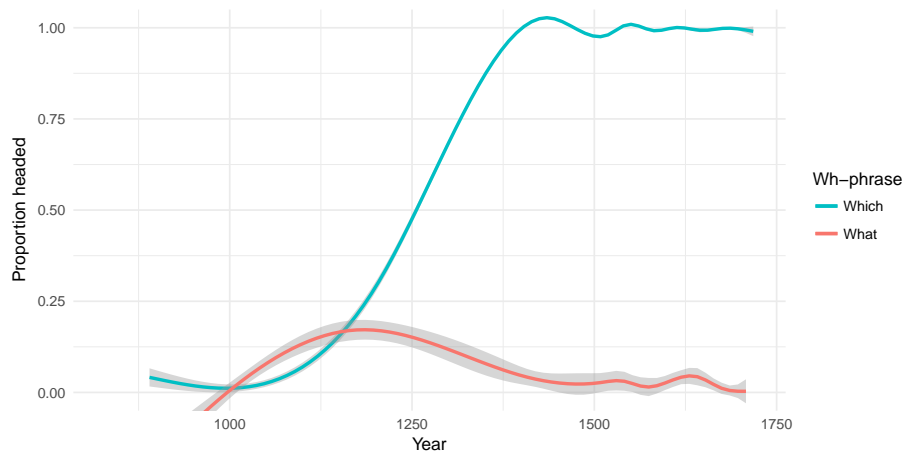


Figure 2: Proportion of *which*- and *what*-relatives which are headed, as opposed to free

The bottom half of Figure 1 reveals that *which*- and *what*-relatives occurred with a frequency barely above zero throughout Early Middle English. The first point of interest in our story is the period c.1250–1350, during which the frequency of *which*-relatives began to move upwards, while that of *what*-relatives flatlined at just above zero.

4.3 *Which* and *what*

The increase of frequency of *which*-relatives reflects the emergence of headed *which*-relatives (recall that headed relatives are by far the more common type of relative). Figure 2 shows the proportion of *which*- and *what*-relatives which are headed. The beginning of the increase in frequency of *which*-relatives in Figure 1 corresponds closely to the point at which *which*-relatives become categorically associated with headed relatives, while *what*-relatives become categorically associated with free relatives.

Free *what*-relatives typically had no NP complement, while free *which*-relatives optionally had such a complement. This is shown in Figure 3: in Old English, *what* categorically occurs without NP, and although this restriction is no longer categorical in Middle English, there is still a significant statistical association of NP complements with *which* until c.1300, the point at which free *which*-relatives disappear.⁷ This means that examples like (18a–c) were found throughout Early Middle English, but examples like (18d) are a hallmark of later Middle English.

⁷Figure 3 is presented as a scatterplot, rather than with regression lines, because the only clear diachronic trends in association of *which* and *what* with NP complements emerge after c.1300, when *what* essentially takes over all NP-gap free *wh*-relatives, regardless of the presence of an NP complement, as indicated by the scatter of red dots on the right hand side of Figure 3.

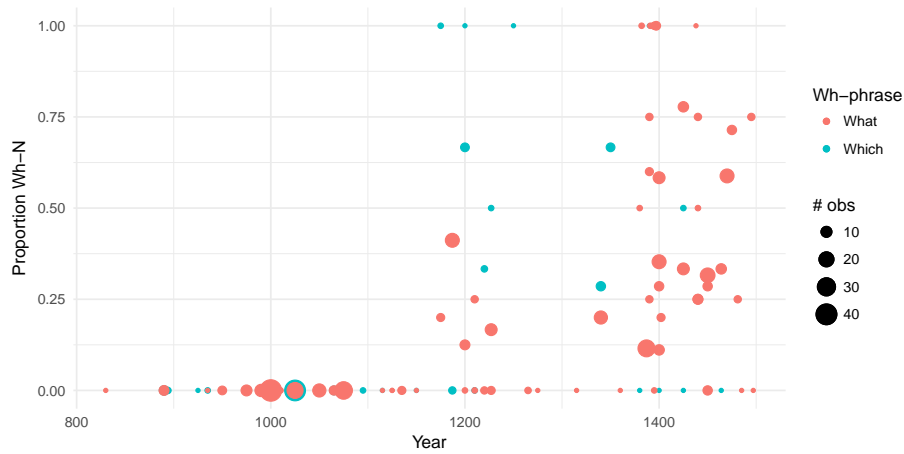


Figure 3: Proportion of free *which*- and *what*-relatives that had an NP complement

- (18) a. beo þe cnotte icnut eanes of wedlac. beo he cangun oðer crupel beo
 be the knot knitted once of wedlock be he fool or cripple be
 he [hwuch-se he⁸eauer beo]; þu most to him halden.
 he which.so he ever be thou must to him hold
 ‘If the knot of wedlock is knitted once, if he is a fool or a cripple or
 whatever he may be, you must remain with him.’
 (Early 13th century, PPCME2, cmhali-m1,152.352)
- b. [Hwich saule. þe þer cumeþ to]. Naueþ heo neuer reste ne ro.
 which soul that there comes to NEG.have he never rest nor repose
 ‘Whoever sould that comes there will never have rest or repose.’
 (Mid-13th century, PCMEP, ElevenPains,148.52.28)
- c. leteð writen on an scrouwe [hwetse 3e ne cunnen].
 let write on a scroll what.so you NEG can
 ‘Let what you don’t know be written on a scroll.’
 (Early 13th century, PPCME2, cmancriw-1-m1,I.74.292)
- d. doo [what seruise þat þu canst];
 do what service that thou can
 ‘Do what service you can.’ (c.1400, PPCME2, cmaelr3-m23,40.418)

Figure 4 shows that the first headed *which*-relatives, like the last free *which*-relatives, optionally took an NP complement. Moreover, there is no evidence of a difference in the frequency of NP complement between headed and free *which*-relatives, although the sparsity of data c.1300 (visible in Figure 4 as very wide confidence intervals) limits our ability to interpret this absence of evidence. We interpret this as indicating that headed *which*-relatives emerged directly from free *which*-relatives. More specifically,

⁸This word is omitted from the version in PPCME2 but supplied on the basis of the transcription in the Linguistic Atlas of Early Middle English (Laing 2013).

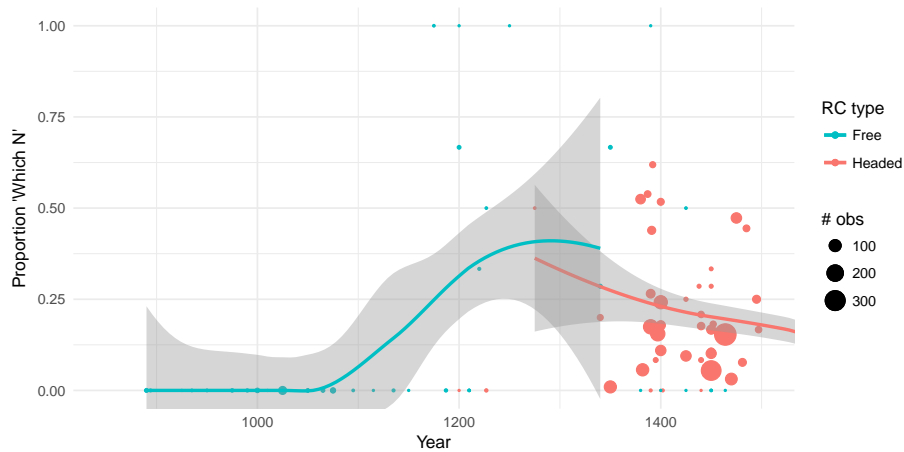


Figure 4: Proportion of free and headed *which*-relatives that had an NP complement. Lowess smoothers are plotted for free relatives until 1350, and for headed relatives from 1250, because of absence of data at other times. Note the wide confidence interval for the free relative smoother.

we assume that clause-final free *which*-relatives are the diachronic source of headed *which*-relatives (because clause-initial free relatives are not a likely candidate for re-analysis as postnominal headed relatives — see Truswell & Gisborne 2015). We will now investigate restrictiveness of headed *which*-relatives with and without NP complements against this background.

4.4 Nonreferential antecedents

From the earliest texts with headed *which*-relatives, examples with nonreferential antecedents are found. Figure 5 shows this in two different ways: the left-hand plot shows how many *which*-relatives had a nonreferential antecedent, while the right-hand plot shows how many of the relatives modifying nonreferential antecedents were *which*-relatives.⁹ In each case, we see an upward trend across the period covered, but in each case, the regression line starts above zero.¹⁰ Text-by-text inspection of results confirm that even in the mid–late 14th century, every major text with has a nonzero proportion of nonreferential antecedents for its headed *which*-relatives. (19) illustrates this for mid–late 14th-century texts, immediately after the emergence of headed *which*-relatives.

⁹For the quantitative analysis, nonreferential antecedents were operationalized as those with one of the determiners *each*, *every*, *few*, *little*, or *no*. We initially also included *any* and *all* in this list, which are nonreferential in some of their uses, but these turned out to give too many false positives, particularly with examples like *all the people* in the latter case.

¹⁰The upward trend is more pronounced in the right-hand graph simply because *which*-relatives increase in frequency throughout Middle and Early Modern English, as shown in Figure 1.

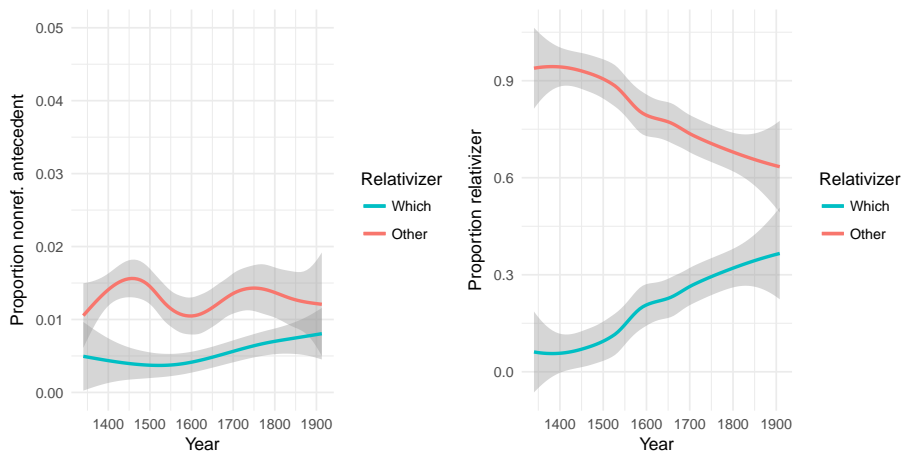


Figure 5: Proportion of *which*-relatives and other relatives that have a nonreferential antecedent

- (19) a. if we luf God in al oure hert, þar es **na thyng** in us [thurgh þe
if we love God in all our heart there is no thing in us through the
whilk we serve to syn].
which we serve to sin
'If we love God in all our heart, there is nothing in us through which we
serve to sin.' (Mid-15th century copy of mid-14th century text,
PPCME2, cmrollep-m24,110.794)
- b. for **fewe** ther ben [the whiche han this feruour to chastise her body
for few there are the which have this fervour to chastise their body
so].
so
'For there are few people who have this fervour to chastise their body in
this way.' (Mid-15th century, PPCME2, cmaelr4-m4,12.336)
- c. Y schal sle **ech fleisch** [in which is the spirit of lijf] vndir heuene
I shall slay each flesh in which is the spirit of life under Heaven
'I shall destroy each flesh [living thing] under Heaven in which is the
spirit of life.' (Late 14th century, PPCME2, cmotest-m3,6,1G.224)

This falsifies the simplest form of the hypothesis that headed *which*-relatives inherit the properties of free *which*-relatives: free *which*-relatives are commonly taken (e.g. by De Vries 2002, 2006) to be syntactically and semantically closer to nonrestrictive relatives than to restrictive restrictive relatives, but there is no stage of Middle English during which only free and nonrestrictive *which*-relatives are attested.¹¹ However, con-

¹¹We cannot exclude the possibility that the late 13th and early 14th centuries were just such a period, coincidentally the period with fewest tokens of *which*-relatives. Strictly speaking, the considerations above show only that any such period was extremely short-lived.

sideration of the role of NP complements reveals that there is a robustly nonrestrictive type of *which*-relative.

4.5 Headed *which*-relatives with and without NP

Without exception, no headed *which*-relatives with an overt NP complement take a nonreferential antecedent with *no*, *few*, *little*, *each*, or *every*. This absence is statistically highly unlikely to be a matter of chance. We can construct a simple estimate of the expected number of *which NP*-relatives with a nonreferential antecedent as follows: among all the corpus texts written since the *Ayenbite of Inwynt* in 1340, there are 223 examples of *which*-relatives with nonreferential antecedents. In the same texts, the frequency of NP complements of *which* in headed relatives is $1620 \div 18,318 \approx 0.09$. We therefore expect $223 \times 1620 \div 18,318 \approx 20$ *which NP*-relatives, as opposed to an observed value of 0. A binomial test (0 successes in 223 trials, with a hypothesized probability of success of $1620 \div 18,318$) returns $p < 10^{-8}$.

A more subtle estimate of the expected value takes into account the fact that the use of *which* with nonreferential antecedents increases over this period, while the use of NP complements of *which* declines over the same period. We used lowess smoothers to estimate the frequency of these two variables year-by-year (see red and blue lines in Figure 6), and then, for each text, estimated the expected number of *which NP*-relatives with nonreferential antecedents on the basis of these two values for the year of the text's composition (the solid green line in Figure 6). Summing these text-by-text estimates gives us an almost unchanged prediction of 22 such structures. Although we do not have a precise *p*-value for 0 observations, we used the 95% confidence interval on the product of the two lowess smoothers (the dashed green line in Figure 6) to give a criterial value of 10 observations for $p < 0.05$. Accordingly, 0 observations is again very low probability. This refines the result from Section 4.4: although bare headed *which*-relatives are never necessarily nonrestrictive, headed *which*-relatives with NP complements are always nonrestrictive, throughout their c.600-year existence.

Given our confidence in this result, we can sharpen the notion of 'referential antecedent' relevant to nonrestrictive *which NP*-relatives. In many respects, these relatives pattern just like Present-Day English nonrestrictive *which*-relatives (with no NP complement). For a start, classic donkey-anaphora configurations like (20) can be found, parallel to Sells' example (13a).

- (20) **euery temporall man** schuld paye *the x^{th} parte of on yerly valu of hys londys and tenementis*, except lordis of the parlement. [Whiche x part amountith to the summe in euery shyre, citie and burgh as partyclerly hereafter ensuete]: . . . 'Every temporal man should pay the tenth part of the yearly value of his lands and tenements, except lords of the parliament, which tenth part amounts to the sum in every shire, city, and burgh, as particularly hereafter ensues . . .'
(Late 15th century, PPCME2, cmreynes-m4,307.564)

This extends to modal and other subordination phenomena in the sense of Roberts (1987), where Sells' (21) is structurally quite similar to Early Modern English (22).

- (21) Each boy might catch a fish, which will struggle to get away. (Sells 1985: 33)

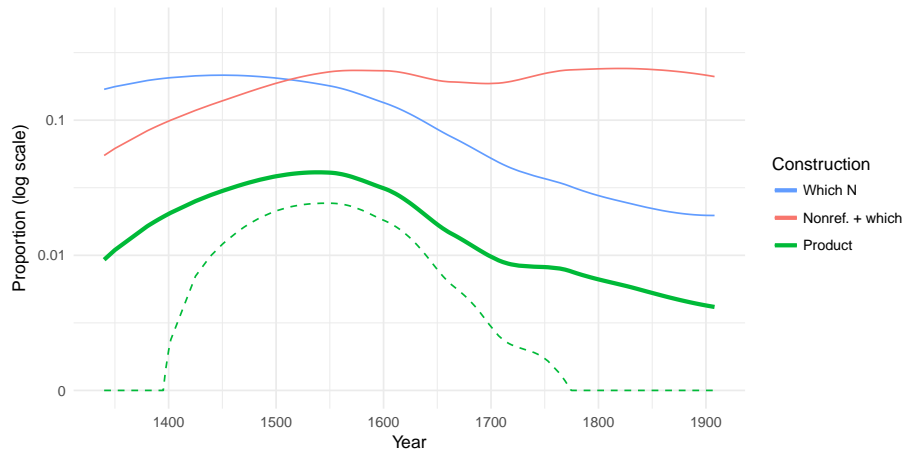


Figure 6: Expected frequency of *which NP*-relatives with nonreferential antecedents over time (solid green line), plus lower bound of 95% confidence interval (dashed green line), calculated as the product of lowess smoothers tracking the frequency of *which* among all relative clauses modifying nonreferential DPs (red line), and the frequency of NP complements of *which* in headed relatives (blue line). The y-axis has a logarithmic scale, except that the point marked ‘0’ represents all values ≤ 0.001 .

- (22) everie Clothier within this Realme sholde sett his seale of lead unto everie Clothe and Kersey that shold be redy made and dressed to be put to sale, in whiche seale of lead sholde be conteyned the true and juste content of the lenghe of everie of the same Clothes or Kerseyes
‘Every clothier within this realm should put his seal of lead on every cloth and kersey that is ready made and dressed to be put on sale, in which seal of lead should be contained the true and just content of the length of each of the same cloths or kerseys.’ (1540–5, PPCEME, stat-1540-e1-p1,3,854.17)

Also broadly similar to Present-Day English, a quantified noun phrase does not license introduction of a plural discourse referent corresponding to the domain of quantification. That is, examples like (23) are infelicitous in Present-Day English and absent from the historical record.

- (23) #Every book was on the shelf, which were arranged in alphabetical order.

However, unlike Present-Day English, the antecedent of a *which NP*-relative need not be a single accessible discourse referent. Examples like (24) are found, in which the antecedent of *which Townes* is the sum of *the Town of Rowcastell* and *the Town of Langton*. That is, the antecedent of a *which NP*-relative can correspond to the sum of multiple accessible discourse referents.

- (24) my broder Philipp Dacre with ccc. men which burnt and destroyed the Town of Rowcastell ... and Sir Roger Fenwike with ccc. men burnt the Town of Langton ... which Townes er in the hert of the countre two myle beyond Jedworth upon the watere of Chevyot.
 ‘My brother Philip Dacre with 300 men, who burned and destroyed the town of Rowcastle ... and Sir Roger Fenwick with 300 men burned the town of Langton ... which towns are in the heart of the country two miles beyond Jedworth, on the water of Cheviot.’ (1513, PPCEME, dacre-e1-p2,1.1,94.6–8)

Corresponding configurations in Present-Day English are ungrammatical.

- (25) #Coldstream is in Scotland and Cornhill is in England, which are on opposite sides of the Tweed.

We do not currently have a synchronic or diachronic account of this difference, but we suspect that the overt NP complement facilitates retrieval of this antecedent. A similar effect is found with Present-Day English demonstratives: *they* in (26a) is most naturally interpreted as referring to Philip, Roger, and their men, while (26b) shows that a demonstrative that explicitly mentions *towns* can refer to the presumably less topical Rowcastle and Langton.

- (26) a. Philip and his 300 men burned Rowcastle. Roger and his 300 men burned Langton. They are two miles beyond Jedworth.
 b. Philip and his 300 men burned Rowcastle. Roger and his 300 men burned Langton. These towns are two miles beyond Jedworth.

Finally, we note one example which apparently contradicts several of the above generalizations. (27) appears to make liberal use of coercion of the sort that is infelicitous in (23). The *wh*-phrase *the which holes* is surely licensed by the preceding passive participle *holed*, itself in the scope of two universal quantifiers, but refers to the plurality of holes related to participle *holed*.

- (27) euery Spondel is holed on euery side, through the which holes both Arteirs and veynes doo bring from the hart and the Lyuer both lyfe & nourishment
 ‘Every vertebra is holed on every side, through the which holes both arteries and veins bring from the heart and the liver both life and nourishment.’
 (1548, PPCEME, vicary-e1-p2,74.266)

It is hard to interpret this single example. A corresponding structure (like (28)) would clearly be impossible in Present-Day English. This may mean that our conclusion about absence of coerced group antecedents in Middle and Early Modern English is inaccurate, but it may equally indicate that (27) is an outlier.

- (28) #Every vertebra is holed on every side, which [= the holes] are ...

5 Discussion and conclusion

Our main empirical results can be summarized as follows. *Which NP*-relatives are always nonrestrictive. Bare headed *which*-relatives can always be restrictive or nonrestrictive, although there is a historical trend towards greater frequency of restrictive relatives.

We want to make two points about the role of formalism in these results. Firstly, having clear, formally grounded criteria for identifying restrictive relatives allowed us to find unambiguously restrictive *which*-relatives, even among the earliest headed *which*-relatives, thereby falsifying the natural hypothesis that the early headed *which*-relatives are nonrestrictive. Secondly, the line of research on the formal link condition led us to investigate the nonobvious connection between NP complements and nonrestrictiveness, and thereby find a subclass of universally nonrestrictive *which*-relatives.

A remaining question is why we don't find a period during which all headed *which*-relatives, even bare ones, are nonrestrictive. After all, the logic of reanalysis would lead us to expect such a stage. There is clear semantic overlap between free relatives and nonrestrictive relatives, as noted above, and significant structural ambiguity between nonrestrictive and restrictive relatives, but less of a direct relationship between free and restrictive relatives. The natural diachronic pathway would appear to be from free, to nonrestrictive, to restrictive relative (or in principle in the opposite direction).

A tentative answer to this question is that already in Early Middle English, free *which*-relatives with and without NP complements were already developing different patterns of use, suggesting subtly different denotations. Examples like (18a), repeated as (29), fall within the 'ignorance or indifference' class of readings identified by von Stechow (2000), but are also anaphoric: *hwuch-se* ranges over properties like *cangun* or *crupel*. A further example is in (30), where *whillc* ranges over the priests drawing lots. These are typical of Early Middle English bare *which* free relatives.

- (29) beo þe cnotte icnut eanes of wedlac. beo he cangun oðer crupel beo he
 be the knot knitted once of wedlock be he fool or cripple be he
 [hwuch-se he eauer beo]; þu most to him halden.
 which.so he ever be thou must to him hold
 'If the knot of wedlock is knitted once, if he is a fool or a cripple or whatever
 he may be, you must remain with him.'

(Early 13th century, PPCME2, cmhali-m1,152.352)

- (30) & alle þa prestess þatt off þa twezzen prestess comenn, Shifftedenn
 and all the priests that of the two priests came shifted
 hemm bitwenenn þa Wiþþ lott, whillc shollde serrfenn Allmahhtiz Godd
 them between then with lot which should serve almighty God
 att allterr firrst, Whillc sibbenn i þe temmple.
 at alter first which since in the temple
 'And all the priests that came from the two priests drew lots to decide who
 should serve almighty God first at the alter and who afterwards in the temple.'

(c.1200, PPCME2, cmorm-m1,I,14.238)

The closest examples of free *which*-relatives with an NP complement are represented

by (31) and (32). They are still ‘ignorance or indifference’ readings, but they are not anaphoric. Rather, the structures resemble the topic–comment structures associated with conditionals and correlatives, without an overt anaphoric element in the main clause. For instance, (31) can be paraphrased as *if on any day ... on that day ...*, and (32) as *if any wand ... that wand ...*.

- (31) ‘Hwilche daiȝe,’ he sede, ‘se ðu etst of ðese trewe ðu art deaðes
 which day he said so thou eats of this tree thou art death.GEN
 sceldih.’
 guilty
 ‘“On whichever day,” he said, “that you eat from this tree, you are guilty to
 death.”’ (Early 13th century, PPCME2, cmvices1-m1,51.574)
- (32) quile wāde þat sulde b(ER) blome \ Sulde ber þe p(re)stis hade wiþ
 which wand that should bear bloom should bear the priest’s rank with
 dom(e).
 doom
 ‘Which wand that bears a bloom should bear the priest’s rank with doom.’
 (Early 14th century, PLAEME, edincmct.886)

We do not currently have a theory linking differences among Early Middle English free *which*-relatives to differences among later headed *which*-relatives, but we think that the different referential properties of *which* with and without an NP complement implied by (29)–Last are a natural starting point in construction of such a theory.

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