# Abbreviation Application: A Stylochronometric Study of Abbreviations in the Oeuvre of Herne's Speculum Scribe*

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**Abstract**

This research examines the Carthusian monastery of Herne, a major cultural hotspot during the Middle Ages. Between 1350 and 1400, the monks residing in Herne produced an impressive 46 production units, with 40 of them written in the Middle Dutch vernacular. Focusing on the monastery's most productive scribe, known as the Speculum Scribe, this case study employs methods from the field of scribal modelling to achieve two main objectives: first, to evaluate the potential for chronologically ordering the Speculum Scribe's works based on his use of abbreviations, and second, to investigate whether there was a convergence in scribal practices, such as the use of abbreviations, among the scribes living in Herne. Although a complete chronological order of the Speculum Scribe's works could not be determined, we were able to establish his first work. Furthermore, the findings show evidence that cautiously supports the second goal, suggesting that the scribes in Herne indeed converged in their scribal habits by learning from each other.

**Keywords**

Carthusians, orthography, scribal modelling, medieval literature, Middle Dutch

## 1. Introduction

The Herne charterhouse in present-day Belgium had a profound impact on medieval manuscript production [7]. Located approximately 30 kilometres southwest of Brussels, the thirteen scribes in this Carthusian monastery realised a remarkably large output of manuscripts during the fourteenth century, in Latin as well as in the Dutch vernacular. Kwakkel identified a minimum of 46 locally produced production units, of which no less than 40 were written in Middle Dutch [6].[1] Accordingly, Herne was not only renowned as a focal point for manuscript production through copying, but also as a *translatorium*, a centre of translation. This is underscored by the residency of the anonymous 'Bible Translator of 1360' within the monastery. What makes this vast output even more remarkable, is that most of these manuscripts were produced within the relatively short span of 1350 to 1400. The scribes were able to produce

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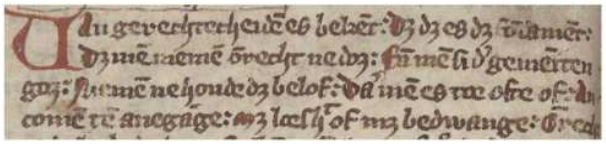
[1]A production unit is a group of quires that formed one material unit at the time of production: these are quires that were demonstrably written off in one continuous piece, either by one text hand or by several copyists. A codex may contain several units of production [6].



UAn gerechtecheidē es bekēt : D$_3$ d$_3$ es d$_3$ fōdamēt : D$_3$ mē niemē ōrecht ne do$_3$ : Eñ mē si d' gemeīten go$_3$ : Niemē ne houde d$_3$ belof : Da' mē es toe ofte of : An comē tē anegāge : M$_3$ loesh$^t$ of m$_3$ bedwange : Ōrecht

**Figure 1:** This excerpt demonstrates the mediocre script of the Speculum Scribe and the frequency with which he applied abbreviations (Ghent, UL, 1374, fol. 1v). The manuscript is digitally available on the website of the Ghent University Library.

such a vast output in such a short time by collaborating together. They would divide tasks when producing manuscripts and correct each other's writings – without verbal communication, as they lived isolated and silent lives. Accordingly, the question arises whether the scribal practices of the monks converged through their collaborations as time went on.

During the latter half of the 14th century, when the Herne charterhouse emerged as a key centre for vernacular literature in the Low Countries, the monastery's most prolific scribe was active. The Speculum Scribe — named after his most significant copy, the second part of the *Spiegel historiael*, the Middle Dutch version of the *Speculum historiale* — played a key role in this development. He was a copyist and corrector, producing the main text on 2,490 pages across seven different manuscripts and adding corrections in five others. This output far surpasses that of the second most prolific scribe in Herne, the Necrology Scribe, who copied 214 pages. Although many works are attributed to the Speculum Scribe, it is notoriously hard to date and order them relatively to each other, since they were all written in a time span of approximately 25 years, a problem this study aims to contribute to [7].

Despite his productivity, the Speculum Scribe's litera textualis was mediocre and aesthetically much less pleasing compared to that of his peers (Fig. 1). Additionally, his ductus could fluctuate significantly, two characteristics often linked to inexperienced scribes [7]. However, such an assessment belies the Speculum Scribe's true expertise, evident not only in the sheer volume of his work, but also in his resourcefulness of parchment utilisation. He would keep his parchment usage to a minimum by applying numerous abbreviations (Fig. 1). These abbreviations were often borrowed from the Latin tradition, suggesting the Speculum Scribe was an educated monk rather than a lay brother [7]. In short, the Speculum Scribe was a seasoned scribe with a nuanced understanding of his craft, despite the superficial appearance of his script.

This study researches the abbreviation use of the Speculum Scribe, employing methods from the field of computational scribal modelling. Scribal modelling, also known as scribal profiling, is concerned with the identification or profiling of different scribes [8]. Due to the absence of a standardised or supra-regional language standard, scribal variation is omnipresent in medieval manuscripts [8, 5]. Instead of viewing this scribal variation as an obstacle (e.g. authorship attribution), scribal modelling embraces this variation as an opportunity to deepen scholarly knowledge about scribal practices. Parallel to the hypothesis that every author possesses a unique fingerprint, McIntosh argues that scribes leave their personal mark on a copied text as well and can be identified through it [8]. Previous research [11], indicates that abbreviations can be part of those personal marks and provide information about the individual scribe that applied them. They tend to be key features when distinguishing between scribes [8, 4, 3].

The aim of this research is twofold: 1) to establish a chronological order in which the Speculum Scribe produced his manuscripts based on his usage of abbreviations and 2) looking at those abbreviations, to establish whether there was a convergence in scribal habits within the monastery of Herne. By investigating the chronological order of the Speculum Scribe's works, this research not only sheds light on his individual contributions but also opens the door for potential extrapolation to other scribes and their practices.

## 2. Materials

The corpus used in our study was created by Haverals and Kestemont [2] and encompasses 19 Middle Dutch manuscripts associated with Herne in the period 1350-1400, previously outlined by Kwakkel [7].[2] This entails that the manuscripts were at some point present in Herne, and were often also produced or corrected there. First, digital facsimiles of the manuscripts were collected, which were partially manually transcribed. Using those transcriptions, a Handwritten Text Recognition (HTR) model was trained using Transkribus.[3] This model then transcribed all remaining material in the corpus with a Character Error Rate (CER) of 2.7%. Given our research focus on scribal practices, particularly the use of abbreviations, it was of great importance that the transcriptions remained as close to the original manuscript as possible. Consequently, graphemic, hyper-diplomatic reproductions of the manuscripts were created [10]. This process entails closely replicating the original manuscript's spelling, including brevigraphs, letters, and other glyphs and standardising each letter form. As is customary in Middle Dutch studies, the distinction between 'u'/'v' and 'i'/'j' spellings were retained because they in some cases mark different phonetic realisations. However, allographic variations, such as the long s (ſ) and the lowercase s or the r rotunda (ꝛ) and the lowercase r, were not retained in the transcriptions.

As shown in Table 1, only a small fraction of the production units copied by the Speculum Scribe can be dated with certainty. Consequently, Kwakkel approximated the dating for the rest of them and assigned them to the time span '1375-1400' [7]. Apart from the dated manuscripts, he bases himself on two more observations for this approximation. First, the Speculum Scribe's closest work partner, the Necrology Scribe, was active from at least 1373 until 1396. Their hands are often found together in manuscripts (either as correctors or both as main scribes), suggesting that the two scribes worked together closely, and thus within the same time frame. Second, proven by the presence of a possessor's mark, one of the manuscripts corrected by the Speculum Scribe (Brussels, KBR, 2979), was already present in another cloister (Rooklooster) *before* 1373. Although this implies that the Speculum Scribe could already have been active as a scribe before the fourth quarter of the fourteenth century, Kwakkel still holds the dating 1375-1400.[4] In total, 17 out of the Speculum Scribe's 29 copied production units, which translates to just two out of seven manuscripts, can be dated precisely; the rest is dated by approximation.

[2] 10.5281/zenodo.10005253

[3] https://www.transkribus.org/

[4] The only explicitly dated works of the Speculum Scribe range from 1393 to 1402. Kwakkel therefore assumes that all of his other works are either older or contemporary [7]. While Kwakkel aligns with other researchers in this assumption, it is important to note that there is limited concrete evidence supporting this view, aside from the fact that we know when some books arrived in Rooklooster, and thus could not have been written after that date.

**Table 1**
Table summarising all production units produced by the Speculum Scribe. From left to right: the manuscript signatures in which the production units are present, the production units, their dates (* signifies that they are an approximation), the number of folia in them, and their content.

| Signature | PU's by Spec. Scr. | Date | Number of folia | Content |
|---|---|---|---|---|
| Brussels, KBR, 2849-51 | PU I | *1375-1400 | 16 | Pericope list |
| | PU II | *1375-1400 | 10 | Prologue of Hieronym on the letters of Paul |
| | PU III | *1375-1400 | 49 | Letter of Paul to the Romans |
| | PU IV | *1375-1400 | 78 | First letter of Paul to the Christians of Corinth |
| | PU V | *1375-1400 | 185 | Various letters of Paul |
| | PU VI | *1375-1400 | 201 | *Acts of the Apostles*; *Book of Revelation*; *Book of Malachi* |
| | PU VII | *1375-1400 | 154 | Pericopes of Old Testament |
| Brussels, KBR, 2905-09 | PU II | *1375-1400 | 200 | Middle Dutch translation of *Audi Filia* |
| Brussels, KBR, 3093-95 | PU I (37r-98v) | *1375-1400 | 124 | Middle Dutch translation of *Sermo de vita et de passione domini Jesu Christi*; *Sente Augustijns waerde* |
| | PU II | *1375-1400 | 176 | Various Middle Dutch translations (a.o. *Lignum vitae*) |
| Ghent, UL, 1374 | PU I | *1375-1400 | 6 | *Spiegel historiael* (pt. 1) |
| | PU II | *1375-1400 | 117 | *Spiegel historiael* (pt. 1, 3, 4) |
| | PU III | *1375-1400 | 91 | The four *Martins* |
| | PU IV | *1375-1400 | 41 | *Gielis van Molhem en Hendrik*; *Rinclus*; *Die Rose* (excerpt); *Boec vander wraken* (excerpt) |
| | PU V | *1375-1400 | 9 | *Der kerken claghe*; *Van der feesten een proper dinc* (excerpt) |
| Vienna, ÖNB, SN 12.857 | PU II | *1375-1400 | 15 | Pericope list |
| | PU IV | *1375-1400 | 444 | Middle Dutch translation of New Testament |
| Vienna, ÖNB, Cod. 13.708 | PU I | 1402 | 8 | *Super modo vivendi* |
| | PU II | 1393 | 52 | Various excerpts regarding the Western Schism |
| | PU III | 1402 | 34 | *Spiegel historiael* (pt. 2) |
| | PU IV | 1402 | 40 | *Spiegel historiael* (pt. 2) |
| | PU V | 1402 | 36 | *Spiegel historiael* (pt. 2) |
| | PU VI | 1402 | 57 | *Spiegel historiael* (pt. 2) |
| | PU VII | 1402 | 53 | *Spiegel historiael* (pt. 2) |
| | PU VIII | 1402 | 68 | *Spiegel historiael* (pt. 2) |
| | PU IX | 1402 | 54 | *Spiegel historiael* (pt. 2) |
| | PU X | 1393-1394 | 28 | Various Middle Dutch texts (a.o. *Derde Martijn*) |
| | PU XI | 1394 | 60 | Various Middle Dutch texts (a.o. *Vanden kerstenen ghelove*) |
| Brussels, KBR, 1805-08 | PU I | 1395 | 82 | Middle Dutch translation of *Dialogi* |

## 3. Preparing the data

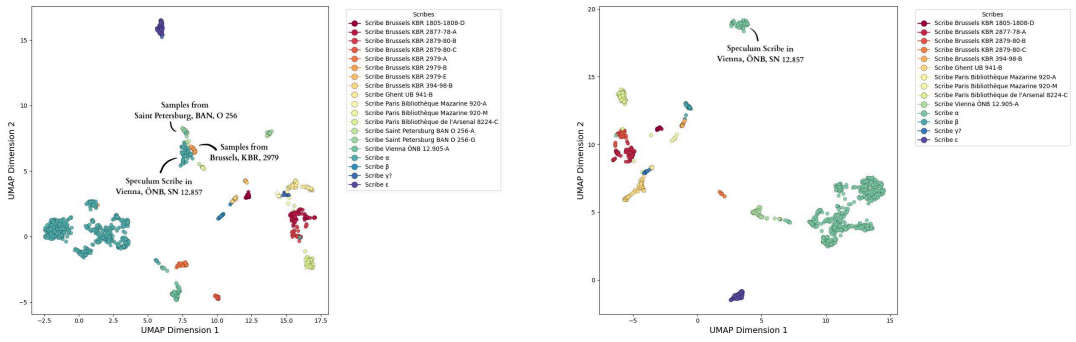
To model the text computationally, we transformed the graphemic transcriptions into a bag-of-words representation consisting of TF-IDF weighted character bigrams. Crucially, we restricted the vocabulary to bigrams that included at least one brevigraph or abbreviatory glyph representing two or more characters [3]. For instance, the Middle Dutch word for *and* was *ende*, which was often abbreviated as *enꝛ̄*. *Enꝛ̄* consists of two characters including a brevigraph, and will thus be included in the bag-of-words as is.[5] However, abbreviations also occur in longer words, for instance *leidet* [leads] could be abbreviated *leidꝫ*. In that case *dꝫ* and *ꝫ_* would be included in the bag-of-words. Applying this restriction to the character bigrams has multiple advantages: brevigraphs are distinctive choices made by the scribes themselves, they are relatively content independent and they are spread evenly throughout the entire corpus. Accordingly, brevigraphs serve a similar function in scribal modelling as function words in authorship attribution, as they both allow to investigate a writer's individual writing style.

## 4. Analysis

Previous research [11] brought to light an unexpected behaviour of Vienna, ÖNB, SN 12.857 when compared to other works attributed to the Speculum Scribe. After segmenting all manuscripts into equal segments with a 5000-character length and applying dimensionality reduction through a combination of PCA and UMAP, a scatterplot was created. In this plot, all works written by the Speculum Scribe cluster together and away from the rest. However, one manuscript does not: Vienna, ÖNB, SN 12.857 deviates from the main Speculum Scribe's oeuvre, clustering with manuscripts copied by different scribes, namely Brussels, KBR, 2979, and Saint Petersburg, BAN, O 256 (Fig. 2a). Interestingly, all three of these manuscripts contain Middle Dutch translations of the four gospels. However, since the analysis is based on character bigrams including a brevigraph, it is improbable that these manuscripts clustered due to similarities in content alone. That is confirmed by an additional experiment: when leaving Brussels, KBR, 2979 and Saint Petersburg, BAN, O 256 out of the analysis for the scatterplot, Vienna, ÖNB, SN 12.857 still moves away from the more typical Speculum Scribe texts (Fig. 2b) [11].

Yet, paleographic analysis leaves no doubt that Vienna, ÖNB, SN 12.857 was written by the Speculum Scribe, so why does it not cluster together with the rest of his works? Kwakkel suggested that the Saint Petersburg manuscript could have served as the exemplar for the Viennese one [7]. Although he rules out Brussels, KBR, 2979 as an exemplar, this scatterplot suggests otherwise. Accordingly, the Viennese manuscript could be one of the scribe's first works, in which he still stuck very close to his (in this case) two exemplars. Vienna, ÖNB, SN 12.857 would then be a *youth work* of the Speculum Scribe. This hypothesis is further supported by the early dating of Brussels, KBR, 2979 mentioned before: Kwakkel suspects it was copied around 1350, since it was already present in Rooklooster in 1373, *with* corrections of the Speculum Scribe [7]. Accordingly, it was most likely written outside of Herne around 1350, but ended up there and was corrected by the Speculum Scribe before 1373.

[5] *nꝛ̄_* would also be included, with _ representing a space.




**(a)** **(b)**

**Figure 2:** Stylometric scatterplots of Middle Dutch manuscript scribes, using character-level bigrams with brevigraphs. This scatterplot, created using PCA and UMAP dimensionality reduction techniques, illustrates the stylistic variation among scribes in our corpus. Each dot represents a 5,000-character segment, coloured uniquely to correspond to a specific scribe (only scribes are retained that can contribute at least 10 segments; '*α*' is the Speculum Scribe). The spatial proximity of the dots indicates stylistic similarity. a) Has all Herne manuscripts included and b) left out the other two evangeliarias: Brussels, KBR, 2979 and Saint Petersburg, BAN, O 256 [11].

To investigate this *youth work* hypothesis further, we trained a *random forest classifier* model on the bag-of-words representation of the segments. This algorithm can detect the most important features when distinguishing between two groups of texts, which are in our case: Vienna, ÖNB, SN 12.857 and the segments of the other manuscripts written by the Speculum Scribe (Fig. 3). This way, we are able to determine which patterns are unique to the Viennese manuscript. In light grey, we show how often the Speculum Scribe applies certain abbreviations in Vienna, ÖNB, SN 12.857, in comparison to the other works copied by him (in dark grey). The height of the box corresponds to the frequency of the feature.

For the scope of this research, features of particular interest are the ones that are less present than expected in the Viennese manuscript, as they possibly indicate that the scribe adopted their use from either his fellow scribes or exemplars. In this regard, *a'*, *dʒ*, and *gē* in the boxplot are noteworthy. When investigating the use context of *a'* and *gē*, their application seems to be stable. Although they are less present than expected, they continuously abbreviate respectively *aer* and *gen*. This is different for *dʒ*, as the Speclum Scribe broadens its application by using it in a wider range of contexts and to represent multiple letter combinations (cfr. infra). This is why this case study focuses on *dʒ*.

## 5. Latin letter et (ȝ)

The character *ȝ* (Latin letter et) is a glyph that stems from the Latin writing tradition and originally represented the coordinating conjunction *et* [and]. It was also used as an abbreviation in Latin, with various possible solutions depending on the surrounding letters, *et* being a common expansion after the letter *-b* [1]. Consequently, medieval scribes would also employ it to abbreviate the letter combination *et* as a part of other words. Therefore, *dȝ* could be used to abbreviate *det*, for instance at the end of a verb (cfr. supra). Kwakkel however observed that

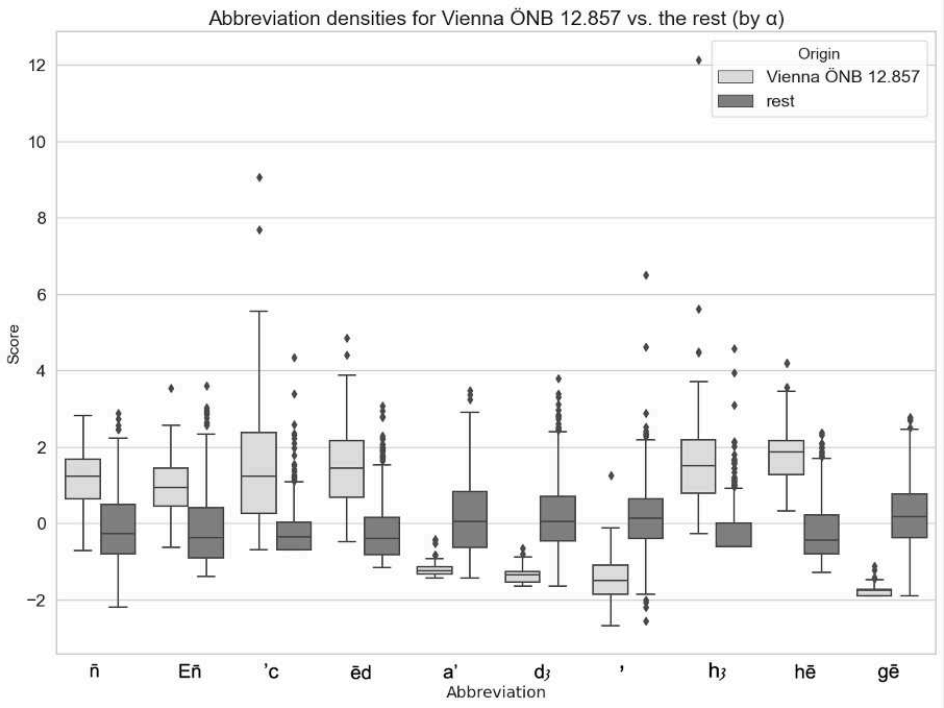



**Figure 3:** Boxplot showing the distribution of the most important features when distinguishing between Vienna, ÖNB, SN 12.857 (light) and all other manuscripts by the Speculum Scribe (dark).

the Speculum Scribe used it in another context as well, namely as a vowel lengthener [7]. In Middle Dutch, an *-e* would be added to elongate the pronunciation of the preceding vowel. The *-e* itself would then not be pronounced anymore, only the elongated version of the vowel it accompanied (e.g. laʒ = la*et* [let]) [7]. Yet, closer inspection of the Speculum Scribe's manuscripts reveals that he applies *ʒ* in another remarkable context as well, namely to abbreviate *at* in the Middle Dutch word *dat* (dʒ = d*at* [that]).[6] In this context, *ʒ* no longer replaces the letter combination *et*, but *at*. Accordingly, there are two possible explanations for the low frequency of *dʒ* in Vienna, ÖNB, SN 12.857: 1) he used the character less frequently in both contexts (*det* and *dat*) or 2) he used the character only in one context (*det* or *dat*).

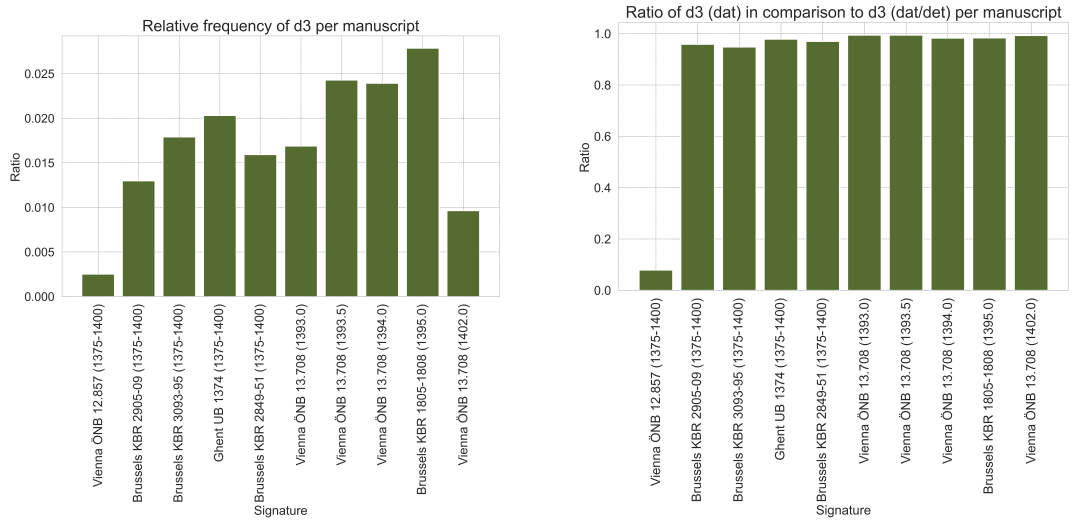
In order to answer the first question, the ratio of *dʒ* in comparison to all characters per manuscript was calculated (Fig. 4a). The plot shows that the scribe uses *dʒ* much less often in Vienna, ÖNB, SN 12.857 compared to his other works, as the boxplot already showed.[7] However, this does not tell us anything about the context in which he applied the abbreviation. Accordingly, we calculated the frequency of *dʒ* in the context of *dat* compared to all usages of *dʒ*, so *dat* and *det* (Fig. 4b).[8] Remarkably, *dʒ* primarily serves to abbreviate *det* in the Viennese

[6]And sometimes also in words containing *dat* (e.g. ōdʒ = o*mdat* [because] in Brussels, KBR, 2849-51).

[7]Vienna, ÖNB, Cod. 13.708 also has a low occurrence of the feature, but this manuscript uses less abbreviations in general.

[8]We did this using two regular expressions. 'dʒ|Dʒ' to retrieve all instances of dʒ and '(?<=[^-]\s)dʒ(?![\S])|Dʒ(?![\S])' to retrieve any non-hyphen character (e.g., to exclude *lei-dʒ* at a line break) followed by a whitespace character,

manuscript, not *dat*. This observation becomes even more apparent when calculating this ratio for all his other manuscripts – since the *dat* ratio is much higher in other manuscripts. The scribe actually makes a binary jump in his application of the abbreviation, from almost never in the context of *dat*, to almost never in the context of *det*. This observation is most likely compatible with the hypothesis that Vienna, ÖNB, SN 12.857 is an early manuscript in the Speculum Scribe's oeuvre.




**(a)** **(b)**

**Figure 4:** a) Frequency of *dʒ* in comparison to all characters per manuscripts and b) frequency of *dʒ* in the context of *dat* in comparison to all instances of *dʒ* (*dat* and *det*).

Upon closer inspection, *dʒ* (*dat*) is not completely absent in the Viennese manuscript. However, it only appears rarely (five times in total) and consistently in the same place: at the end of a line, presumably out of necessity when the scribe ran out of space when copying a verse (Fig. 5a). This aligns with previous research that found abbreviations to be more frequent towards the end of a line.[9] The abbreviation also occurs three times in the pericope list at the beginning of the manuscript (Fig. 5b). According to Kwakkel, that list was added to the manuscript in a later stadium [7]. Last, it is also found once under the text in a lighter ductus, next to a small frame (Fig. 5c). Kwakkel states that additions as these were made later on by the Speculum Scribe during a correction round [7]. Accordingly, just as the pericope list, this instance of *dʒ* was not present when the manuscript was originally written, but added later on. The *emergency dʒ's* at the end of a line, however, were there since the beginning.

followed by *dʒ* at the end of the string or followed by a whitespace character, or, *Dʒ* at the end of a string or followed by a whitespace. This ensures to retrieve all instances in which *dʒ* forms a standalone word and in which it is not the suffix to a verb.

[9] See [3] for an overview.

(a) (b) (c)

**Figure 5:** Vienna, ÖNB, SN 12.857: (a) 'Dat volc dȝ' at the second to last line at the bottom of the page, where the scribe almost ran out of space (fol. 23r). (b) 'Da'ōme es dȝ rike' in the middle of page of the pericope list that was later added (fol. 7v). (c) 'eñ dȝ hueden', a later addition to the page, at the bottom (fol. 157r). The manuscript is digitally available on the website of the Austrian National Library.

## 6. Convergence?

Interestingly, the application of *dȝ* in the context of *dat* is consistently found in only three Herne manuscripts not written by the Speculum Scribe: Vienna, ÖNB, SN 12.905 (c. 1350-1375), Brussels, KBR, 1805-08 (c. 1395), and Brussels, KBR, 2979 (c. 1350). Notably, Brussels, KBR, 2979 is one of the manuscripts that clusters with the Vienna manuscript in the scatterplot analysis. This manuscript was present in Rooklooster as early as 1373, featuring corrections by the Speculum Scribe. This indicates that the Speculum Scribe undoubtedly read, and possibly copied from, this manuscript at the start of his copying endeavours. Consequently, it is highly probable that he observed the expanded use of *dȝ* in this manuscript, which influenced him to adopt and consistently apply this abbreviation in all his subsequent works after completing his own version of the gospels. If that is the case, an evolution becomes clear: the scribe used *ȝ* in the traditional way in his earliest manuscript: namely to abbreviate *et*; only in his later works, he increasingly applies it to abbreviate *at* – we hypothesise that it is more likely that he *broadened* the application of this brevigraph, rather than restricting its scope - which expands on the observation that the meaning of abbreviations evolves over time [9]. This pattern not only highlights the transmission of scribal practices, but also underscores the significance of specific manuscripts in shaping the Speculum Scribe's abbreviation applications. Furthermore, it brings to light that scribal convergence is present in Herne, at least between the Speculum Scribe's oeuvre and the monastery's library, as the scribe most likely read the broadened application in one of his exemplars and then applied it that way himself.

## 7. Conclusion

The aim of this research was twofold: 1) to establish a chronological order in which the Speculum Scribe produced his manuscripts, based on his usage of abbreviations and 2) to establish whether there was a convergence of scribal habits within the monastery of Herne. We were not able to determine a chronological order based on the scribe's usage of *dʒ*, since he broadened his usage context binary, not gradually. However, we were able to detect what was most likely his first work: Vienna, ÖNB, SN 12.857, indicating that it could be possible to date manuscripts within a scribal oeuvre based on abbreviations. Future research will tell us whether other features went through a similar evolution, and might allow us to reconstruct a more detailed chronological order. Second, we obtained a first indication that there was indeed a convergence in scribal habits within the monastery. The Speculum Scribe learned from a manuscript in his library (copied by a scribe who may or may not have resided in Herne) how to broaden his application of *dʒ*. Future research, in which we align the three evangeliaria of Herne, will provide more insight into whether he learned this in manuscript Brussels, KBR, 2979.

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