Digital Scholarship in the Humanities Advance Access published March 17, 2016

Open versus Closed Recensions (Pasquali): Pros and Cons of Some Methods for Computer-Assisted Stemmatology

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Abstract

By comparing the results obtained through traditional qualitative stemmatics with those obtained through computer-assisted quantitative stemmatology, when both approaches are applied to two authentic data sets (the Old English *Anglo-Saxon Chronicle* and a Latin epitome of Marco Polo's *Devisement dou Monde*), this study aims at bringing to the fore the advantages and the disadvantages of some recent methods for the automatic grouping of witnesses, most of which are based on phylogenetic models. The analysis will show that not all the methods provide results which can be considered reliable in light of the evidence offered by a thorough scrutiny of the documentary history of the texts under inspection. In particular, the majority of computer-assisted methods succeed in providing very good information for detecting the grouping of witnesses, as well as for a preliminary evaluation of their variant readings. Yet, few offer some valuable guidance as to define the sub-groups. This limitation becomes crucial when the existence of more than one *codex interpositus* has to be postulated, i.e. when the historical evidence makes it clear that the actual textual transmission cannot conform to the mathematical ideal of cladistic parsimony. The latter case is particularly evident with 'closed' recensions, where mechanical reconstruction plays a heavier role, and the choice of variants follows rigorous stemmatic steps. On the other hand, the application of computer-assisted methods to 'open' recensions seems to give better results.

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1 Background

The dichotomy 'open' versus 'closed' recension goes back to Giorgio Pasquali who coined this terminology in his volume *Storia della tradizione e critica del testo* (Pasquali, 1952, p. 126). There, he also differentiated between mechanical reconstruction (which implies no *selectio* between the variant readings, a condition made possible only by the presence of a closed recension) and non-mechanical reconstruction (which does imply a *selectio* that proves unavoidable in the presence of an open recension).

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doi:10.1093/llc/fqw014

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Though Pasquali undoubtedly used both terms, and especially the second, in many different ways as noted by Giovan Battista Alberti (1979, pp. 1–18) among others,[1] the dichotomy is still productively used in contemporary textual criticism (Stussi, 2006, p. 13). Broadly speaking, the *constitutio* of a text whose recension is closed is more dependent on the constellation of witnesses as sketched in the stemma, while the *constitutio* of a text whose recension is open heavily relies on the philologist's *iudicium.* Therefore, these two types of recensions require the application of editorial procedures which, though to a certain extent similar, are not identical.[2]

The aim of this article is to compare the results offered by traditional qualitative stemmatics with those offered by computer-assisted quantitative stemmatology when both approaches are applied to 'open' versus 'closed' recensions of real textual traditions.[3] By doing so, the pros and cons of some recent methods for the automatic grouping of witnesses, mostly based on computer-assisted models, will be brought to the fore. The manuscript traditions that have been selected as case studies are, on the one hand, the Old English *Anglo-Saxon Chronicle* (whose compilation was most likely started in the late 9th century during the reign of King Alfred the Great), and, on the other hand, a Latin 14th-century epitome of Marco Polo's *Devisement dou Monde* known as Liber *qui vulgari hominum dicitur El Melio[n]e.*[4]

2 Open Recension: A Case Study in a Traditional Perspective

2.1 The Anglo-Saxon Chronicle documentary history

The annalistic text known as *The Anglo-Saxon Chronicle* has been passed down to us in seven manuscripts:

A Corpus Christi College, Cambridge MS 173, ff. 1–32, dated as mid-10th century by N. R. Ker (1957: p. 57, n. 39), is the oldest surviving witness. It is also known as the *Parker Manuscript*, after Matthew Parker, archbishop of Canterbury, who acquired it from Nicholas Wutton in the mid-16th century (Bately, 1986, p. xiv). A is the source text for two other *Chronicle* witnesses: namely G, a direct copy of A created some time between 1001 and 1012/13, and F, compiled just after 1100 at Christ Church, Canterbury, where the scribe used A to write some of his annals, adding also various annotations to it. Some entries unique to A seem to show strong Winchester connections as do some of the hands that contributed to the text.[5] Yet, the assumption that the earliest section was copied at Winchester is still under debate.

B London, British Library, Cotton Tiberius A.vi, written by a single scribe who used a Square minuscule typical of the second half of the 10th century. B contains annals in Old English until 977. The manuscript has traditionally been attributed to Abingdon, and must have been in the possession of Christ Church, Canterbury by ca. 1100, when Latin material—among which a list of popes who sent *pallia* to archbishops of Canterbury—was added, by a possibly identical hand, to A (f. 54v) and B (f. 35) (Taylor, 1983, pp. xxi–xxii).

C London, British Library, Cotton Tiberius B.i, which contains annals to 1066, where it breaks off in the middle of the account of Stamford Bridge, which is concluded by a 12th-century hand on a supply sheet. The text of the *Chronicle* is written in seven (Ker, 1957, p. 253) or eight (Conner, 1996, pp. xxiii–xxv) hands of the mid-11th century.[6] The text up until 977 is so close to that of Manuscript B that it has been proposed that B and C share a common exemplar (O'Brian O'Keeffe, 2001, pp. xxvi–xxxviii).

D London, British Library, Cotton Tiberius B.iv, containing annals to 1079, where it breaks off in mid-sentence at the bottom of the half-sized folio 86r.[7] It is written in over ten to eighteen hands, whose writing is typical of the second half of the 11th or early 12th century. The section covering A.D. 262–692/3 has been lost. D is

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considered a conflation of a northern edition of the *Chronicle*, known as the 'Northern Recension' (which had been expanded with material from Bede's *Historia Ecclesiastica* and other northern sources) and a manuscript similar to C (Cubbin, 1996, p. xxvii).

E Oxford, Bodleian Library, MS Laud 636, which was most likely copied in 1121 at Peterborough and maintained up to 1154 (Irvine, 2004, p. xviii). Like D, this manuscript forms part of the 'Northern Recension', though the compiler made no use of the Mercian Register and omitted the Brunanburh poem. E also includes a set of 'Norman' chronicles in Latin and unique material relating to Peterborough. This witness is often referred to as the *Laud Chronicle*, after the Archbishop of Canterbury William Laud (1633–45) who acquired it in 1638, and as the *Peterborough Chronicle*.

F London, British Library, Cotton Domitian A.viii, is a bilingual *Chronicle* with entries in Old English and Latin. It was written at Christ Church, Canterbury, just after 1100, and was compiled from various sources, including A, the ancestor of E ($\surd$E), the *Annales Wintonienses*, and a set of 'Norman' chronicles. F is generally considered a 'secondary' *Chronicle* text, while A, C, D, and E are considered 'primary' (Baker, 2000, p. xxviii; Dumville, 1995; Plummer, 1972, pp. II.xliv-xlv provides a facsimile edition of F).

G [A_2,W] London, British Library, Cotton Otho B.xi is an early 11th-century (partial) copy of A (Bately, 1991). This manuscript was almost completely destroyed in a fire incident in 1731, and the text survives only in a transcript made by the 16th-century scholar Lawrence Nowell. In 1643, Abraham Wheloc used this transcript for his edition. The *siglum* W is for Wheloc. The more widely used *siglum* G follows instead Thorpe's collective edition of 1861. A reconstructive edition of G, labelled as *G, may be found in Lutz, 1981.

To these seven witnesses, a brief fragment of an eighth one should be added, namely London, British Library, Cotton Domitian A.ix (**H**), which contains on a single leaf (f. 9) two late entries under the years 1113 and 1114.

2.2 Genealogical relationship between the witnesses

The genesis of this work, as well as the history of its tradition, makes it the perfect candidate for what Pasquali would have called an 'open'—and also highly contaminated—recension. Traditionally, it is maintained that the aforementioned seven witnesses contain four redactions of the *Anglo-Saxon Chronicle*: G is clearly a *codex descriptus* derived from A, and therefore it can be expunged; B is very close to C, both having been copied from the same ancestor; F is an epitome of E. According to Charles W. Plummer (1972, p. II.xxiii), 'A, C, D, E, have every right to be considered distinct Chronicles', though they grew out of a common stock (until the year 892), and even in their later parts used common material, which especially increased internal contamination. The very complex relationships between the extant witnesses, as well as with other Latin texts that have a version of the *Chronicle* among their sources—in particular Asser's *Life of Alfred*, Æthelweard's *Chronicon,* and the *Annals of St Neots*—have been variously interpreted and represented by scholars.[8] What follows is a couple of stemmatic hypotheses which acknowledge the recent debate on these matters (see Figs 1 and 2 below).

Two features in particular seem to point to the fact that the composer of the Latin *Annals of St Neots* was using a copy which must have preceded all the other *Chronicle* witnesses: first, at 642 and at 672, the form *koenuualch* is older than *cenwalh* of all the vernacular texts; and secondly, the *Annals* lack the chronological dislocation between the years 756 and 842 shared by all the other manuscripts.[9] Æthelweard's *Chronicon*, contrary to all the surviving witnesses and Asser's *Life of Alfred*, had not lost by homoeoteleuton a whole sentence from annal 885, and does not have the additions also absent in A, which means that the *Chronicon* belongs to the same branch as A, though it is, in some respect,

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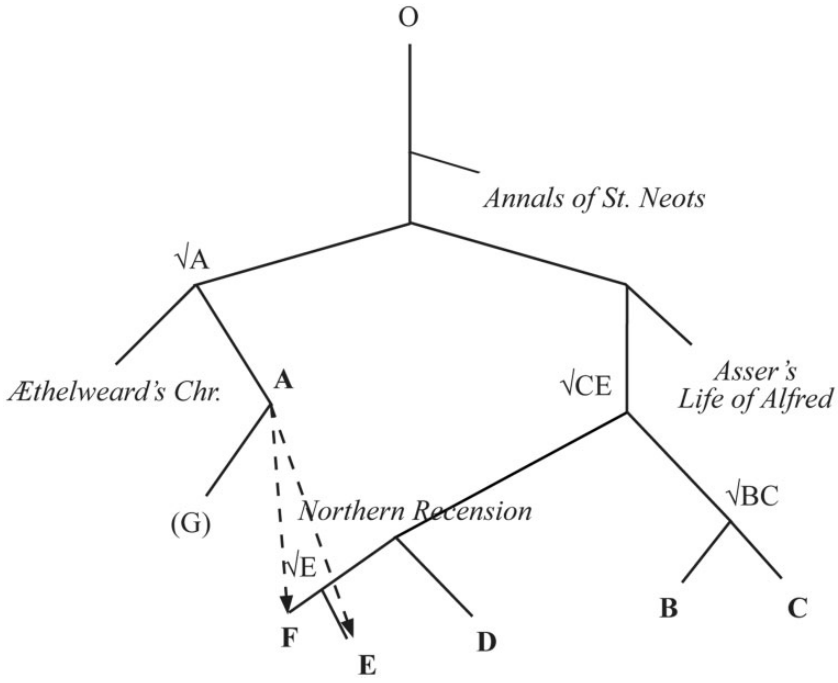


Fig. 1. A revised version of the stemma provided in Buzzoni, 2001: 42 (to be compared with Swanton, 1996, p. xxix)

closer to the original. As for the *Life of King Alfred*, Dorothy Whitelock (1979, p. 118) states that its author, Asser, 'can be shown to have used a version of the Anglo-Saxon Chronicle which already [...] was at least two removes from the original text'. Whitelock further claims (*ibid.*) that since there are places where Asser's text, Æthelweard's *Chronicon,* and A agree against B, C, D, and E, these four manuscripts can be taken to descend from a common version which contained several new features ($\sqrt{CE}$). Due to their closeness (e.g. they agree in entering the Mercian Register as a whole block of annals, 902–24, and they share annals 957, 971, and 977 which do not occur anywhere else), it is generally assumed that B and C are copies of a common ancestor ($\sqrt{BC}$).[10] Finally, D and E agree against all the other witnesses in their inclusion of an early set of annals known as the 'Second Northern Group' (901–66), which contains material of northern interest drawn mainly from Bede's *Historia ecclesiastica gentis anglorum* and from spare northern annals. It is generally assumed that they descend from a common ancestor, from which E seems to be two removes, since D's readings probably till 1031 are derived not only from the alleged subarchetype, but also from the direct ancestor of E, i.e. $\sqrt{E}$ (Cubbin, 1996, p. liii).

Tony Jebson's stemma is not far from the previous one (see Fig. 2 below) in its bottom part, and therefore is in the final grouping of the extant manuscripts. Yet, it appears that it fails to capture the agreement of B, C, D, and E as opposed to A, as well as the strong contamination between the A-branch and the E-branch of the *Chronicle* tradition.

3 Closed Recension: A Case Study in a Traditional Perspective

3.1 The Melione documentary history

The *Liber qui vulgari hominum dicitur El Meliole* (sic: read *Melione*)—more precisely, the *Extracta et [et] translata de libro Domini Marchi Paulo de Veneciis de diversis provinciis et regnis maioris Asie et de diversis moribus habitancium et de multis mirabilibus in hiis locis*—offers a good example of a tradition belonging to a 'closed' recension. The text—

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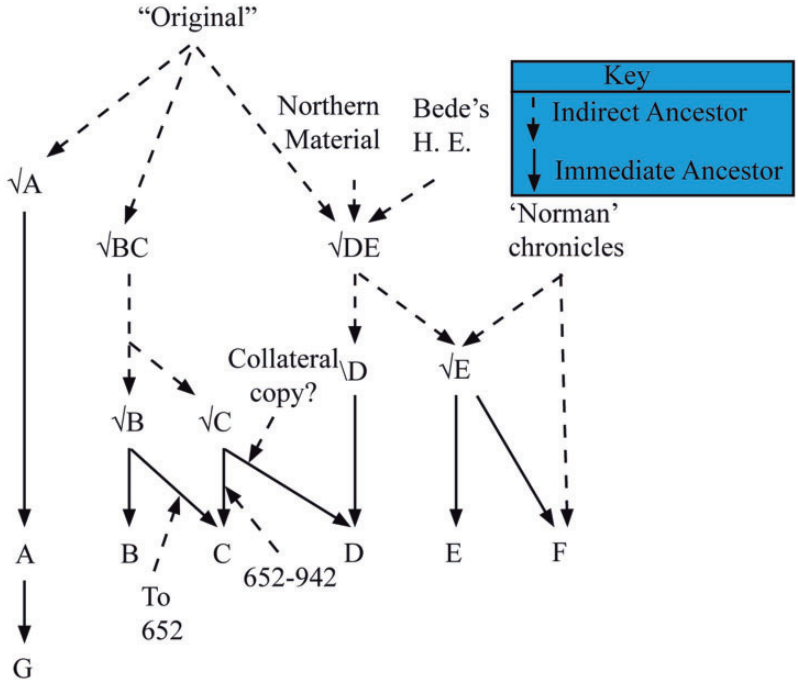


Fig. 2. Taken from Tony Jebson's online XML edition of the *Anglo-Saxon Chronicle* (http://asc.jebbo.co.uk/, accessed on 9 February 2015)

hereafter *L* (Benedetto, 1928, p. CLXXX ff.)—is a Latin epitome of Marco Polo's *Devisement dou Monde*, produced in the 14th century (first half) by a Venetian clerk. With great adeptness, he used a text akin to the Franco-Veneto one (marked as *F* by Benedetto, 1928), which now can be found in the Parisian MS BnF, fr. 1116 (Burgio and Mascherpa, 2007, pp. 132–47).[11]

L text is transmitted by six manuscripts:

A Antwerpen, Bibl. Moretus-Plantin, M 16.14—vellum, 15th century, the Netherlands: contains only *L* (*Extracta de libro Domini Pauli de Veneciis de diversis provinciis et regnis maiorum, et de diversis moribus habitantium et de multis mirabilibus in hiis locis et Asye*);

B Bloomington, Indiana University, Lilly Libr., Allen MS—paper, 15th century (second half), Flanders (?): contains *L* (ff. 1a–35d: no title) and Hayton's *Flos Historiarum* (Dutschke, 1993, pp, 295–98);

F Ferrara, Bibl. Ariostea, cl. II 336—paper, 14th century *in.*, Emilia (?): contains only *L* (*Incipit prologus,* etc.);

V Venezia, Bibl. Correr, Cicogna 2408—paper: contains *L* (ff. 9r–36r: *Extracta et [et] translata de libro Domini Marchi Paulo,* etc.) and Odorico's *Itinerarium*, copied in Padua (February 1401) by Filippo *Muleti* da Fagagna (Udine) (see the *colophon* on ff. 36r e 46v);

W Wolfenbüttel, Herzog-August-Bibl., Guelf. 41 Weissenburg—paper, 15th century (half), Lower Rhineland: a collection of travel texts (Ricoldo di Montecroce, Odorico, the *Descriptio terrae sanctae* by Jacques de Vitry, l'*Historia Mongalorum* by Giovanni di Pian di Carpine). It contains L at ff. 121a–60d (*Incipit Itinerarium nobilis et discreti viri Domini Paulo de Veneciis de regionibus et pertibus* [sic] *maioris Asye nec non de ritibus et moribus hominum earumdem. Et Cetera*);

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X 'present location unknown' (Dutschke, 1993, p. 487)—paper; contains a collection of texts (*L*, ff. 1r–49v; Odorico's *Itinerarium*; *Historia destructionis Troiae*). Prete, 1974, p. 5 - the only person to see the manuscript before its sale to an American bibliophile - records that it was copied in Ferrara in 1373 by Iacopino da Rimini OFM (as certified by the *colophon* on f. 185v).

To sum up, *L* is an abridged 202-chapter version—as can be inferred from V^{12}—of *F* (the latter consisting in 233 chapters); the comparison between the Latin version and its model was therefore a crucial step in the *recensio* (of all witnesses except X, of course), and it allowed us to fix some points in the reconstruction of the history of textual transmission. The following are the most important among these.[13]

3.2 A traditional 'recensio'

No traces of contamination have been identified. No witness is *descriptus*, as is readily demonstrated by the absence of a common chapter structure, and by the presence of many *errores singulares* in each of them. These two points need further clarification from the methodological point of view: (1) If a text is originally divided into chapters (like the Franco-Veneto *Devisement* used as a model by the author of the Latin *Epitome L*), the (post)-lachmannian method admits that a different partition of the text is a criterion for formulating hypotheses about the genealogical relationships of the witnesses. In f. 4a, F has a *rubrica*, *De sarracenorum Papa*, which subdivides ch. 23 (*De Civitate maxima Baldach*) in two parts (ch. 23 describing Baghdad, and ch. 23a describing its conquest by Alau); since in the other witnesses (A 20, f. 11r-v; B 22, f. 4a; V 23, f. 11v; 22 W, f. 124b–c) these two parts form an undivided chapter, just like in F XXIV, it is reasonable to assume that (1) the section marked by *De sarracenorum Papa* is a new creation of F (or of its *exemplar*) and (2) none of the other witnesses is a copy of F, since they do not have that innovation. Such observation can be repeated for A, B, V, and W (with reference to other *textus loci*). (2) Each witness is also characterized by specific errors (called *errores singulares*) not attested in any of the others; their presence testifies that that particular witness is not the *exemplar* of the others (otherwise, they should share the same error). In principle, this phenomenon should escape automated analysis: in fact, the focus here is on a peculiar subset of variant readings evaluated as such through the philologist's *iudicium*. What follows is an example in which all the witnesses of *L* behave in a different way when faced with a difficult *textus locus*. *F* II 10 explains that Maffeo and Nicolò Polo, who have spent a year at the Court of Barca Khan (near the Volga river), are unable to return to Constantinople because of a sudden war between the Tartars; therefore, they decide to go east, because—they think— '*poron retorner autaesse*' ['we may be able to return…' (Ricci, 1931, p. 4)]. *Autaesse* is incomprehensible (Eusebi suggests reading *a Venesse*), and the editor-translator of *L* decided to solve the problem by reading *au Taesse* (*Taesse* being a place name); its *scribae* adopt different solutions: F 3, f. 2 writes *ad taesse tandem reverti posse*; V 3, f. 9r *sperantes* (a verb skipped by F, while present in V) *ad caesse tamdem reverti posse*; A 2, f. 2v *sperantes reverti tandem ad sua posse* (*ad sua* is an elegant solution to replace an unintelligible word); B 3, f. 1b omits the phrase (a radical solution); W 3, f. 121b *sperantes aptam esse tandem reverti posse* (an honest confession: W does not understand the passage). The presence of many of such *errores singulares* points to the aforementioned fact that no witness is *descriptus*.

Further fixed points in the history of the *Melione* tradition are the following. The original text of *L* (or of its archetype) should have not contained more than 202 chapters: in fact, none of the witnesses contains any chapters absent in V. It should also be noted that the geographical classification of the witnesses (F, V, (X): Northern Italy, and A, B, W, probably Flanders, see below) corresponds to the distinction in chapters: 200/202 in the Italian tradition, between 190 (A) and approximately 150 (B, W) in the 'Flemish'.

All the witnesses are descended from an archetype characterized by copying errors, whose existence can be postulated only through a thorough scrutiny of the *loci critici*, as shown below.

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In *F* XXXVI 22, Polo, who is leaving the plains of the Persian Gulf, explains as follows:

> [. . .] ne voç contaron de Endie a cestui point, car voç bien le conterai en nostre livre avant, quant tens et leu sera; mes mo retornerai por tramontaine por conter de celle provence, e retorneron por un autre voie a la cité de Creman qe je voç ai contés, por ce que en les contrés dont je voç voil conter ne se puet aler se no da ceste cité de Creman.[14]

F renders the passage as follows (F 31, f. 5bis):

> Non intendit auctor amplius procedere quia ingrederentur ad partes indie. de quibus specialiter magis infra loquetur. *S*ed ad presens intendit loqui de partibus versus septemtrionem ut autem hoc faciat oportet reverti ad Cremosam de qua ad presens dictum est. per septemtrionem versus ad Creman / de qua supra dictum est / quia inde incipiam dictum monstrum.

In the last sentence *monstrum* is clearly a mistake, which F shares with A, B, and W:

> A 28 (f. 17r) quia inde incipiemus monstrum dicere
> B 29 (f. 5d) q. i. incipiemus dicere monstrum
> W 29 (f. 126b) q. i. incipiemus dicere monstrum

V 31 (f. 13r) offers a reading (*quia inde incipiam dicere nostrum*) which is more plausible, but not entirely satisfactory: what does *nostrum* refer to? The assumption is that *nostrum* was the reading of the archetype and that the noun originally placed after the possessive, most probably *iter*, is now missing (*iter* is normally used by L to indicate the 'journey').[15]

The agreement of F, A, B, and W, which share the error *nostrum—monstrum*, suggests the existence of a common model (β) for the four manuscripts. This is confirmed by many other *loci textus*, including the following:

(a) *F* CXCIV 6 tells that the inhabitants of *Escier*

> [. . .] font beiscot de peisonz, car il le trencent a peitit bocconç, que puent estre entor une livre, et le font secher au soleil et puis le repoinent es maisonz e le mengient tout l'an come beiscot.[16]

Now, let us consider F 183 (f. 25v):

> *p*isces habent multos maximos / *e*t bonos quos in modum panis biscocti exsiccant soli in non magna frustra sicque conservant.

The same conclusion (with the variant reading *in parvis frustris*) is present in A 173, B 89, W 89; in V 184, after the very last words *sicque conservant*, an expansion is present: *et eis per totum annum loco panis utuntur* (f. 34r).

(b) *F* CXCI 15 offers a digression on India that concludes with the following sentence:

> La menor Yndie est da Çinaba jusque a Montifi, que hi a .VIII. grant roiames. E toutes foies entendés †{qe je ne voç}† sanz celz de l'isle, que sunt grandismes quantités des roiames. Or voç conteron de la meçane Yndie que se dit Abasce.

The following chapter is devoted to Abyssinia (*F* CXCII 2):

> Or sachiés que Abasce est un grandissme provence que est la meçaine Yndie. Or sachiés que le greingnor roi de toute ceste provence est cristiens, et tuit les autres rois de la provence sunt sotpost a lui, et sunt .VI., entres les quelz en a .III. cristienz et .III. saraçinz. [18]

In F 179 (f. 25r), this articulation is lost, due to the effect of a *saut du même au même* generated by mentioning twice the number of realms.

> *M*inor vero *I*ndia durat a *C*iambu usque ad motisi in qua sunt .VI. regna magna *E*x quibus tres reges sunt christiani. tre. . .que (*lacuna*) sarraceni. *V*erumptamen rex principalis totius provincie cui reliqui alii sunt subiecti christianus existit. *e*t vocatur hec provincia *A*basce que dicitur india mediana *I*n qua sunt .VI. magna reg. . . (*lacuna*) [. . .]

In A, B, and W, the same *iunctura* (*Ciambu usque ad motisi in qua sunt .VI. regna magna*) can be found, as well as the same conclusion (*et vocatur hec*

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provincia Abasce que dicitur india mediana), generated by the same error:

> A 169 (f. 106v) M. v. yndia d. a ciauba u. ad motisi in q. sunt .VIII. regna... *E*t v. h. p. abasce q. d. y. m. i. q. s. .VI. regna magna
>
> B 86 (f. 22c) ^{M}. v. i. d. a cyamba u. ad monchi i. q. s. .VIII. magna regna... et v. h. p. abasche q. d. i. m. i. q. s. .VI. regna magna
>
> W 86 (f. 143b) M. v. Jndia d. a cyanba u. ad monchi i. q. s. .VIII. magna regna... et v. h. p. Abasche q. d. Jndia m. i. q. s. .VI. regna magna

Only V 179–80 (f. 33r) has a structure that reflects the Franco-Veneto model *F*:

> [179] Minor vero india a Cianba usque ad motifi in qua sunt .8. magna regna absque regnis ysularum que sunt multa. || [180] *de maxima provincia abasce que dicitur india mediana.* | Abasce est maxima provincia. et ipsa est india mediana in qua sunt .6. magna regna. ex quibus tres reges sunt christiani. tresque saraceni. [vex] (*cassato dal copista*) verum tamen principalis rex tocius provincie / cui omnes reliqui sunt subiecti christianus existit.

The common geographical location of A, B, and W also matches at the textual level: the three manuscripts record a text that is the same in many *loci*, against the common readings of F V. One can assume that this variance is ascribable to the clerk who, in the Flemish area, made the copy that served as their common ancestor. Further evidence is offered by a passage, which has been thoroughly analysed in Burgio, 2008, p. 54, describing the sledges used in Northern Asia (F CCXVI 10):

> [...] ont il fait faire une trejes qe ne a roies, {n}e sunt faites en tel mainere q'eles alent {sor} por la glace e por la boe e por le fanc, si qe ne i se fiche mie trop. E de ceste trejes en a maintes en nostri païs, car elle sunt celle ou l'en aporte sus le fen e la paie l'invern{o}, quant il est grant pluie e grant fanc.[18]

F 195 (f. 26v) and V 197 (f. 35v) read:

> [...] habent enim machinas ex lignis atque rotas taliter ordinatas / quod super glaciem bene currunt / et in luto parum se figunt. quas in partibus nostris appellamus troias (*treias* V).
>
> A 185 (f. 115v), B 148 (f. 35b), and W 147 (f. 159d) agree in providing the underlined information in a different form: *quas in partibus nostris appellamus in flamingo slede* (*sledem* B, *sleden* W).

B and W are copies produced independently from the same model. A major piece of evidence supporting this hypothesis is a macroscopic material error which occurred in the disposition of the quires before their binding to form the manuscript used by the scribes of B and W: at least two quires underwent a change of position. Due to this error, in B 69 (f. 17b) and W 69 (f. 138b), the text shifts without any break from *et bene ei providetur a magno chane* (= F 80, f. 13r: *et bene eis domino providetur*) to *Fratres regulares et presbiteri in more suo eis reverenter valde obviam accesserunt* (= F 160, f. 21r: *fratres regulares et presbiteri more suo* etc.), namely from the description of the postal system in the Mongol Empire to the report of the arrival of Buddha's relics at the Mongolian capital (described in the chapter on Sri Lanka); in B, f. 23c / W, f. 145c, the last sentence of this section, *et est hec civitas sub dominio melich de cormos* (= F 185, f. 25v: description of Calacu) is followed by the *incipit* of BW 92 *Per vias vero principales et ordinatas versus quascumque provincias arbores plantate sunt super vias* (= F 81, f. 13v: description of the roads arboreal ornamentation practised in China). This displacement obviously involves the deferral of the previous section according to the pattern that is represented in table 1.

3.3 The Melione stemma

To sum up, the history of the textual transmission of L can be condensed in Fig. 3.

Though the *stemma* is a two-branch one, it does not produce any equivalence in variants: all cases of opposition α versus β are normally solved by *collatio* between their readings and those of the Franco-Veneto model (*F*). This would result in V being chosen as the base-text for the edition. Yet, this

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Table 1 Displacements in the *Melione* tradition

A F V	F 1–80; A 1–75; V 1–80	F 81–160; A 76–150; V 81–160	B 160–84; A 150–74; V 160–85	B 185–200; A 175–90; V 186–202
B W	B 1–69; W 1–69	B 92–141; W 92–140;	B 69–91; W 69–91	B 141–52; W 140–51

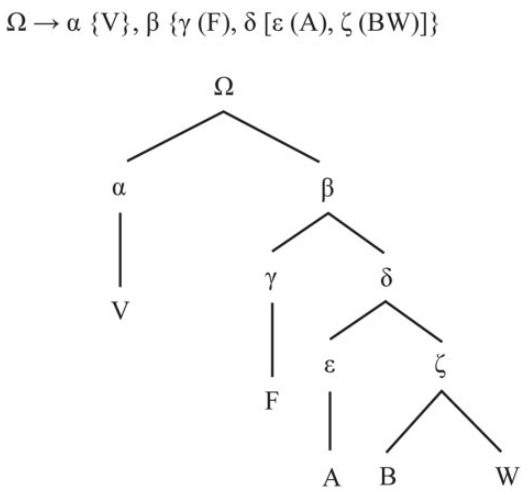


Fig. 3. The *Melione* stemma

method is not completely pursuable because of a variable that has to be taken into careful consideration. Filippo da Fagagna was not a careful scribe, and he gave an idiosyncratic linguistic form to the text he was copying. This makes it preferable to use F, correcting its isolated readings by the concordance of V (α) and δ (and/or *F*).

4 The Application of Computer-Assisted Methods to Textual Criticism

The application of computer-assisted methods to the study of textual traditions seems to be quite simple in principle. The witnesses are transcribed in full, and their texts are 'aligned' in a matrix where corresponding words at corresponding locations in the texts appear on the same row. Each row is then encoded as a string of characters (with each character corresponding to either a word or more complex features, such as rearrangements of word order) and then usually converted to a NEXUS file, the most common format used by tree-building programs based on various methods (see, among others, Howe and Windram, 2011, pp. 1–2).[19] These methods are usually called quantitative in that all the 'variants' (or rather, variant places) are taken into consideration independently of their nature and of their stemmatic weight. Trivial errors can be corrected *ex ante*, and variants that are judged as poorly informative, e.g. spelling variants, can be normalized while aligning the text. Although computer-assisted methods are claimed to have been variously used in several editorial projects, including the *Lanseloet van Denemerken* (Salemans, 2000), the Middle High German poem *Parzival* (Stolz, 2003), parts of the New Testament (Spencer *et al.*, 2004), treatizes on the use of the astrolabe (Eagleton and Spencer, 2006), writings of St. Gregory of Nazianzus (Macé *et al.*, 2004), historical poems on the Kings of England (Mooney *et al.*, 2001), Dante's *Monarchia* (Windram *et al.*, 2008), the Mahabharata (Phillips-Rodriguez *et al.*, 2010), and the Finnish *Legend of St. Henry* (Roos and Heikkilä, 2009), the very few genuine comparative studies published so far have shown that the results are not always in agreement with those from 'conventional' scholarship.[20] For example, Paolo Trovato's (2009) intense essay *Di alcune edizioni recenti di Antonio Pucci, del codice Kirkup e della cladistica applicata alla critica testuale* is critical of the achievements of cladistics in the study of Pucci's *Reina d'Oriente*. Trovato's stemmatic hypothesis, carried out by using a neo-Lachmannian qualitative approach to the text, is detached from Robin's cladograms obtained by applying a quantitative method (in Motta and Robins, 2007). The major difference consists in that the cladogram groups

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together two witnesses, M and K (traced back to a common ancestor γ), which should instead be kept apart given that they share only 'correct or at least indifferent readings' ('accordi in lezioni buone o almeno indifferenti') (Trovato, 2009, p. 95). From an editorial point of view, this is relevant since

> [m]entre nello stemma di Robins ci troviamo di fronte a una recensione aperta con soluzioni equiprobabili ($\alpha + \beta = \gamma$), nello stemma che chiameremo per comodità Bettarini Bruni-Trovato l'accordo K + M o K + η basta a ricostruire con sicurezza la lezione dell'archetipo, ossia della redazione più antica del cantare cui siamo in grado di risalire, consentendoci di valutare con maggior precisione anche gli apporti dei successivi rifacitori [...].[21]

Further comparative research needs to be performed to better evaluate the reliability of potentially promising automatic methods for producing stemmata.

5 Comparing the Results of our Textual Traditions

5.1 The Chronicle data

The application of four computer-assisted methods—namely, RHM, Semstem, NeighborJoining (NJ), and NeighborNet (NNet)[22]—to the *Anglo-Saxon Chronicle* textual tradition has led to the results represented in the following graphs, where the numbers (1) and (2), respectively, indicate text with erased content,[23] and text with corrections or interpolations made by later medieval hands.[24] For the first application, manuscript F was excluded since it is a bilingual epitome of E, and therefore not very informative from the stemmatological point of view. Furthermore, minimal normalization was introduced (e.g. ð versus þ in the appropriate contexts) to avoid bad results due to potentially misleading spelling variation.[25] Before commenting on the outcome, it should be kept in mind that, differently from traditional stemmata, the graphs analysed in Figs 4–7 are unrooted (unless one decides to root them manually) and unoriented (they do not say anything about the direction of changes/innovations).[26]

As can be easily seen by comparing the tree-like structures, the four methods give similar results for the grouping of witnesses, in that they all show the structure ((D,E), A, (B,C)). These results are very much consistent with the manually drawn stemmata (Figs 1 and 2).

If F is added, the outcome changes only for Semstem (Fig. 8).

The Semstem graph still captures the close and unique relationship between D and E (which share a common ancestor represented by the internal node governing them both). Yet, the same graph tells us that this is also true of A and F; on the contrary, one knows from the history of the *Chronicle* transmission that F is an epitome of E, and A is among its sources. Therefore, A and F cannot share a common ancestor.

Let us now turn to the other three methods. While RHM (Fig. 4) is not designed to account for the mutual 'distance' between the witnesses (as can be easily inferred from the invariable edge length of the model), NJ (Fig. 6) is able to tell us, for example, that the edge length separating D and E from the rest of the tradition, including A, is quite relevant, which suggests that there is significant evidence setting D and E apart. The same can be said of B and C. NJ also seems able to capture the fact that B, C, D, and E can be taken to descend from a common version of the *Chronicle* (as the graph's central node suggests), quite distant from A. This is perfectly coherent with the historical framework as sketched above under section 2. Finally, NJ has detected that the relationship between B and C is closer than that between D and E, whose mutual distance in the graph is larger. Therefore, this phylogram seems to confirm Plummer's hypothesis that 'A, C(/B), D, E, have every right to be considered distinct Chronicles' (Plummer, 1972, p. II.xxiii), and offers a potential editor the basic information they need to make their own choices both from a reconstructive perspective, as well as from a documentary one.

The NNet graph (Fig. 7) suggests that there may be some contamination between A and the (D,E) (B,C) groups. Yet, the phylogram, due to its intrinsic

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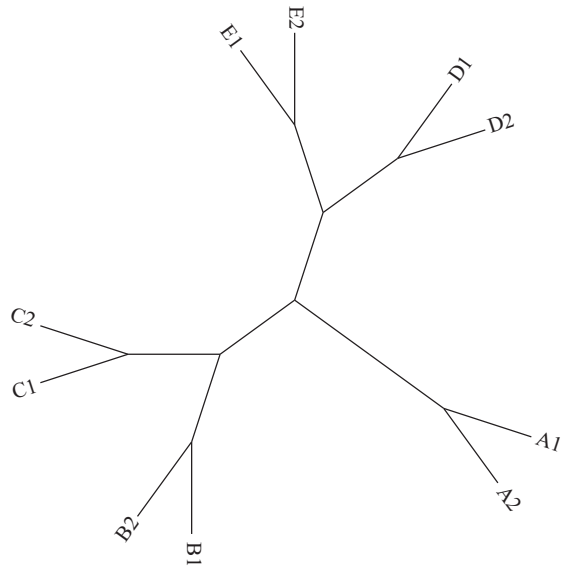


Fig. 4. RHM-*Chronicle*

unoriented nature, does not say anything about the direction in which contamination has acted. Furthermore, what appears even less convincing is that D (and not E) seems to be the contaminated witness. In fact, as we have shown above, it should be exactly the other way around. If F is added, the outcome remains very similar with respect to A and E (Fig. 9).

Therefore, though the idea of using methods which allow the reconstruction of phylogenetic networks to cope with contamination is in principle very promising (Howe and Windram, 2011, p. 3),

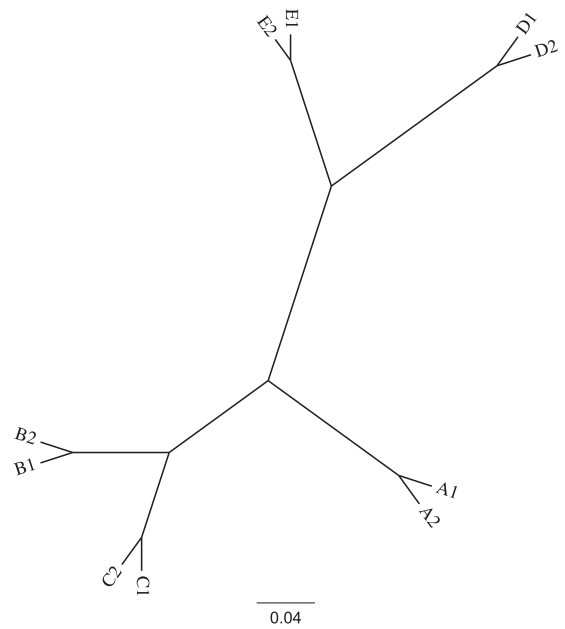


Fig. 5. Semstem-*Chronicle*

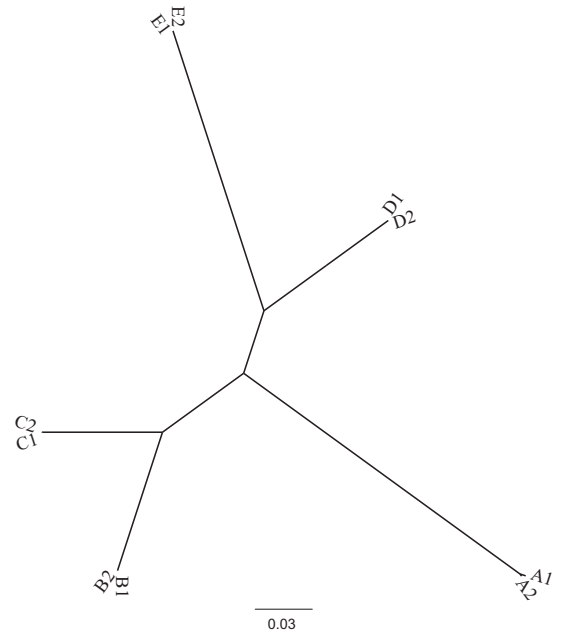


Fig. 6. NJ-*Chronicle*

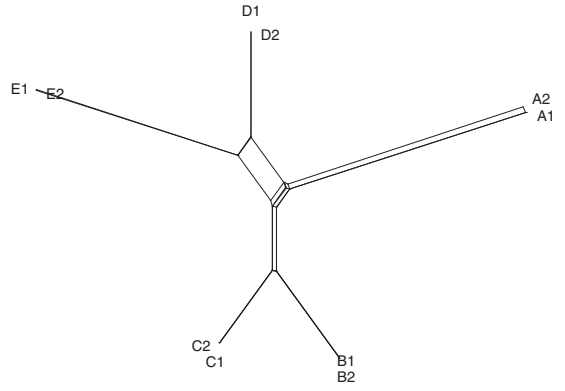


Fig. 7. NNet-*Chronicle*

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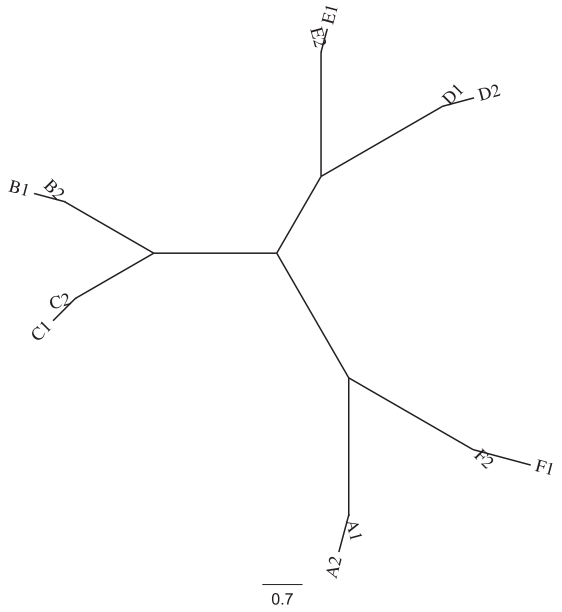


Fig. 8. Semstem (including F)-*Chronicle*

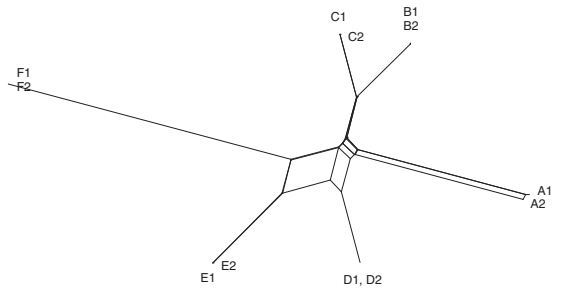


Fig. 9. NNet (including F)-*Chronicle*

the model(s) should be fine-tuned for best practical results.

5.2 The Melione data

The Latin *Melione* tradition has been the object of the application of four computer-assisted methods—namely: RHM, Semstem, NJ (also used in the study of the *Anglo-Saxon Chronicle*), and Maximum Parsimony (PS).[27] Their results are represented in Figs 10–13.

The four graphs provide analogous, though not identical, information. In particular, they all identify three groups of witnesses: ((V,F), (B,W), A). Within this general framework, the data to be particularly highlighted are the separation of A from the other branches of the tradition, and the

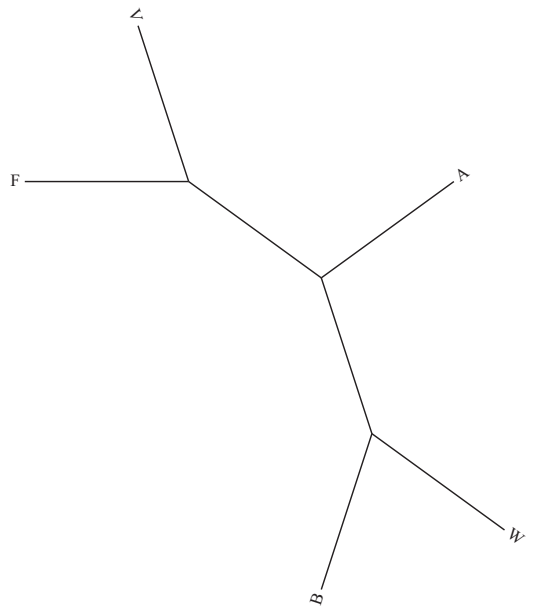


Fig. 10. RHM-*Melione*

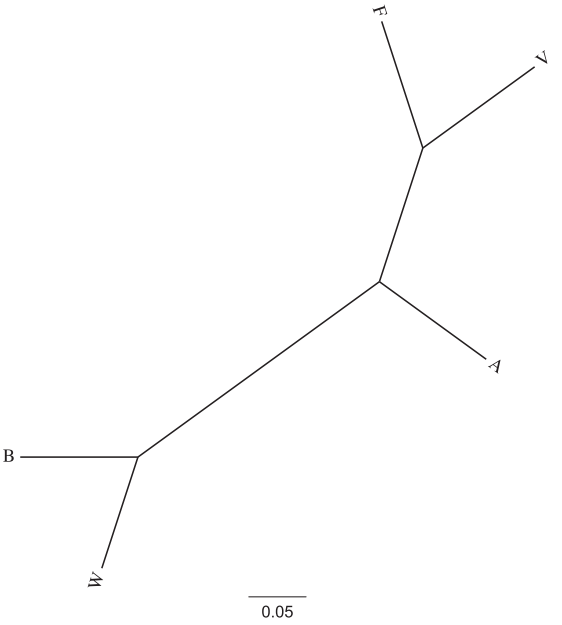


Fig. 11. Semstem-*Melione*

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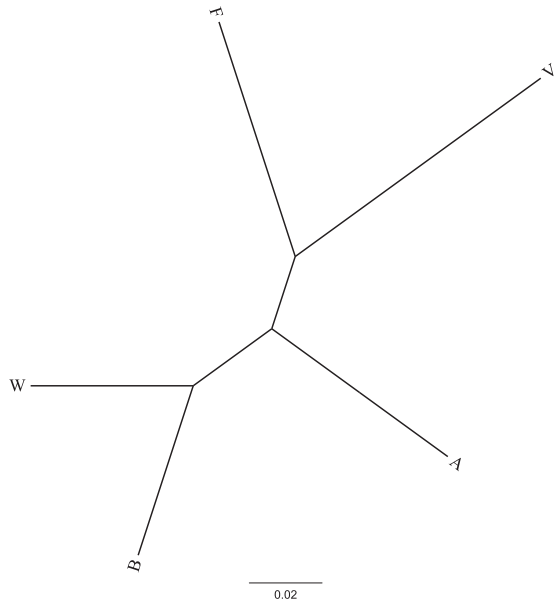


Fig. 12. NJ-*Melione*

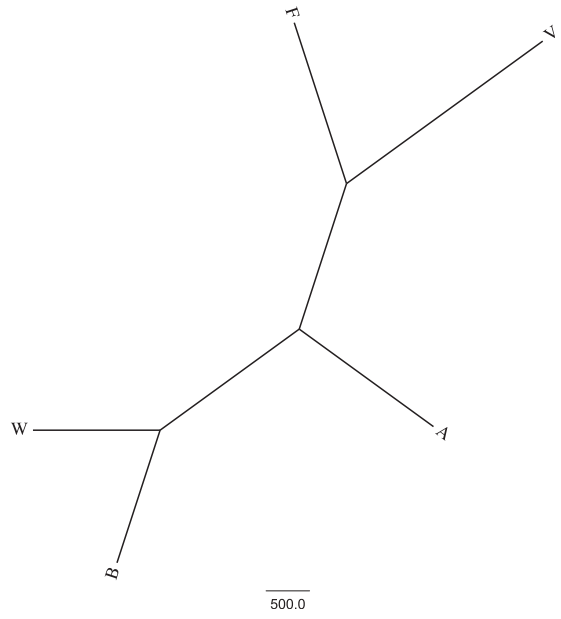


Fig. 13. PS-*Melione*

identification of V and F as independent copies of the same model.

The graphs produced by RHM and Semstem do not allow to proceed further in the analysis, since edge length is either not relevant or not remarkable. On the contrary, in NJ and PS, edge length proves crucial for a historical interpretation of the data in that it indicates, in direct proportion, the 'distance' of each witness from the respective node, and of each node from the root (the alleged 'original' textual state of *L*), if the philologist wishes or needs to fix it. The heart of the matter is indeed where 'to root' the graphs; the historical background seems to indicate that the root is to be located at the node (V, F), or very close to it: in fact, *L* was produced in Italy (as the passage on the sledges, quoted above, demonstrates), and V and F are the only Italian witnesses in the tradition of the *Epitome*. Both NJ and PS suggest then that F—the witness which is closest to the root—represents the textual status that, in the history of transmission, was subject to the smallest deviation from the original. PS however differs from NJ for the position of (A), which the latter locates at a greater distance from the root than (W, B).

To summarize, both NJ and PS identify F as the witness which is closest to the root as fixed by the philologist taking into consideration external evidence (i.e. historical data), and suggest it should be considered as the base-manuscript to produce the critical edition of *L*. However, the two graphs differ in the placement of A: PS locates A closer to the root with respect to (B, W), and B is the farthest witness, while NJ apparently gives the opposite order, and places A at a greater distance than (B, W).

5.3 'Stemma does it better'

The comparison between the PS/NJ graphs and the stemma given under section 3.3 (Fig. 3) allows to raise some points of discussion. A first important observation concerns the relationship between (A) and (B W), oppositely defined by the two graphs. This difference, albeit small, is indeed inferable from the graphs, and it is not trivial from the point of view of a philologist-editor. If we did not have the text of F and/or V and wanted to edit *L* using the text of the other three witnesses, NJ would suggest to use W, and PS to use A. In the absence of F/V, the method to be preferred is the one that orients the

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editor towards the *dispositio* recoverable from A. Due to these reasons, our analysis will now focus in particular on PS.

The PS graph agrees with most of the conclusions of the qualitative analysis—e.g. the priority of F, and the superiority of (F V) over (A) and (B W)—but some important deviations can also be noted. The 'traditionally' drawn stemma, which in the Neo-Lachmannian tradition also incorporates the data gathered from the historical dimension of each single witness,[28] pivots on a clear-cut bifurcation; the sub-grouping of the witnesses is significantly different from the one suggested by the graphs, particularly as regards the position of A, located in the β branch (in turn divided into γ and δ), and V, the only representative of the α branch (PS seems to group V with F in the same branch, and so does NJ). Another non-negligible difference concerns the *codices interpositi* postulated by the stemmatic hypothesis: the cladistic PS analysis, which pursues a principle of parsimony and therefore tends to choose the most economical representation in terms of 'treelength',[29] does not recognize the existence either of β, or of α and γ (Fig. 3). Only δ (i.e. the shared ancestor of A and B, W) and ζ (the shared ancestor of B and W) are spotted.

This is, of course, a fact inherent in the method; nevertheless, this is what might make it less applicable from an editorial point of view (at least to a closed tradition): both the manually drawn stemmata and the computer graphs are, of course, working hypotheses; yet, while the former, albeit hypothetical, is always able to orient the philologist in the choice of a variant reading over another, the latter is not. With this respect, two points are crucial: (1) the absence of branch β leads to a misinterpretation of some readings, since by applying the 'law of majority' the corrupted variants shared by F and δ against V would be wrongly considered acceptable (e.g. the error shared by F 31 and δ, A 28 B 29 W 29: *monstrum* would be given priority over V 31: *nostrum*, see above *3.2*); (2) the choice of F as the base-text is not sufficient to account for all the cases in which it is necessary to discard a *lectio singularis* of F to the advantage of a reading shared by α (V) and δ (A B W).[30]

6 In Lieu of a Conclusion

A thorough examination of our case studies, in which some quantitative methods for computer-assisted stemmatology were compared to more traditional qualitative approaches, has shown that not all these methods provide results which can be considered equally reliable in light of not much of the stemma itself but rather of the evidence offered by the scrutiny of the documentary history of the texts under inspection. RHM and NJ give the best results for the *Anglo-Saxon Chronicle* set of data ('open' recension), while PS proves to be the most reliable for representing the *Melione* tradition ('closed' recension).

This latter case study, in particular, has revealed that a computer-assisted approach succeeds in providing very good information for detecting the major groups of witnesses, as well as for a preliminary evaluation of their variant readings; yet, it does not seem to offer much guidance as to how to establish a priority of a variant reading over another. This limitation becomes particularly crucial in the presence of a 'closed' recension due to its constant dependence on the stemmatic configuration (a dependence that an 'open' recension shows only at a lower degree), and especially when the existence of more than one *codex interpositus* has to be postulated, i.e. when the historical evidence makes it clear that the actual textual transmission cannot conform to the mathematical ideal of cladistic parsimony.[31] Though further investigation is needed, the application of computer-assisted methods to 'open' recensions seems to give better results, as the case of the *Anglo-Saxon Chronicle* has clearly shown. In applying computer-assisted stemmatology for editorial purposes, the type of tradition under inspection ('closed' versus 'open') has proven more relevant than its extension and width.

Furthermore, a fact that should not be neglected is that the complete transcription of the primary textual data (as opposed, for example, to the traditional prior selection of *loci variantes* to be submitted to the editor's *iudicium*), as well as their subsequent alignment, can be complex operations, and are not without a certain amount of inherent ambiguity in the data treatment and risk of making

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errors.[32] An advantage is undoubtedly that, once this complex process has been completed, the data at the disposal of a philologist are quantitatively more and more easily reusable than in the traditional methods.

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Notes

1 Open recension is very often synonymous with 'contaminated recension'.
2 See, for example, Trovato, 2014, p. 73.
3 On artificially created textual traditions see, among others, Macé *et al.*, 2006.

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4 For the purpose of the Italian academy, Marina Buzzoni is the research group coordinator and is responsible for sections 2 (2.1, 2.2), 4, and 5.1; Eugenio Burgio is responsible for section 3 (3.1, 3.2, 3.3); Martina Modena is responsible for section 5.2; Samuela Simion is responsible for section 5.3. Sections 1 and 6 have been jointly written by the four authors, who warmly thank Teemu Roos and Yuan Zou (University of Helsinki) for providing the graphs presented under section 5, as well as for their cooperation in commenting the results.

5 Fourteen according to Plummer, 1972, pp. II.xxv-xxvi; five according to Ker, 1957, p. 58; six according to Parkes, 1976, p. 154 and Bately, 1986. p. xxi; ten or eleven according to Dumville, 1983: 42, who takes into consideration only the scribes contributing to the sections 924–1001. The fact that some hands closely resemble one another makes it very difficult to discriminate between them.

6 Slight changes in the hands suggest that it might have been updated annually ca. 1043–48.

7 No more than half a page of the text can have been lost because a new annal (for 1130) starts at the top of the other side (Cubbin, 1996, p. xi).

8 For a general overview, see Bately, 1986, pp. lxxiii-lxxxix.

9 Notice that David Dumville (Dumville and Lapidge, 1985, pp. xxxv–xxxvi), however, maintains that this evidence is too slender to draw substantial conclusions about the position of the *Annals of St. Neots* in the text-history of the *Chronicle*.

10 Yet, their history may be more complicated as the scribe of C seems to have copied B up until 652, and then drawn material from other sources.

11 The same *sigla* is used here as that chosen for my critical edition of *L* (forthcoming). Dutschke, 1993 gives ample information about the witnesses.

12 The number of chapters are 190 in A, 152 in B, 200 in F, and 151 in W. Variance in number of chapters is a common phenomenon in the *Devisement* tradition, because translators and scribes freely mixed up chapters of their model. The variance between *L* and *F* can be explained in large part by the deletion of many historical chapters in *L*: for example, the last chapter of *L* (V 202) summarizes the content of *F* CCXXI-CCXXXII; see also Burgio and Mascherpa, 2007, pp. 136–37.

13 Hereafter, *F* will be quoted according to the 2010 edition by Eusebi (the English translation is taken from Ricci, 1931). F will also be used as the base-text for the *collatio* (manuscript punctuations, *comma* and dots, have been kept, the *tituli* have been changed into letters, and italicization has been used for the characters marked in red).

14 'I will not tell you of India at this point, for I wish to do so further on in this book, in due time and place. At present, we will turn northwards, to tell you of the countries there, returning by another road to the city of Kerman, of which I have already spoken, for you cannot reach the countries of which I wish to tell you, except through that city of Kerman.' (Ricci, 1931, pp. 46–7).

15 See e.g. F 3 (f. 2r) *Qua de causa iter revertendi Soldadiam impeditum erat* [. . .].

16 '[. . .] they make fish-biscuits. They cut the fish up into pieces, and [. . .] they make cakes of them, perhaps weighing a pound each, and dry them in the sun; these they store away in their houses, eating them in the course of the years, like biscuits.' (Ricci, 1931, pp. 355–6).

17 'Lesser India stretches from Chanba to Mutfili, with eight large kingdoms; but you must understand [. . .] without counting those in the islands, which come to an immense figure. Now we will tell you of Middle India, namely of the province of Abash.'; 'You must know that Abash is a very large province and constitutes Middle India. You must also know that the chief King of all this province is a Christian. All the other Kings of the province are subject to him; they are six – three Christians and three Saracens.' (Ricci, 1931, p. 347).

18 '[. . .] they use sledges, which have no wheels, and are made in such a way that they can travel on ice, as also on mud and mire, without sinking in too much. There are many of these sledges in our countries, too, namely those on which we carry hay and straw, in winter, when there is a great deal of rain and mud.' (Ricci, 1931, p. 386).

19 Of the methods analysed below (section 5), only RHM takes the actual textual data, after they have been aligned.

20 Perhaps it goes without saying that the term 'conventional' is an overgeneralization of different stemmatological procedures that are not computer-based.

21 'While in Robins' stemma we are faced with an open recension which offers equiprobable solutions ($\alpha + \beta = \gamma$), in the stemma which, for the sake of convenience, we shall label "Bettarini Bruni-Trovato," the agreement between either K+M or K + η is sufficient in order to reconstruct the reading of the archetype, i.e. the oldest redaction of the text to which we can go back, thus enabling us to evaluate with higher precision the interventions of later rewriters [. . .]' (Trovato, 2009, p. 96).

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22 On RHM, see Roos and Heikkilä, 2009, pp. 432–33 (i.e. Appendix: A Description of the RHM Method); on Semstem, see Roos and Zou, 2011; on NeighborJoining applied to stemmatology see van Reenen, den Hollander, and van Mulken, 2004; on the possible application of the NeighborNet method, especially to contaminated tradition, see Howe and Windram, 2011. A preliminary distinction between RHM and the other methods consists in the fact that the graphs produced by the former do not have edge length. Semstem, based on a structural EM algorithm (Roos and Zou, 2011), is able to produce multifurcating stemmata—where the other methods only produce bifurcating stemmata—as well as to place manuscripts in internal nodes—where the other methods place them in the leaf nodes.

23 For example, Ms A *s.a.* 90: Annal erased; restored reading based on *G.

24 For example, Ms A *s.a.* 101 [*Hand* 8: Her Clemens papa forþferde].

25 'Normalization' is a long-debated problem both from the conceptual and the methodological points of view (see, among many others, Cadioli and Chiesa, 2008). Here it has been kept to a minimum, with the sole intent of removing misleading signals for the computer programs. Giving a fully normalized version of texts that 'live in variants' would entail a return to the non-normalized version when preparing the edition, thus resulting into a time-consuming process (and not without controversy and complications).

26 All the graphs contained in this section, as well as in the following one, have been kindly provided by Teemu Roos and Yuan Zou (University of Helsinki).

27 PS is from the PAUP package.

28 Cf. the discussion in Buzzoni and Burgio, 2014.

29 'Coherently with this parsimony principle, the programs compare a great amount of possible dendrograms (treelike branching diagrams), calculating for each tree the number of changes they would account for (their *treelength*), and thus establishing the *Most Parsimonious Tree* (MPT)' ('Coerentemente con questo principio di parsimonia, i programmi informatici confrontano un vasto numero di possibili dendrogrammi (diagrammi simili ad alberi con biforcazioni), calcolando per ogni albero il numero di cambiamenti a cui esso darebbe luogo (la sua *treelength*), e identificando così l'albero più parsimonioso (*Most Parsimonious Tree*, MPT)'; Motta and Robins, 2007, p. LXXXXVII).

30 Here are some examples of F's *lectiones singulares* to be discarded by the editor: (1) In F 8, f. 2bis (breaking news of the Pope's death took the Polo's brothers on their way to Acri by surprise) *dum ad Layas pervenissent ad Acri* is opposed to V and *δ dum de Layas pervenissent ad Acri* (and this reading is confirmed by F IX 2 *Et de Laias se partirent et s'en alent ad Acri* [...]: 'They left Laias and went to Acre [...]', Ricci 1931, p. 8); (2) the people of Camandi: V and *δ Estate vero tantum habent calorem quod nullatenus possunt vivere in civitate*, while F 30, f. 5bis reads *colorem*; (3) F 50, f. 7bis explains that the people of Ciarcian [...] *fugiunt cum eorum uxoribus et bestiis in arenis* [...] when some enemy arrives; the reading of V A and W [...] *fugiunt cum eorum uxoribus et filiis et bestiis in arenis* [...] is confirmed by the Franco-Veneto tradition, *F* LV 8 [...] *il fuient con lor femes et con filz et con lor bestes entre le sablon* [...] ('[...] the people flee with their women and children and cattle [...]', Ricci, 1931, p. 66).

31 Even the philologists who follow Lachmann's ideas pursue a principle of economy, though attenuated by historical considerations (Contini, 1935, p. I.109; Buzzoni and Burgio, 2014).

32 One might think, for example, of the process of aligning textual dislocations, which can be treated very differently, namely either maintaining the order attested in the manuscripts or changing it—the latter resulting in the loss of a conspicuous amount of information.

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