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Magnetic margins: insights into the digital descriptive census of William Gilbert's *De Magnete*

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ABSTRACT

This essay investigates the reception of William Gilbert's foundational work on magnetism, *De Magnete*, through a comprehensive analysis of extant copies of its early modern printed editions (1600, 1628, 1629, 1633). By employing a hybrid methodology combining quantitative and qualitative approaches to readers' annotations, this study charts patterns of engagement with Gilbert's text across diverse contexts and intellectual traditions. While celebrated for its experimental innovations and practical applications in navigation, it also elicited cosmological and humanist interests. Statistical analyses of readers' marks demonstrate a skewed distribution of engagement, with the majority of annotations concentrated in a small fraction of extant copies. This study moreover contributes to the historiography of early modern science by illustrating the methodological potential of combining large-scale digital datasets with close textual analysis, advocating for more systematic, collaborative approaches to the history of reading and book culture. In addition, a near-complete census of copies of *De magnete* is provided.

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Magnetism; book history; William Gilbert; census; reader annotations; digital humanities

1. Introduction

> I am interested to learn that you have secured that very fine copy of De Magnete. You probably know that there are only 77 copies known to be in existence, and most of these, being in the libraries of public institutions, can never come into the market. There are 165 copies known of the Shakespeare First Folio: so that Gilbert's book is much rarer.[1]
>
> It can be seen from them [the auction catalogs] that the significant price increase [of the sold copies of *De Magnete*], as a consequence of more frequent demand, began at the start of the 1880s of the previous [19th] century. That is, at a time when the internationally coordinated meteorological-magnetic research in the polar regions ('Polar Year 1882–83') had once again provided a powerful impetus to the study of geomagnetism.[2]

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[1] See copy #1458 (ID to be resolved against the census in the supplementary material to this artice). Transcription of a handwritten letter by Sylvanus P. Thompson to T. Vincent Smith Esq. and/or W. Dubrisle, c. 1905.

[2] Translated from Gustav Hellmann, 'Zur Bibliographie von W. Gilbert's "De Magnete"', *Terrestrial Magnetism and Atmospheric Electricity*, 7.2 (1902), pp. 63–66 (p. 66), doi:10.1029/TE007i002p00063: 'Man ersieht aus ihnen [den Auktionskatalogen], dass die große Preissteigerung [der verkauften Exemplare von De magnete], als Folgeerscheinung einer

This essay is the first to provide and study a largely complete census of early modern editions of a milestone in the history of early modern science, William Gilbert's *De Magnete* (DM). First printed in 1600 in London, the work was then reedited and reissued without authorization in 1628, 1629, and 1633 in Frankfurt and Stettin.[3] The 363 recorded copies of the four early modern Gilbert editions and issues are now recorded in a publicly accessible database at magnetic-margins.com.[4] This (still growing) resource contains basic information on provenance, but in particular records marks and annotations by readers of each copy. References in this article to individual copies (#-prefixed) are based on this dataset and its unique IDs. A human-readable census of these copies is included in the supplementary material of this article.

This essay will briefly describe the printing history of the work but will focus on the work's reception based on readers' marks.[5] Readers' marks or annotations are taken as proxies or traces of readers' attention and their interest in the topics of DM.[6] Studying this interest both with a qualitative and quantitative methodology provides a balanced insight into patterns and currents of the reception of this landmark publication. While

häufigeren Nachfrage, zu Anfang der achtziger Jahre des vorigen [19.] Jahrhunderts eingesetzt hat. Das heißt, in einer Zeit, wo durch die international vereinbarte meteorologisch-magnetische Forschung in den Polargebieten (‚Polarjahr 1882–83') das Studium des Erdmagnetismus aufs Neue eine mächtige Anregung erhalten hatte.'

[3]On the re-issues and the complicated print history, see the first section below.

[4]Christoph Sander, Alessandro Adamou, and Hassan El-Hajj, *Magnetic Margins. A Census and Annotations Database* (2022), doi:https://doi.org/10.48431/res/qk19-bj96/magmar; Christoph Sander, Hassan el-Hajj, and Alessandro Adamou, 'Magnetic Margins. A Census and Reader Annotations Database', *Digital Humanities 2023. Collaboration as Opportunity (DH2023)* (Graz), doi:10.5281/zenodo.8107608. The Gilbert census extends to these editions: William Gilbert, *De Magnete, magneticisque corporibus, et de magno magnete tellure; physiologia noua, plurimis & argumentis, & experimentis demonstrata* (excudebat Short, 1600); William Gilbert, *Tractatus, sive Physiologia nova de magnete, magneticisque corporibus et magno magnete tellure sex libris comprehensus* (Typis Götzianis Sumptibus authoris, 1628); William Gilbert, *De Magnete: magneticisque corporibus, vi eius attractiua, & medicinali proprietate, motionibus, vsuque & directione, vt & pyxidis nauticae compositione, terrestrisque globi diurna reuolutione magnetica* (Apud Guilelmum Fitzerum, 1629); William Gilbert, *Tractatus: sive, Physiologia nova de magnete, magneticisque corporibvs & magno magnete tellure, sex libris comprehensus* (Typis Gotzianis, 1633). A condensed census is provided as a separate attachment of this article. For the digital data, see also Christoph Sander, 'Magnetic Margins: Analytical Data', Zenodo, 11 February 2025. doi:10.5281/zenodo.14851167; Christoph Sander, *Magnetic Margins: Analysis* (12 February 2025) <https://github.com/ch-sander/raramagnetica/tree/main/analysis/magnetic_margins> [accessed 12 February 2025]. Providing a final number of copies is difficult as the data is subject to change, and the census includes spurious copies and copies only traced through auction catalogs which may have introduced a small number of duplicates. The extent to which the census is complete remains unclear. However, the majority of copies were located through online library catalogues, both aggregated and individual ones, in addition to conducting individual enquiries with libraries that offer less comprehensive online coverage. Nevertheless, particularly in Eastern Europe, it is suspected that there may be further copies that have not yet been traced. The inclusion of provenance information is primarily contingent on extant cataloguing. Information pertaining to bindings and paper was not recorded, in order to ensure the project's feasibility.

[5]In order to contextualize insights and enable comparisons, the census of two other works on magnetism will occasionally be used as a reference, see Niccolò Cabeo, *Philosophia magnetica* (Apud Franciscum Succium, 1629); Niccolò Cabeo, *Philosophia magnetica in qua magnetis natura penitus explicatur, et omnium quae hoc lapide cernuntur, causae propriae afferuntur, nova etiam praxis construitur, quae propriam poli elevationem, cum suo meridiano, ubique demonstrat, multa quoque dicuntur de electricis, et aliis attractionibus, et eorum causis: additis figuris variis, tam aeneis, quam ligno incisis* (Apud Ioannem Kinckum, 1629); Petrus Peregrinus, *De Magnete, Seu Rota Perpetui Motus, Libellus*, ed. by Achilles Pirmin Gasser (Philipp Ulhart d.Ä., 1558); Raimundus Lullus, *De virtute magnetis* (Marcello Silber, 1520). These census are not included in this publication and are not discussed here either, to limit the paper's scope. References given in the following to to IDs beyond DM can be discovered from the custom copy ID at https://www.magnetic-margins.com/resource/:magnet_Copies.

[6]The phrases '(readers') marks' and '(readers') annotations' will be used interchangeably. For a nominal definition and examples, see Christoph Sander, 'Traces of Attention: A Computational Approach to the Study of Readers' Marks in Early-Modern Printed Books', in *Thinking in the Margins: Marginalia in Medieval and Renaissance Philosophy*, ed. by Mario Meliadò, Cultures and Practices of Knowledge in History, 20 (De Gruyter, 2026), pp. 425–60, doi:10.1515/9783111560229-012. Some exemplification is also included in the semantic documentation on the Magnetic Margins website (https://www.magnetic-margins.com/resource/magnet_Semantics).

a few famous or at least clearly identifiable readers allow for a confrontation of their professional-biographical profile and their interest in DM, a distant reading of all, mostly anonymous readers' marks enables us to chart tacit and shared interests on a large scale.

DM was a prominent and widely received publication in its own time, attracting interest from multiple readerships, as historians of science have unearthed already.[7] The work is composed of six books each with a rather coherent thematic focus, organizing 155 chapters, including 90 images (printed as woodcuts across 77 pages in the first edition) and roughly 254 (folio) pages containing text (66,410 words, including paratexts). Gilbert opts for a decisive departure from Aristotelian natural philosophy by offering an experimentally grounded account of magnetism as a specific natural power (esp. in books 1 and 2). On the basis of systematic experiments, most notably with the *terrella*, a magnetized model of the Earth, Gilbert identifies the Earth itself as a giant magnet and explains geomagnetic phenomena such as declination and inclination (esp. in books 3–5). Instruments like the compass and the inclinatory needle play a central epistemic role as navigational aids and as means of revealing natural (ir)regularities. DM offers a magnetic causal explanation of the Earth's rotation that aligns him with key Copernican claims (esp. in Book 6, and referenced in the dedication letter by Edward Wright). This stance for Copernicus, as well as the work's experimental and rhetorical (anti-Aristotelian) rigour, ensured DM a lasting influence on early modern thinkers, such as Johannes Kepler, Galileo Galileo, Francis Bacon, and René Descartes.

A close look into all of these readers' reception of Gilbert's ideas confirms and extends dominant historiographical narratives on how DM impacted early modern science. While older historiography primarily emphasized the work's relevance for experimentalism and practical application of magnetism for navigation,[8] Steven Pumphrey has shown that DM was read as a cosmological work by its first readers.[9] Both these aspects are in fact reflected in the readers' annotations, with some fascinating examples. Moreover, surveying thousands of readers' marks proves that the reading of this work was often surprisingly humanist, in the sense that Gilbert's impressive doxography and engagement with other authors' works received particular attention.[10] This might say as much about the practice of annotating or reading itself as it does qualify the more specific interest in Gilbert's work.[11]

[7]As a starting point, see Christoph Sander, Magnes*: der Magnetstein und der Magnetismus in den Wissenschaften der Frühen Neuzeit*, Mittellateinische Studien und Texte, 53 (Brill, 2020), pp. 825–39 <https://doi.org/10.1163/9789004419414>.

[8]See, e.g., Mary B. Hesse, 'Gilbert and the Historians (I)', *The British Journal for the Philosophy of Science*, 11.41 (1960), pp. 1–10; Mary B. Hesse, 'Gilbert and the Historians (II)', *The British Journal for the Philosophy of Science*, 11.42 (1960), pp. 130–42; Edgar Zilsel, 'The Origins of William Gilbert's Scientific Method', *Journal of the History of Ideas*, 2.1 (1941), pp. 1–32.

[9]See esp. Stephen Pumfrey, 'William Gilbert's Magnetic Philosophy, 1580–1684: The Creation and Dissolution of a Discipline' (unpublished Diss., University of London, 1987).

[10]See, e.g., Christoph Sander, 'Magnetism for Librarians. Leone Allacci's *De Magnete* (1625) and Its Relation to Giulio Cesare LaGalla's *Disputatio de Sympathia et Antipathia* (1623)', *Erudition and the Republic of Letters*, 5.3 (2020), pp. 274–307, doi:10.1163/24055069-00503002.

[11]See esp. Lisa Jardine and Anthony Grafton, '"Studied for Action": How Gabriel Harvey Read His Livy', *Past & Present*, no. 129 (1990), pp. 30–78; *Scientia in margine: études sur les marginalia dans les manuscrits scientifiques du moyen âge à la renaissance*, ed. by Danielle Jacquart and Charles Burnett, Hautes études médiévales et modernes, 88 (Droz, 2005); Heather Joanna Jackson, *Marginalia: Readers Writing in Books* (Yale University Press, 2001); William H. Sherman, *Used Books. Marking Readers in Renaissance England*, Material Texts (University of Pennsylvania Press, 2010); Stephen Orgel, *The Reader in the Book: A Study of Spaces and Traces*, Oxford Textual Perspectives (Oxford University Press, 2015); Renée Jennifer Raphael, *Reading Galileo: Scribal Technologies and the 'Two New Sciences'* (Johns Hopkins University Press, 2017); *Early Modern English Marginalia*, ed. by Katherine O. Acheson, Material Readings in Early Modern

This essay has four main parts. First, the printing history of the individual editions and issues will be outlined, with detailed observations on handwritten corrections during the printing process and additional states and stop press cancellations of individual printed sheets or copies. The second part provides a basic overview of the multitude of surviving copies and their provenance, focusing especially on copies belonging to a selected range of renowned seventeenth-century scholars. The third part addresses readers' annotations from a bird's-eye view, sketching some overarching thematic foci. This includes traces of censorship due to the Copernican theory in Gilbert's work, reactions to the experiments Gilbert describes, a specific type of visual and diagrammatic annotation as well as traces of humanistic reading. The final section offers a glance at some statistical results by way of a quantitative description of annotations as traces of readers' attention. This reveals tacit and shared practices of reading in general as well as emergent clusters of copies in particular.

2. Printing Gilbert

The first edition (London, 1600) of William Gilbert's *De Magnete* was edited and printed with much care, but in too small a print run to meet the demand.[12] This led to later pirate editions executed and distributed predominantly in Central Europe. The 1600 in-folio *editio princeps*, published and printed by Peter Short in London, is extant in 281 known copies. The second edition appeared in 1628 in Stettin, in quarto format, and with a slightly different title. 86 copies are known to exist. Almost 25 years after the author's death, this first edition was re-edited by Wolfgang Lochmann in Stettin and printed by Georg Götzke. While shrouded in some mystery, there is no evidence to suggest that these two later editions were authorized. The editor, in his preface, however, mainly remarks on the shortage of available copies of the *princeps*.

The financial backing for this 1628 print initially came from Johann Hallervord, a bookseller from Rostock. However, financial difficulties likely led to Lochman taking over the project, as he seems to be invested in the project for his interest in mathematical sciences.[13] Evidence supporting this shift in financial responsibility is found in the different states of the engraved title page.[14] The copper plate used for printing underwent two key changes. The word 'Excusum' (M issue) was corrected to 'Excusus' (S issue),

Culture (Routledge, Taylor & Francis Group, 2019); Anthony Grafton, *Inky Fingers: The Making of Books in Early Modern Europe* (The Belknap Press of Harvard University Press, 2020); *Impagination: Layout and Materiality of Writing and Publication: Interdisciplinary Approaches from East and West*, ed. by Ku-ming Kevin Chang, Anthony Grafton, and Glenn W. Most (De Gruyter, 2021) <https://doi.org/10.1515/9783110698756>; *Handschrift im Druck (ca. 1500–1800): Annotieren, Korrigieren, Weiterschreiben*, ed. by Sylvia Brockstieger and Rebecca Hirt (De Gruyter, 2023), doi:10.1515/9783111191560; *Gabriel Harvey and the History of Reading*, ed. by Anthony Grafton, Nicholas Popper, and William H. Sherman (UCL Press, 2024), doi:10.14324/111.9781800081659.

[12] See esp. Franz M. Feldhaus, *Die Begründung der Lehre von Magnetismus und Elektrizität durch Dr. William Gilbert (+1603)* (Winter, 1904); Hellmann, 'Zur Bibliographie von W. Gilbert's "De Magnete"'; Duane H. D. Roller, *The De Magnete of William Gilbert* (Hertzberger, 1959), pp. 174–82; Peter John Wallis, 'The 1628–1633 Editions of William Gilbert's "De Magnete": A Tribute to the Late Clifford Dobb', *The Bibliotheck, a Scottish Journal of Bibliography and Allied Topics*, 6.2 (1971), pp. 33–40. See also Silvanus P. Thompson, 'Peter Short, Printer, and His Marks', *The Library*, 4.1 (1898), pp. 103–28, doi:10.1093/libraj/TBS-4.1.103.

[13] On Lochmann's own interest in mathematics and instruments, see Wolfgang Lochmann, *Instrvmentvm instrvmentorum mathematicorvm: das ist, ein newgeordnetes mathematisch Instrument.. kan gebraucht werden.* (Gedruckt durch N. Barthelt, in verlegung M. Gutten, Buchhändlern in Berlin, 1626).

[14] I would like to thank the library staff of Linda Hall Library and J.P. Asher for confirming and correcting my observations of the different states of the engraved title page. For conceptual distinctions implied here, see G. Thomas Tanselle, *Descriptive Bibliography* (The Bibliographical Society of the University of Virginia, 2020).

aligning with proper Latin grammar, and the phrase '[sumptibus] Hallervordij' was altered to '[sumptibus] Authoris' (referring to Lochmann), indicating a change in the commissioners of the print run. In total, three distinct states of these title page alterations exist (Figure 1). Additionally, the 1628 edition featured new woodcuts throughout, some of which were replaced with copper engravings, and modifications to the paratexts, including added dedications, poems, and an index.

A 1629 Frankfurt title reissue, printed or fabricated by William Fitzer, an Englishman, featured a newly typeset title page, notably lacking the copper engraving. This very rare issue (only 6 copies are known to exist) may have been an unauthorized reselling of the (itself unauthorized) Stettin edition, only replacing the title page. A novel edition was printed in 1633, again printed by Götzke in Stettin, extant in 106 copies. This edition was completely reset and published without the engraved title page, but appears highly similar to the 1628 edition, including the reused woodblocks and copper plates, which however were often only included on one sheet instead of being inserted in their proper places.[15]

All editions listed *errata*. Some of these errors were manually corrected by the readers or owners of the copies.[16] Notably, *errata* from the 1600 edition were corrected in the 1628 print, though this edition also introduced new errors. By the time of the 1633 edition, errors from the 1628 edition were corrected, and, commendably, no new errors were added. Manual corrections of the typeset text are a particularly fascinating aspect of these editions. Numerous copies of the 1600 *princeps* exhibit handwritten corrections, seemingly made by the same hand, as they look almost identical across all copies.[17] This suggests that these corrections were implemented before the sale of the bound copies, i.e., not by the individual owners and readers of the copies. There are numerous minor textual interventions across twelve pages. The extent of these corrections varies among copies; some contain corrections on just one page, while most feature them across all twelve pages. There is good reason to believe that these corrections were added in the print shop, but it remains speculation whether Gilbert himself may have been involved.[18]

These manual corrections are all but one quite simple corrections of spelling or grammar, while on page 47, the hand replaced 'non' with 'aut' in superscript in virtually all extant copies. This emendation of a negation of the text's statement—that straw is attracted by the amber—qualifies as an intervention made by someone with a coherent understanding of the subject matter. It is a semantic emendation (Figures 2 and 3).

Related to these manual alterations is a stop-press cancel of sheet $*4^{v}$, which was reprinted in nine copies to incorporate one of these manual corrections into the printed text.[19] Other sheets do not appear in a different state. It can be assumed that this correction at $*4^{v}$ was realized at an early stage so that the sheet could still be reprinted for subsequent copies.

[15]That the print was reset is immediately visible from different line breaks compared to the 1628 edition.
[16]See, e.g., #1464, #1474, #1551, #1614.
[17]See a visual compilation "mm_data_gilbert-editorial-corrections.pdf' in Sander, 'Magnetic Margins'.
[18]#1495 has an inserted paper slip reading (with typewriter): 'All known copies have ink emendations, which may indicate that Gilbert saw the edition through the press in Peter Short's Bread Street Shop, near to Wingfield House, Gilbert's London Home'.
[19]I found 34 uncorrected copies, 139 copies with a manual correction, and 8 copies with a cancellation in print. See a visual compilation 'mm_data_gilbert_variants-iiiiv.pdf' in Sander, 'Magnetic Margins'.

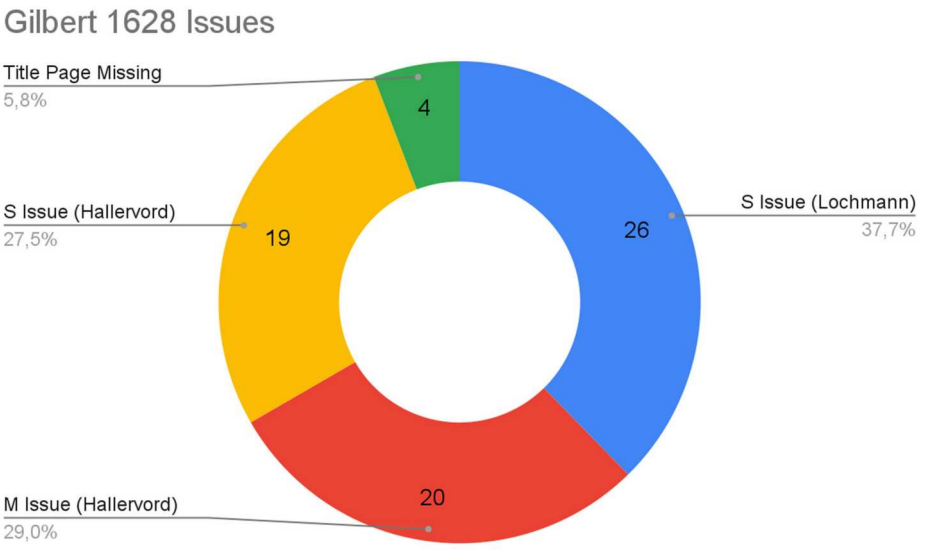

Figure 1. A donut chart showing the distribution of the different issues of Gilbert 1628 based on their inclusion of the state of the engraved title page, reading either 'excusum' (M Issue) or 'excusus' (S Issue).

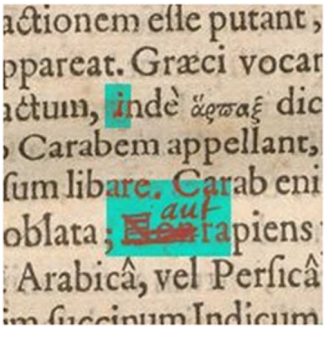

Figure 2. Manual correction on page 47 in Gilbert 1600, occurring in most copies, made by presumably the same hand. While the change from 'unde' to 'inde' is rather stylistic, the correction of 'Non' to 'aut', however, inverses the meaning of the entire sentence. Detail from copy #1354 (Zurich, ETH-Bibliothek, Rar 1253. https://doi.org/10.3931/e-rara-8370), coloured highlighted region added digitally.

In the Gilbert 1628 edition, however, only the engraved title page underwent a grammatical correction by hand, conforming to the amended engraving described above. This also suggests that the manual corrections were made in the print shop, before the new corrected engraving was printed.[20]

While a thorough reconstruction of the print history of DM remains wanting, the observations collected from analysing extant copies display the active role of editors in

[20]Similar patterns of manual corrections at or shortly after print time are observed in Peregrinus' 1558 edition, suggesting a broader practice in the printing and correction processes of the period. See, e.g., on E4v in #1171, #1405, #1408, #1409.

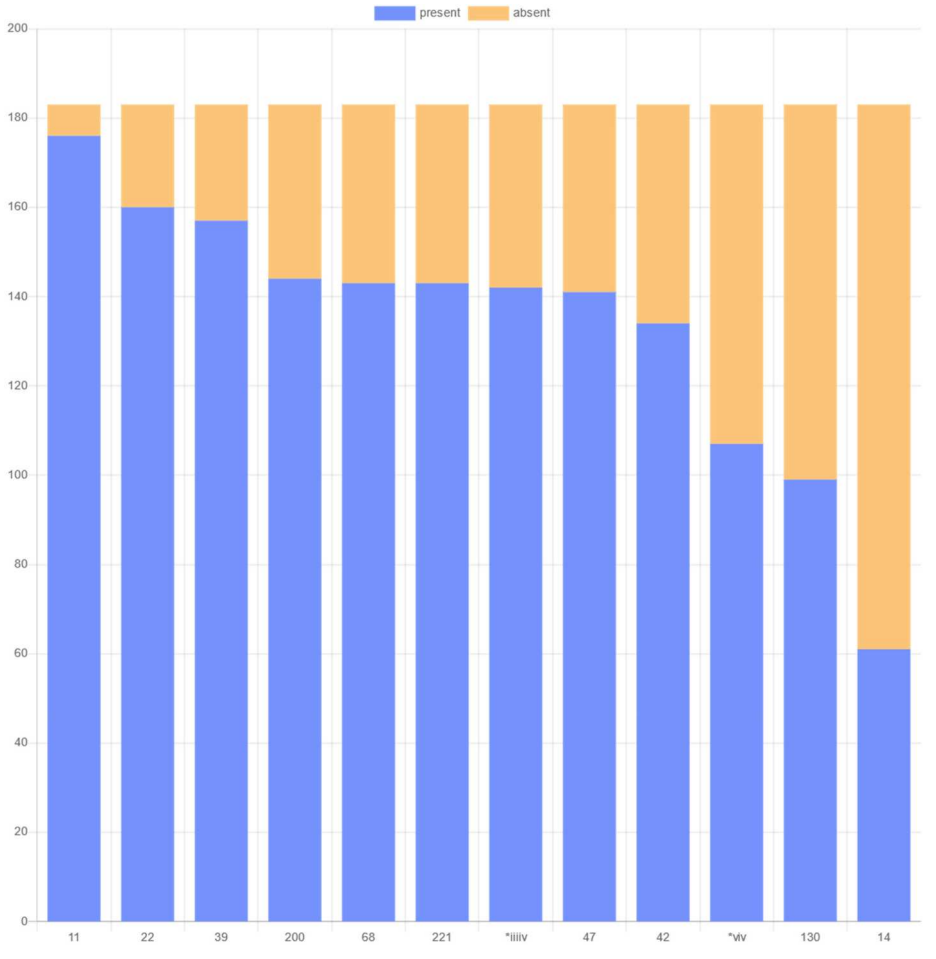

Figure 3. A stacked bar chart displaying the presence and absence of manual editorial corrections in controlled copies of Gilbert 1600. The x-axis shows the printed page numbers, the y-axis the respective number of copies exhibiting the relevant correction(s) on this page as blue bars.

the dissemination of knowledge.[21] How much the editors' job mattered to some readers can be learned from handwritten annotations added by Andreas Granius, seventeenth-century natural philosophy professor at Helmstedt University:[22]

> Granius is repeatedly unsatisfied with the editor of this edition, Wolfgang Lochmann […]. Already on the title page he changed Lochmann's announcement of textual and visual fidelity (*diligenter recognita et emendatius quam ante in lucem edita, aucta et figuris illustrata*) into its opposite: *diligenter* he corrected to *negligenter*, *emendatius* to *vitiosus* and *illustrata* to *obscurata*. He remains faithful to this agenda and corrects Lochmann's text in numerous places. Granius even, almost pedantically, corrected the *errata* of Lochmann's edition.[23]

[21] See *Publishing Sacrobosco's* De Sphaera *in Early Modern Europe: Modes of Material and Scientific Exchange*, ed. by Matteo Valleriani and Andrea Ottone (Springer Nature, 2022).
[22] See copy #1315 and below.
[23] Christoph Sander, 'Magnetism in an Aristotelian World (1550–1700)', in *Alte und neue Philosophie—Aristotelismus und protestantische Gelehrsamkeit in Helmstedt und Europa (1600–1700)*, ed. by Bernd Roling and others, Wolfenbütteler Forschungen, 175 (Harrassowitz Verlag, 2023), pp. 69–105 (p. 91).

3. Famous readers and owners

Gilbert's *De Magnete* has been read by hundreds in the first decades after its publication. While many of these readers may remain anonymous, several can, in fact, be identified through known provenance information gathered from library catalogues and identified owners' marks.[24] Before describing readers' marks as a statistical phenomenon (see last section), there are copies of DM that deserve special attention, mainly because of their very owners' prominence or importance. However, not all of these 'display copies' bear peculiar traces of reading, let alone neatly align with what is known about the reader's intellectual profile. Nonetheless, this lack is sometimes itself revealing. Moreover, even without establishing any pronounced 'pattern of ownership'[25], this sample of identifiable or even famous owners testifies to the dissemination and relevance of Gilbert's work both to specialists in the field and to a wider intellectual or cultural elite.[26]

Among the noteworthy provenances, particular mention must be made of copies Gilbert dedicated to third parties (*ex dono authoris*).[27] These include presentation copies and dedication copies. Six such copies can be considered authenticated, having been verified through digital reproductions of their title pages.[28] Two additional copies are credibly believed to belong to this group but could not be examined visually.[29] Given the limited knowledge about Gilbert's life and social network, coupled with the absence of his correspondence, these presentation and dedication copies cannot be readily contextualized. Their recipients remain unknown to date. Moreover, these copies do not stand out for their traces of reading but are noteworthy solely due to their provenance.

Although it is well documented that some of the most renowned scientists of the early seventeenth century studied Gilbert's book thoroughly, copies owned by these readers have often not survived.[30] For instance, we know that Johannes Kepler and Francis Bacon were among Gilbert's earliest readers, yet no trace of their copies has been found.[31] Another exceptionally early reader of Gilbert, who holds a prominent place in the history of science and is particularly significant for the early reception of Gilbert's work, is Galileo Galilei.[32] Galileo's copy has indeed survived and has received scholarly

[24]A complete reconstruction of the provenance of all existing copies of Gilbert editions from its publication to the present remains wanting. However, the known provenances and profiles of the owners of these copies do not differ significantly from those of other early modern works for which such research has been conducted in greater detail. See n. 11 and 111. Furthermore, a deep-dive into auction catalogs and book trade, or indications and suspicions of counterfeit copies cannot be addressed here, either, but is a promising avenue for future research. I owe remarks in this direction to Nick Wilding. As the necessary research has not been fully conducted, I will abstain from preliminary suspicions to not cause harm to third parties.

[25]See, e.g., Dániel Margócsy, Mark Somos, and Stephen N. Joffe, *The Fabrica of Andreas Vesalius: A Worldwide Descriptive Census, Ownership, and Annotations of the 1543 and 1555 Editions*, Medieval and Early Modern Philosophy and Science, 28 (Brill, 2018), pp. 8, 10–12, 30–55. The authors als remark on p. 35: 'The concentration of the *Fabrica* appears to follow patterns similar to Copernicus' *De revolutionibus*, with most copies located in the southern and western areas of the Holy Roman Empire, the Low Countries, Northern Italy, Rome, Paris, and Oxbridge.' This also holds true for DM.

[26]Copies of magnetism editions beyond DM were, e.g., owned by John Dee (#1444), Achilles Pirmin Gasser (#1170, #1450), Isaac Vossius (#1660), and John T. Graves (#1964).

[27]See also similar presentation copies beyond DM: #1153, #1686, #2178.

[28]See #1020, #1721, #1613, #1709, #1798, #1711.

[29]See #1811, #1812.

[30]See the list in Sander, Magnes, p. 832.

[31]See Johannes Kepler, *Gesammelte Werke*, ed. by Walther von Dyck and Max Caspar, 22 vols (C.H. Beck, 1938–2002), vol. 14, p. 347.

[32]See, e.g., Mario Loria, 'William Gilbert e Galileo Galilei: la terrella e le calamite del granduca', in *Saggi su Galileo Galilei*, ed. by Carlo Maccagni (G. Barbèra, 1972), vol. 2, pp. 208–47.

attention already.[33] However, the copy itself offers relatively little insight into Galileo's reception of Gilbert's work, as the few annotations and underlinings focus exclusively on technical astronomical aspects. A similar observation applies to two copies of the 1633 edition that have been preserved within Galileo's circle of students, belonging to Giovanni Nardi and Vincenzo Viviani.[34] These copies also lack any significant annotations or underlinings that would provide relevant insights. The significance of Gilbert's work as a physical explanation for Copernican cosmology is therefore not clearly reflected in the provenance surrounding Galileo Galilei (see also in the following section).

Other copies owned by renowned seventeenth-century scholars also demonstrate a rather superficial interest in Gilbert's ideas. For instance, the English writer, Ben Johnson, owned a copy and sporadically marked passages in the margins related to the natural history of the magnet.[35] Gabriel Naudé, French librarian, who explicitly mentioned Gilbert in his famous bibliographical work, summarized one of Gilbert's geological hypotheses in a marginal comment.[36] Seth Ward, co-founder of the Royal Society, also left behind a copy of DM.[37] However, this provenance is based on circumstantial evidence, as the copy has been restored in a way that makes definitive proof a matter of debate. Apart from a very minor modification to one of Gilbert's diagrams, Ward's copy is also unremarkable. Additionally, we know that Robert Hooke owned a copy of Gilbert's work, but its current whereabouts remain unknown, as it has not been identified among the surviving copies.[38]

In contrast to these illustrious provenances, which exhibit relatively few or even no traces of reading, there are copies that can be attributed to less renowned but identifiable scholars, which are brimming with annotations and marginal comments. Six examples illustrate this, each containing such an abundance of reading traces that only a rough identification of the main areas of interest is possible.[39] At the same time, all six authors left only minimal or no discernible impact of Gilbert's ideas in their own published works. Thus, their engagement with Gilbert's ideas apparently did not result in any immediate resonance within their own writings.

The copies owned by the mathematicians and astronomers Willebrord Snellius and Anthony Linton are particularly notable for their extensive focus on the practical and applied aspects of Gilbert's work.[40] Since both were authors of navigation manuals, their study of Gilbert's book must be understood in this context. While magnetic cosmology does not play a decisive role in their navigation manuals, the correct use of the compass, and especially the magnetic declination anomaly—a phenomenon crucial for navigation at the time and one to which Gilbert devoted considerable attention—was of paramount importance.[41] Their focus on Books 4 and 5, where Gilbert extensively

[33]Galileo's copy is #1092. For references to Galileo, see also the title page in #1342 and #1049 for a copy bound with a work by Galileo.
[34]See copies owned by Giovanni Nardi (#1069) and Vincenzo Viviani (#1087).
[35]See #1569.
[36]See #1641.
[37]See #1611.
[38]See #2161, #2162, #2163, #2164.
[39]It should be noted that all six copies of Gilbert's work are annotated almost continuously. The identification of focal points is therefore primarily a tentative and qualitative assessment.
[40]See Willebrord Snellius's copy in #1473 and Anthony Linton's one in #1357. Cf. also Anthony Linton, *Nevves of the Complement of the Art of Nauigation: And of the Mightie Empire of Cataia. Together with the Straits of Anian. By A.L. The Principall Contents Whereof Follow in the next Page.* (Imprinted by Felix Kyngston, 1609); Willebrord Snellius, *Tiphys batavus, sive, Histiodromice, de navium cursibus, et re navali* (Ex officinâ Elzeviriana, 1624).
[41]See, e.g, Art Roeland Theo Jonkers, *Earth's Magnetism in the Age of Sail* (Johns Hopkins University Press, 2003).

addresses the phenomena of declination and inclination, is especially noteworthy because these two sections were otherwise rarely annotated by other readers. To this group of readers with a particular interest in navigation, a third scholar can be added: Andreas Granius.[42] However, unlike Snellius and Linton, Granius was neither a mathematician nor the author of a navigation manual, but a natural philosopher at the University of Helmstedt.[43] This makes his focus on the practical aspects of Gilbert's work all the more surprising and noteworthy.

Granius's reading and annotations also engage deeply with Gilbert's cosmological theories, a tendency that also stands out as remarkable and unusual within the broader context of the surviving reading traces. A similar cosmological interest seems to have guided Martin Fogel, a student of Joachim Jungius.[44] Fogel left several comments in the sixth book, focusing on Gilbert's geokinetic theory. However, it is important to note that both Granius and Fogel refrained from taking a clear stance on Copernicus or Gilbert's astronomy and cosmology. This silence can be seen, on the one hand, as a reflection of the politically sensitive debates surrounding heterodox doctrines. On the other hand, it might also suggest an impartial or at least not overtly biased engagement with Gilbert's ideas.

A deeper interest in Gilbert's experiments and natural philosophical theory is evident in a copy owned by a certain Laurentius Deechbroot.[45] Deechbroot appears in connection with Pierre Gassendi but remains an otherwise unstudied figure of the seventeenth century.[46] What makes his annotations particularly noteworthy are the visible attempts to replicate Gilbert's experiments, as will be discussed in the next section.

A final example in this collection is the copy owned by Sebastian Schobinger, a physician, humanist, and librarian from St. Gallen, Switzerland.[47] Schobinger read several works on magnetism, which he connected through cross-references in his annotations.[48] His study of Gilbert's work is primarily situated within a humanistic reading, engaging notably with the author's extensive doxographical summaries. The predominant form of Schobinger's annotations consists of underlining. Unlike the other readers mentioned, his copy contains very few written additions or drawings.

While a general discussion of the role of Gilbert's editions in the libraries and collections of famous collectors, as well as their purchase and sale through documented auctions, cannot be addressed here, it is worth highlighting the copies owned by some prominent figures of the twentieth century.[49] Among the earliest scholarly and historiographical engagements with Gilbert's work are undoubtedly the studies of Silvanus P. Thompson, who also translated DM into English. Two of his copies have been preserved.[50] The German Meteorological Library also holds two copies, though it would

[42]See #1315.
[43]On this, see esp. Sander, 'Magnetism in an Aristotelian World'.
[44]See #1351.
[45]See #1363.
[46]Cf. Sander, Magnes, p. 834.
[47]See #1355. See also Paul Jung, 'Der Stadtarzt Dr. Sebastian Schobinger in St. Gallen (1579–1652)', *Gesnerus*, 5.3–4 (1948), pp. 57–64; Helen Thurnheer, 'Die Bibliothek Sebastian Schobingers' (unpublished Diplomarbeit, Ecole de Bibliothécaires, 1943).
[48]Cf. Sander, Magnes, p. 834, n. 295. See also for examples beyond DM: #1688 and #1689.
[49]For famous historians owning magnetism editions beyond DM, see also the copies owned by Pierre Duhèm (#2021) and by Ian Fleming (#2094).
[50]See #1458, #1534. See also beyond DM copy #2085. See also William Gilbert, *On the Magnet, Magnetick Bodies Also, and on the Great Magnet of the Earth; a New Physiology, Demonstrated by Many Arguments & Experiments*, ed. and trans. by Silvanus P. Thompson (Chiswick Press, 1900); A. C. Lynch, 'Silvanus Thompson—Teacher, Researcher, Historian',

be speculative to attribute them to Gustav Hellmann, who significantly contributed to the early historical study of magnetism as well.[51] By contrast, it is undisputed that a copy owned by Stillman Drake has been preserved, the outstanding scholar for the history of early modern science.[52] Additionally, a copy previously belonging to Umberto Eco has recently become publicly accessible.[53] Eco approached the subject of seventeenth-century magnetism in a literary context, albeit indirectly.[54] Since these early modern copies were already valuable collector's items for their owners rather than scientific reference material, it is hardly surprising that the mentioned copies bear no markings or annotations from their prominent owners.

4. Themes of Reading

A selection of thematic areas or approaches in annotation copies of DM provides a preliminary, broad mapping of the scope of reading DM in its own time.[55] This qualitative and synoptic analysis shows that patterns of reading DM reflect multiple dimensions of seventeenth-century intellectual history, including the expansion of the university canon of natural philosophy, the use of diagrams in natural-philosophical argumentation, ecclesiastical censorship of cosmology, and the translation of scientific literature from Latin into the vernacular. Sketching eight such themes—without pursuing exhaustive discussion for reasons of brevity—once again demonstrates that the study of readers' marks provides a valuable empirical means of assessing the impact of broader intellectual and medial trends among actual readers. These marks reveal the intricacies and conjunctions of divergent yet complementary ways of reading and annotating a book, for example by indexing authors or by adding ego-statements to record replicated experiments. Beyond their value as historiographical indicators, the thematic map of reading practices developed here provides the necessary backdrop against which subsequent computational and statistical analyses can be situated. Only through such qualitative sampling can quantitatively derived results be validated in a historiographically robust manner.

4.1. Classroom readings

Gilbert himself expressed strong disdain for the natural philosophy typically taught at universities of his own time.[56] Little is securely known about the actual use of DM in

Electronics and Power, 33.3 (1987), pp. 173–75; B. C. Shipley, 'Gilbert, Translated: Silvanus P. Thompson, the Gilbert Club, and the Tercentenary Edition of De Magnete', *Canadian Journal of History*, 38 (2003), pp. 259–80; Geoffrey Cantor, 'Thompson, Biographer', *Centaurus*, 63.3 (2021), pp. 475–88, doi:10.1111/1600-0498.12404.

[51] See #1341, #1342.

[52] See #1521. See also copy #2089 beyond DM.

[53] See #1835.

[54] Cf. Umberto Eco, *L'isola del giorno prima* (Bompiani, 1994).

[55] The selection of themes and exemplary copies is based on comments, scans, and tags added during the investigation of all known copies. This methodology relies on the author's 'educated eye' to spot particular noteworthy marks without transcribing and semantically describing all of them to the degree needed for a synoptical study as done here. A convergence of some of the results here with statistical results may, at large, validate both approaches.

[56] See Gad Freudenthal, 'Theory of Matter and Cosmology in William Gilbert's De Magnete', *Isis*, 74.1 (1983), pp. 22–37; Sander, 'Magnetism in an Aristotelian World'; W. James King, 'The Natural Philosophy of William Gilbert and His Predecessors', *Contributions from the Museum of History and Technology Series Bulletin*, 218 (1959), pp. 121–39; Stephen Pumfrey, 'Neo-Aristotelianism and the Magnetic Philosophy', in *New Perspectives on Renaissance Thought: Essays in*

classrooms of higher learning. Annotations often are a tacit trace of learning and studying a book in a pedagogical context. Andreas Granius's copy (see above) suggests that natural philosophy professors used it, as his many annotations impressively demonstrate. Yet, this is rather the exception, except for copies owned by Jesuit colleges or Utrecht theology professor Matthias Nethenus that show little or no traces of didactic use.[57] Moreover, what about students reading DM? One 1628 copy is bound together with a disputation thesis on the magnet from Gdansk.[58] In between these two printed texts, presumably the candidate of the very disputation noted on a flyleaf an experimental instruction on how to magnetize hot iron (*Modus quemlibet obelum ferreum magnete exciendi confricandique*).[59] This combination suggests that a doctoral candidate engaged deeply with Gilbert's work as part of his dissertation and points to a didactic context in which scholarly literature on magnetism was studied.

4.2. Medical readings

Other surviving copies place Gilbert's work in a medical context. Notably, Gilbert being a royal physician himself, his work was sometimes bound together with medical works.[60] Librarians and collectors thus deemed DM to qualify as or to be related to medical literature. Moreover, DM played a significant role in the so-called weapon salve controversy, although unknown to Gilbert himself.[61] This controversy revolved around a magical-medical preparation that claimed to heal wounds at a distance by treating not the wound itself, but the weapon that had inflicted it, with a special ointment. This miraculous healing was often naturalized as 'magnetic.' In this context, naturalistic arguments, some derived from Gilbert's work, played a notable role, as has been extensively documented in the literature. While Gilbert's remark on the medical use of magnets is frequently commented on, contemporary explicit references to the weapon salve itself are hard to find.[62] However, two copies show that Gilbert's work was still studied in the eighteenth century, in a related context: animal magnetism.[63] To both of these copies,

the History of Science, Education and Philosophy: In Memory of Charles B. Schmitt, ed. by John Henry and Sarah Hutton (Duckworth, 1990), pp. 177–89.

[57]See #1049. For copies with a ownership related to the Society of Jesus, see also #1404, #1405, #1364, #1019, #1724, #1768, #1122, #1156, #1178, #1391, #1394, #1432, #1149, #1371.

[58]Attached to copy #1332 is: Petrus Crüger and Adrianus Stodertus, *De motu magnetis disputatio publica ordinaria* (Hünefeld, 1615). The copy itself shows moderate marginal annotations.

[59]The author might have been inspired by Cabeo, *Philosophia magnetica*, p. 333; Athanasius Kircher and Johann Jacob Schweigkhard von Freihausen, *Ars magnesia: hoc est disquisitio bipartita empeirica seu experimentalis, physico-mathematica de natura, viribus et prodigiosis effectibus magnetis* (Zinck, 1631), p. 21.

[60]For copies bound with a medical work, e.g., see: #1347, #1394, #1509.

[61]As a starting point, see Sander, Magnes, 4.3.3; Roberto Poma, '"Hopliatria", discours savants sur la guérison magique' (unpublished Diss., A.N.R.T., 2005); Allen G. Debus, 'Robert Fludd and the Use of Gilbert's De Magnete in the Weapon-Salve Controversy', *Journal of the History of Medicine and Allied Sciences*, 19.4 (1964), pp. 389–417, doi:10.1093/jhmas/XIX.4.389; Salvatore Ricciardo, 'Dalla mumia agli effluvia. Cure magnetiche e weapon-salve nella medicina e nella filosofia naturale inglese alla metà del XVII secolo', in *Di stelle, atomi e poemi: verso la Physis*, ed. by Enrico Giannetto and Salvatore Ricciardo, Ishtar Studies, 2 (Aracne editrice, 2018), pp. 39–66.

[62]#1548 carries a reference to the author of this work on its flyleaf: Johann Ernst Burggrav, *Biolychnium; seu, Lucerna, cum vita ejus, cui accensa est Mystice, vivens jugiter; cum morte ejusdem expirans; omnesque affectus graviores prodens* (Ex officina Ulderici Dominici Balck, 1611).

[63]As a starting point, see Patricia Fara, *Fatal Attraction: Magnetic Mysteries of the Enlightenment* (MJF Books/Fine Communications, 2005); Heinz Schott, 'Paracelsus and van Helmont on Imagination: Magnetism and Medicine before Mesmer', in *Paracelsian Moments: Science, Medicine & Astrology in Early Modern Europe*, ed. by Gerhild Scholz Williams

long excerpted notes on the 'medical effect of Magnetism' and 'magnetisme animal' were attached in the 1780s.[64]

4.3. Humanist readings

A particularly comprehensive engagement with an aspect of Gilbert's work, evident in reader annotations, can be characterized as a humanist approach. These annotations are best understood as a scholarly practice of intertextual positioning, aimed at situating Gilbert's work within a broader intellectual and textual framework.[65] Above all, these comments, rubrics, and appendices elaborate, supplement, or discuss the bibliographical (cross-)references in Gilbert's text.[66] First of all, Gilbert's doxographical chapters were annotated by far the most, as will be elaborated on in the next section. Here, for example, cross-references were inserted and Gilbert's name-dropping was marked by underlining and numbering authors.[67] One copy includes a multipage transcription from Gerolamo Cardano, whom Gilbert discusses frequently.[68] Another copy introduces a long text of a French theologian, Louis Richeome, on chronology—unknown to Gilbert.[69] Several copies use the front blank papers to add literature references and for commonplacing.[70] Willebrord Snellius common-placed DM, while a copy of the 1600 edition even features an extensive handwritten subject index, based on the published index of the 1628 edition, thereby making it available for the first edition.[71] Owners repaired copies with torn pages by adding them again in manuscript or reviewed extant editions of the work.[72] This demonstrates how readers adopted and replicated the editorial efforts and enhancements of a later edition to complement earlier versions of the text.

4.4. Astronomical readings

In its own time, DM has often been read as a work of Copernican cosmology, while its astronomy even suggests Gilbert's support from experts in the field.[73] This astronomical reception is also reflected in quite a few copies. DM was bound, e.g., together with contemporary or later astronomy works, such as Jofrancus Offusius's *De divina astrorum facultate* (1570),[74] Tommaso Campanella's *Astrologicorum libri VII* (1630),[75] Galileo's *Dialogo*

and Charles D. Gunnoe, Sixteenth Century Essays & Studies, 64 (Truman State University Press, 2002), pp. 135–47; Robert Darnton, *Mesmerism: And the End of the Enlightenment in France* (Harvard University Press, 1968).

[64]See #1826, #1602.

[65]Cf., as a starting point, Anthony Grafton, *Joseph Scaliger: A Study in the History of Classical Scholarship. Textual Criticism and Exegesis*, Oxford-Warburg Studies, 2 vols (Clarendon Press, 1983); Ann Blair, *Too Much to Know: Managing Scholarly Information before the Modern Age* (Yale University Press, 2010).

[66]Also corrected errata, above note 16.

[67]See, e.g., #1089, #1551.

[68]See #1046. See also copy #1446 beyond DM.

[69]See #1396. See Louis Richeome, *L'Adieu de l'ame dévote laissant les corps avec les moyens de combattre la mort et l'appareil pour heureusement, se partir de cette vie mortelle, composé par le P. Richeome, jésuite. 2e Edit* (1593). I thank Albert Derolez for helping with this copy.

[70]See esp. #1060 (reference to Daniel Georg Morhof), #1548 (references to Thomas Bradwardine, Roger Bacon, Nicholas of Cusa), #1027 (a remark by Joseph Scaliger on Gilbert), #1530 (later remark by Francis Bacon about Gilbert).

[71]See #1473 and #1527. See also #1506, carrying a sheet of a similar nature but with content not related to DM.

[72]See #15440 (with remarks on DM editions), #1544 (missing printed paratext were added in manuscript).

[73]See esp. Pumfrey, 'William Gilbert's Magnetic Philosophy', pp. 60–65; Sander, Magnes, p. 317.

[74]See #1539.

[75]See #1565.

(1632),[76] Pierre Gassendi's *Institutio astronomica* (1647).[77] All four of these works are well familiar with or even draw on Copernicus's *De revolutionibus* themselves.[78] Copernican cosmology partly also informed the reading of DM itself. While marginal notes on Book 6, addressing magnetic cosmology, are frequent, explicit references to Copernicus himself are scarce.[79] Readers' strong and explicit support for Copernicus's cosmology and Gilbert's take on it is entirely lacking; polemics are rare as well.[80] Galileo's critical assessment of Gilbert's mathematical skill is quoted by one reader on the copy's title page.[81]

4.5. Censorship

Censorship is a trace of reading, too, or its very preparation and limitation. DM has been subjected to this institutionalized annotation, up to the complete removal of the sixth book on Copernican astronomy from the respective copy.[82] More subtle forms of censorship involved marking the relevant pages with a thin vertical line to indicate their emendation.[83] However, this approach still allowed readers to access and study the text containing these supposedly heterodox ideas. Other censors blacked out individual phrases or merely the names of suspect authors, a practice typical of book censorship in the period.[84] Since DM itself was never placed on the Index of Forbidden Books, the reported acts of censorship appear to be sporadic overzealousness rather than systematic and mandatory interventions. However, it is important to note that Galileo's censor, the Jesuit Melchior Inchofer, explicitly criticized the 'haereticus perversus', denoting Gilbert, in his condemnation of Galileo's *Dialogue*.[85] This denunciation likely influenced the reception of Gilbert and his work among Catholic censors, diminishing its favorability within such circles.

4.6. Vernacular readings

While the full reading of DM was limited by censorship in a few cases, the popularization of its content was an opposite effort reflected in readers' marks as well. The early modern period was also an era of popularization and multilingual dissemination of what had previously been almost exclusively Latin-written natural philosophy and physics.[86] DM, written in sophisticated Latin, was not published in translation before very recently and was at best and very indirectly accessible in the vernacular languages of the period through intermediaries. Gilbert's immediate British followers and colleagues, such as Mark Ridley or Wiliam Barlow, published about what was by then referred to as

[76]See #1049.
[77]See #1623.
[78]See, as a starting point, Pietro Daniel Omodeo, *Copernicus in the Cultural Debates of the Renaissance: Reception, Legacy, Transformation*, History of Science and Medicine Library, 45 (Brill, 2014).
[79]See #1026, 219. See also Granius, Sander, 'Magnetism in an Aristotelian World'. See an underlining on p. 214 in #1020, a remark on the title pages of #1535 and #1552 (dated 1854). See also #1685, for a reference to Copernicus beyond DM.
[80]A remark on the theory's 'economia' is made in #1148, on p. 220.
[81]See #1342. See also #1069.
[82]See #1090 (see there also fols. *vr, *iiiiv), #1100, #1827.
[83]See #1149.
[84]See, e.g., #1171 (title page, fol. iiir), #1098 (fols. *vr, *iiiiv), #1827 (p. 213, fols. Kk1v, Mm2v).
[85]See *I documenti vaticani del processo di Galileo Galilei (1611–1741)*, ed. by Sergio M. Pagano, Collectanea Archivi Vaticani, 69 (Archivio segreto Vaticano, 2009), pp. 86, 92.
[86]See, e.g., *Translating Early Modern Science*, ed. by Sietske Fransen, Niall Hodson, and Karl A. E. Enenkel, Intersections, 51 (Brill, 2017).

'Magnetic Philosophy' in English.[87] Scientific works written in other modern European languages before 1650 invoked DM as well in a superfial way.[88] How would readers of DM cope with the Latin text, vis-à-vis vernacular idioms? A few copies show marginal comments in French, Spanish, and English, systematically attempting to succinctly summarize or categorize the content of the Latin text.[89] This effort even extended to the visual apparatus of the work, summarizing the idea of diagrams verbally, in a vernacular language.[90] However, these annotations remain descriptive in nature and do not constitute original research contributions that go significantly beyond the Latin source material.

4.7. Reenacting readings

Did readers engage in experiments themselves? Gilbert describes a large number of experiments and emphasizes that the originality of his method is fundamentally tied to them. He underscores the reproducibility of his experiments and explicitly encourages readers to repeat them, occasionally providing relatively detailed descriptions of the experimental setup to facilitate close reproduction.[91] Gilbert marked descriptions of his experiments typographically with an asterisk in the margin, providing readers with a clear prompt to enrich these symbols with personal notes and experimental records.[92] Particularly notable were experiments involving so-called armed magnets, which aimed to multiply a magnets's attraction by adding iron caps to its ends or poles. These experiments were widely discussed and tested, not least because they saw in it a lucrative opportunity to strengthen magnets and sell them at a higher price.[93] Given this context, it is surprising that clear indications or comments from readers suggesting attempts to reproduce these experiments are relatively rare.[94] At the same time, chapters with many or detailed descriptions of experiments feature quite a few annotations.[95] Moreover, some marginal notes suggest that a small number of readers indeed undertook the effort to reproduce Gilbert's experiments using their own magnets.[96] Occasional so-called ego-statements suggest that certain experimenters

[87]Cf., e.g., William Barlow and William Gilbert, *Magneticall Aduertisements: Or Diuers Pertinent Obseruations, and Approued Experiments Concerning the Nature and Properties of the Load-Stone: Very Pleasant for Knowledge, and Most Needfull for Practise, of Trauelling, or Framing of Instruments Fit for Trauellers Both by Sea and Land* (Printed by Edward Griffin for Timothy Barlow, 1616); Mark Ridley, *A Short Treatise of Magneticall Bodies and Motions* (Printed by N. Okes, 1613).

[88]References to Gilbert are found in various vernacular works, from natural philosophy (K. Digby), natural history (T. Browne, J.E. Nieremberg), and from navigation (E. Wright).

[89]See #1500 (French texts added), #1519 (Spanish texts added), #1482 (English texts added).

[90]See, e.g., #1500 (e.g., pp. 13, 16, 29), #1482 (p. 133).

[91]See Sander, Magnes, pp. 888, 896.

[92]See Sander, Magnes, pp. 829–30.

[93]See Sander, Magnes, p. 904; Christoph Sander, 'Pumping Iron. Quantifying Magnetic Force in Early Modern Science', in *Making Evidence and Crafting Gravitational Knowledge in the Early Modern World*, ed. by Sergio H. Orozco-Echeverri, Xiaona Wang, and Micheal Bycroft (submitted 2026).

[94]Cf. Margócsy, Somos, and Joffe, *The Fabrica*, p. 95: 'Less than 10% of the annotators mention their own experiences with studying the human body, while more than half include a reference to another book or author.' For DM, not even 10% are to be assumed.

[95]A detailed analysis of this is wanting. However, Gilbert marked his experiments with an asterisk in the printed margin. Most of these sign posts are in Book 2 (esp. chapters 2, 15–26, 32–34) which is also the part of DM with most readers' marks.

[96]See, e.g., #1363 (e.g., pp. 53, 97), #1357 (p. 32). See also #2192 (p. 302) beyond DM. Cf. Christoph Sander, 'How to Send a Secret Message from Rome to Paris in the Early Modern Period: Telegraphy between Magnetism, Sympathy, and Charlatanry', *Early Science and Medicine*, 27.5 (2022), pp. 426–59 (p. 458), doi:10.1163/15733823-20220056; Sander, 'Quantifying Magnetic Force in Early Modern Science'.

engaged in a hybrid research activity of reading and simultaneously experimenting with magnets.[97] These practices therefore closely align with Gilbert's research ideal and his philosophy of magnetism, embodying the modern scientific approach championed most famously by Francis Bacon. Such annotations suggest that these readers embraced Gilbert's experimental ethos, positioning themselves as active participants in the advancement of empirical knowledge.

4.8. Visual readings

A final fascinating aspect of the reading traces concerns not textual, but visual, graphic, and diagrammatic annotations.[98] While underlinings and simple marginal markers, such as vertical lines or manicules, already go beyond mere textual commentary by condensing information into an easily processable visual system, many copies exhibit far more sophisticated visual annotation techniques. This includes, on the one hand, the enhancement of printed diagrams and illustrations, such as the addition of labels, auxiliary lines, or new elements. On the other hand, it also involves entirely original drawings and diagrams created by readers. The exact forms and functions of these visual annotations vary from case to case. As has been shown, diagrams on magnetic phenomena were often meant as abstracted experiments, pointing to causal relationships.[99] This holds true for visual annotations as well, when readers performed a virtual experiment on paper: Granius, e.g. sketched declination angles in a diagram,[100] Linton graphically engaged with one of Gilbert's experiments.[101] In many other instances, it is plausible to argue that these visual annotations primarily served to better understand the relationship between the printed text and the images, effectively weaving the two media more tightly together. Gilbert repeatedly embeds, at least rhetorically, his arguments within a kind of diagrammatic proof structure.[102] He employs diagrams to lend geometrical evidence to his physical theories, reinforcing the formal plausibility of the theorems demonstrated experimentally in a way that appears almost irrefutable. This technique seems to have been effective, as readers do not dismiss the visual material; instead, they engage with it, enriching and deepening it with their own comments and drawings. Yet, there are also drawings on the flyleafs at the beginning or end of the book that appear entirely unrelated to the content of the work, seemingly serving more as a kind of sketchpad.[103] For example, one copy features a drawing of a lightly clothed woman receiving some unidentifiable object. Another copy includes what appears to be an architectural sketch, which likewise seems to have no connection to the theme of magnetism.

DM is a complex work, connecting a multitude of subjects and approaches, and may owe some of its success to exactly this complexity and selective compatibility. It appears

[97]Cf. also Margócsy, Somos, and Joffe, *The Fabrica*, p. 95.
[98]This, hopefully, will be elaborated on soon by Bill Sherman, following up on lectures on 'The Reader's Eye'. See also some remarks in Christoph Sander, 'Rendering Magnetism Visible. Diagrams and Experiments between 1300 and 1700', *Centaurus*, 64.2 (2022), pp. 315–59, doi:https://dx.doi.org/10.1484/J.CNT.5.131247.
[99]See Sander, 'Rendering Magnetism Visible'.
[100]See, e.g., #1315 (following p. 155). Granius annotated most printed diagrams, and added many himself (e.g., pp. 55, 80, 140, 150, 155–156, 168, 199, 214, 223, 227–229, 231–232).
[101]See, e.g, #1357 (p. 32). See also pp. 188–189, 198.
[102]See Laura Georgescu, 'The Diagrammatic Dimension of William Gilbert's De Magnete', *Studies in History and Philosophy of Science*, 47 (2014), pp. 18–25.
[103]See #1441, #1491.

consequential that this complexity is also mirrored in its reception. As has been shown, DM played a pivotal role in many thematic and disciplinary contexts in the first half of the seventeenth century.[104] This intertextual footprint of references to Gilbert's work in later authors was preceded or accompanied by a likewise wide thematic interest of readers, as manifested by their reading marks.

5. Patterns of Reading

A comprehensive quantitative exploration of DM's readers marks necessitates meticulous methodological reflection and profound insights into its data model and feature engineering.[105] Although this comprehensive account cannot be provided here, insights into the 'numbers of reading' are particularly intriguing when viewed against the qualitative backdrop of the preceding sections. Therefore, these insights will be outlined in a rudimentary manner.

The fundamental semantic model underlying the ensuing analyses and statistics is straightforward: Each copy may contain pages that have been annotated in various ways, which are understood in the broadest sense to include any trace of intentional intellectual use or engagement.[106] Single annotations are tagged and weighted to qualify their characteristics as nominal categorical features (tags) and as discrete numerical features (weights). Copies represent editions that realize a work, the latter being structured by semantic sections such as DM's six books and their chapters. Each of these sections is qualified by semantic features, such as topics they address. Accordingly, each annotation can be mapped to one or many semantic features, at least indirectly and approximately, as it occurs on a page that is part of a unit dealing with some content. Importantly, tagged annotations also allow for the exclusion of those annotations that are clearly identified as additions made by librarians/owners, such as pagination, owners' marks, stamps, shelfmarks, etc.—all of which by definition are not traces of attention to the printed content of the work and thus would compromise the desired semantic quantification.

Copies after all can be represented as multidimensional embeddings of their aggregated annotations, each dimension proxying one semantic feature. Each of these semantic features measures the extent to which any of the work's topics is reflected in the annotations within the respective copy. Put simply, each copy hence gets a complex fingerprint, encoding its readers' interests. This fingerprint then allows us to group or cluster similar copies in this multidimensional semantic feature space, revealing similar patterns of reading.[107] While these patterns and clusters may also implicitly emerge in a full-blown qualitative examination of all copies, unsupervised machine learning allows for their explicit and automated detection—while of course all of this is based on the semantic features stipulated.

[104]This is elaborated on in Sander, Magnes. The index of names provides access to various premodern research domains and contexts involving Gilbert.

[105]This is fleshed out in Sander, 'Traces of Attention'. For the software used to create results, see Sander, *Magnetic Margins: Analysis*.

[106]A synopsis is spelled out at and illustrated at https://www.magnetic-margins.com/resource/magnet_Semantics [accessed 12 February 2025].

[107]These patterns can also be based on formal features, such as the use of different writing tools for annotations, the type of annotations themselves (underlining, adding text, etc.), or the positions on the page where annotations occur, and so on.

A few general statistics help to prepare the ground for a better assessment of the semantic analysis. Of the total 363 examined copies of DM, 272 of them contain annotated pages in the stipulated sense, excluding owner's marks, etc. The total of 4558 annotated pages carries a total of 6715 annotations, while the actual method for counting annotations is not of subsequent importance. A closer look at these metrics reveals a highly skewed distribution of the annotated pages among the copies. While a copy contains approximately 12 annotated pages on average, its median is only 2 pages. After all, the most annotated 4.5% of all copies already contain almost 50% of all annotated pages, and 80% of all annotated pages are part of less than 13% of all most annotated copies (Figure 4).[108] In essence, the majority of annotations are found in a limited number of heavily annotated copies. If we conceptualize annotations as wealth and copies as individuals, we observe a pronounced skewness in the distribution of wealth, with a Gini coefficient of 0.82.[109]

When looking at the four different editions/issues (Figure 5), the 1628 edition, on average, has the most annotated pages, beating the 1600 *editio princeps*. The interpretation of this finding needs to take into account that standard deviation and variance for the 1628 is much higher than for the 1600 edition, i.e., a small number of 1628 copies carries a very high number of annotations. Yet, a cautious and safe conclusion is that DM was still eagerly read and annotated in 1628, proving the proclaimed need for the new edition by its editor, Lochmann.

Further analysis reveals that pages containing printed illustrations were neither significantly more nor less frequently annotated than pages containing only text. While the data shows slight variations across different editions, these differences are not significant enough to support clear conclusions. The inverse conclusion, however, appears valid: the page layout—specifically, whether or not it includes an illustration—does not seem to have a significant impact on the annotation practice of readers.

Turning to the statistics of annotations across all copies per chapter, the first book and parts of the second book of DM, as well as sections of the sixth book, clearly garnered the most significant attention from readers (Figure 6), as indicated by their higher mean number of annotations. Median values, however, reveal that more than often, the majority of copies have no annotations at all, except for chapter 2 in Book 2, while the maximum number of annotations in any copy demonstrates that no chapter was ignored entirely. Taken together, these simple statistics show that readers' interests in the work varied widely and that only a small number of sections elicited annotations from larger groups of readers.

When proxying these predominant chapters by the topics they discuss, it can be asserted that doxography, natural historical accounts, foundational natural philosophy, and cosmology attracted the greatest interest. In contrast, the sections dealing with practical applications, geomagnetism, and navigation are relatively underrepresented in terms of annotations. These findings, however, should not be overinterpreted. They

[108]Cf. also Margócsy, Somos, and Joffe, *The Fabrica*, p. 57: 'Only a small minority of them annotated the volume throughout. The average reader of the 1543 edition annotated 28 pages of the total of 673, while the average reader of the 1555 edition annotated 38 pages. Most readers consulted this hefty volume for very particular concerns, and ignored the bulk of the text.'

[109]UNU-WIDER, World Income Inequality Database (WIID) Companion dataset (wiidcountry and/or wiidglobal). Version 30 June 2022. https://doi.org/10.35188/UNU-WIDER/WIIDcomp-300622.

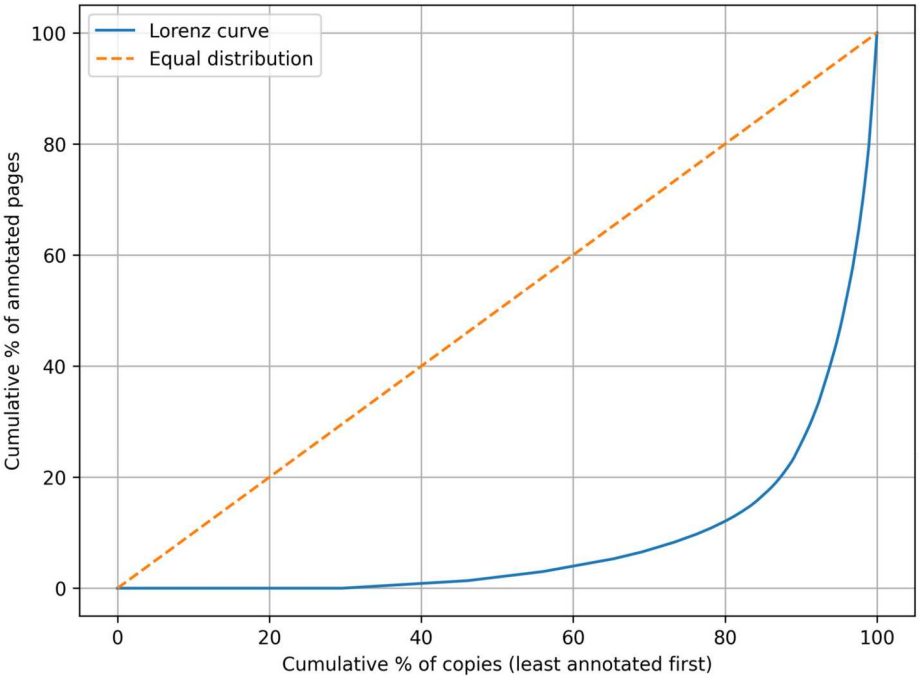

Figure 4. A plot of the Lorenz curve of the distributions of annotated pages to copies. The blue curve clearly shows that the majority of annotations occur in a very small minority of copies, a heavy-tailed distribution. The red dotted diagonal line would be an equal distribution, i.e. each copy having the same amount of annotations.

may reveal more about who owned the books, which copies have survived, and what particularly interested those readers who left annotations. To say that the underrepresented topics in the annotations were simply ignored, thus, is inconclusive and underdetermined by the available data. Moreover, there is a lack of representative, quantitative data that would allow the results for DM to be normalized against overarching trends and patterns in annotation behaviour in the seventeenth century. In short, this analysis does not clarify whether the observed tendencies are specific to DM or reflect broader annotation practices of the period.

When examining the distribution of annotations across the chapters of DM more closely, two chapters stand out as the most frequently annotated. These are the doxographical chapters, in which Gilbert extensively engages with the positions of his predecessors, Chapter 1 in Book 1 and Chapter 2 in Book 2. This highlights the importance of a humanistic and bibliographic interest in his work. Concrete and detailed experiments, practical applications, or his Copernican cosmology play virtually no role in these chapters. Annotations, when analysed in relation to the ordinal position of their related page within the edition, suggest that readers annotated most actively at the beginning of the work, with this activity tapering off as the book progressed. However, it is important to emphasize that this pattern does not align with the fact that the sixth book was also frequently annotated. Moreover, the causal psychological hypothesis of 'annotation fatigue' would require a much larger sample to validate. Whether the heightened focus

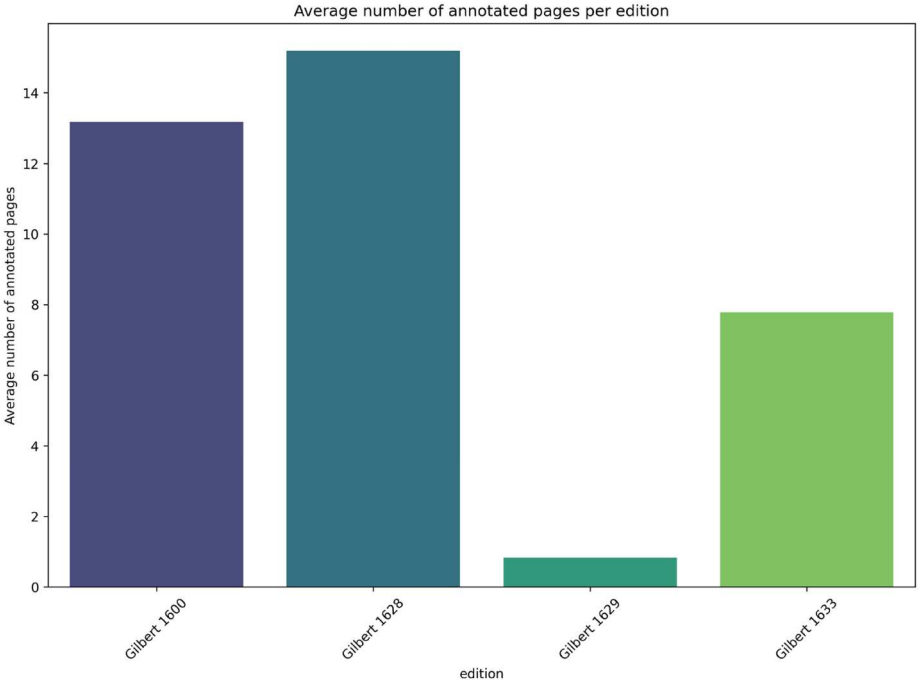

Figure 5. A bar chart showing the average number of annotated pages in each copy for the four Gilbert editions/issues. While extant in fewer copies, the 1628 edition's copies carry more pages with annotations than any other edition on average.

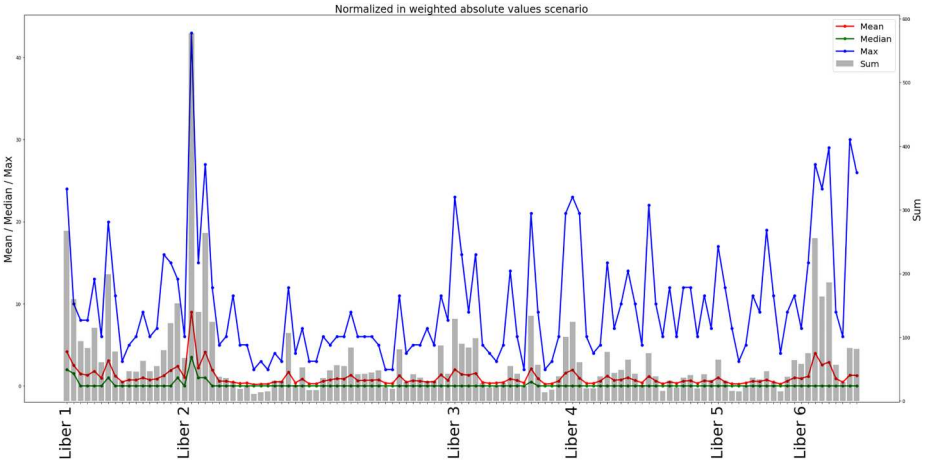

Figure 6. A line chart showing the aggregated distribution of weighted annotations (y-axis) across chapters of DM, arranged in the order they occur in the work (x-axis). Three lines (read for mean, green from median, and blue for max) aggregate the same numbers of annotations differently, while grey bars sum them (because sums are much larger in magnitude, they are plotted on a secondary y-axis on the right).

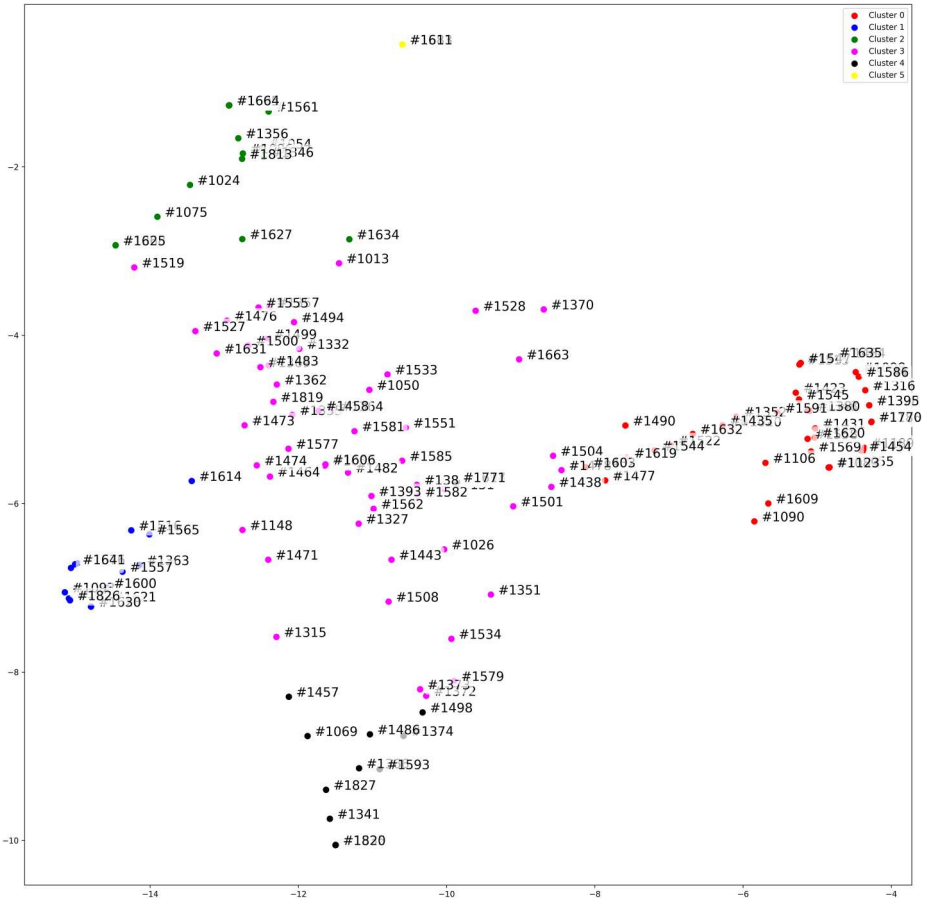

Figure 7. A plot of a t-SNE projection showing neighbourhoods of copies (each dot represents one copy, ID as hash-prefixed number) and respective clusters in colour. Shown copies are analysed by how much certain sections associated with certain topics are annotated. Copies closer to each other are taken to resemble their thematic focus as represented by annotated sections. Clusters then would group copies of similar thematic foci (colour-coded). Identical vectors share the same coordinates and thus are not distinguishable in the plot.

on Books 1 and 2 reflects a broader pattern or is specifically tied to the topics of these books cannot be conclusively determined. Nevertheless, given the prominence of the two doxographical chapters within these books, their significance can be clearly established, regardless of any hypothesized general trends (Figure 7).

Clustering all copies based on semantic features, representing their focal thematic interests according to the frequency of annotations on pages dealing with specific topics, is semantically and computationally complex. Annotations can be counted in their absolute frequency per copy, or by their proportional distribution across all different semantic features within one copy. In either case, copies are represented as multidimensional vectors, with each feature (chapter or topic) forming one dimension and a numerical value encoding the relative or absolute annotation weight of that feature for each copy. When this n-dimensional embedding is projected onto a two-dimensional

plane, unsupervised machine-learning algorithms prove useful by placing feature-similar copies in closer neighbourhoods, thereby revealing a topology of symmetrical similarity. Clustering, by contrast, assigns all copies to a finite (and here predefined) number of six clusters on the basis of their mean distances in n-dimensional space (for example, Euclidean distances). In doing so, it refines or complements, rather than contradicts, the insights gained from two-dimensional projections. To avoid overly complicating the following analysis, it will focus on a few broader conclusions that emerge robustly and relatively independent from parameters, hyperparameters, and semantic feature engineering choices.[110]

Cluster 3 stands out distinctly, encompassing copies that are annotated across all parts of the work, thus covering most topics. These indifferently annotated copies form a single cluster, even though this cluster is thematically less informative due to the lack of a clear focus caused by the sheer number and relatively even distribution of annotations. Nevertheless, this cluster highlights copies belonging to particularly engaged readers who appear to have annotated the work with consistent attention from cover to cover. Different clusters reflect specific thematic interests, e.g. a focus on navigation and geomagnetic phenomena (clusters 2 and 5), while others suggest particular attention to cosmology and astronomy (cluster 4), natural history (cluster 0), or natural philosophy (cluster 1).

The thematic profiles of each cluster have been retrieved from tree-decision-classification machine learning and their historiographical adequacy has been verified only through sampling. However, perhaps more significant than the contingent and probabilistic existence and shape of these specific thematic clusters is the fact itself that the range of annotations across the copies generally maps to clearly distinguishable clusters. Data as sparse and skewed as from the corpus at hand might also have predicted clusters that appear as algorithmic artefacts with no semantic interpretability. The actual results demonstrate that the thematic diversity of interest in Gilbert's work, as suggested in the preceding sections, can be substantiated not only through qualitative examples but also through quantitative methods. This dual and multimodal approach mitigates the risk of cherry-picking—a concern that arises given the large number of copies, where selective examples could be used to support almost any perceived focus by relying on just one or two extrapolated cases. On the other hand, computed results inform a historiographical narrative that is both revealing and plausible.

Technically, much higher-resolution analyses are indeed possible. For example, one could investigate whether copies annotated with a focus on a particular topic also emphasize other topics, or explore correlations between specific forms and methods of annotation with certain topics. The challenge, however, lies not only in the labor-intensive process of digitally annotating the necessary semantic features—a task largely completed—but more importantly in the limited number of sufficiently comprehensively annotated copies. Due to the sparse data and the small sample size of extensively annotated copies, it is difficult to identify statistically significant correlations that could yield deeper insights. As a result, such advanced analyses remain constrained by the lack of a larger dataset.

[110]For more detail, see Sander, 'Traces of Attention'.

6. Conclusion

Overall, neither the dissemination of *De Magnete* copies nor the reading traces and annotations found therein appear to differ significantly from those of other milestone works of early modern medicine, science, and natural philosophy. The *magna opera* by Andreas Vesalius, Nicolaus Copernicus, Galileo Galilei, and Isaac Newton—which can serve as reference points here—seems to exhibit comparable patterns in terms of their provenance and the ways in which they were annotated and studied by contemporaries.[111] While further differences may lie in the detail, DM stands out by covering a broad variety of subjects and disciplinary contexts: written by a professional physician, attempting to replace traditional Aristotelian natural philosophy, inventing a physical explanation of Copernican cosmology, providing practical applications of magnetism in navigation, compiling a highly learned literature review, describing a vast amount of original experiments, and employing a rich diagrammatic apparatus intertwined with geometric arguments—to only name a few dominant themes of this highly influential work. DM's immanent complexity, in fact, is reflected by its readers' interests: a 'Gilbert for everyone'. How this eclectic reading of DM compares to the readers' reception of those other milestone works alluded to above remains to be investigated and requires sufficiently detailed and structured data.

The readers' reception of DM, however, clearly shows that, despite Gilbert's rhetorical efforts to present the work as experimentalist, cosmological, and practical, these were not the aspects that most attracted readers' attention. Admittedly, the survival of extant copies may be biased; yet the available evidence suggests that readers were particularly interested in the doxographical discussions of magnetism. Ironically, the doxographies presented in Books 1 and 2—expressions of Gilbert's own rejection of bookish approaches and of his disdain for predecessors whom he accused of merely copying one another—were precisely the sections most frequently annotated.[112] These readers' pens may simply have been guided by a learned habitus shaped by erudite scholarship and humanism, with its practices of commonplacing, note-taking, and philological markup.[113]

Contingent as this finding is on biases of transmission and on readers' tacit practices, it does not refute existing historiographical narratives about the reception and significance of DM in early modern science. Rather, it adds a further, more continuist layer to its allegedly groundbreaking character. To suggest that readers who mainly underlined author names were bored by Gilbert's experimentalist agenda or his physicalist cosmology would be too bold a claim. What can more cautiously be hypothesized is that DM initially appeared as yet another contribution to the expanding market of natural

[111]See R. S. Westmann, 'The Reception of Galileo's "Dialogue." A Partial World Census of Extant Copies', in *Novità celesti e crisi del sapere: atti del convegno internazionale di studi galileiani*, ed. by Paolo Galluzzi (Giunti Barbèra, 1984), pp. 329–71; Owen Gingerich, *An Annotated Census of Copernicus' De Revolutionibus (Nuremberg, 1543 and Basel, 1566)*, Studia Copernicana, 2 (Brill, 2002); Thomas F. Mayer, 'An Interim Report on a Census of Galileo's Sunspot Letters', *History of Science*, 50.2 (2012), pp. 155–96, doi:10.1177/007327531205000202; Margócsy, Somos, and Joffe, *The Fabrica*; Mordechai Feingold and Andrej Svorenčík, 'A Preliminary Census of Copies of the First Edition of Newton's Principia (1687)', *Annals of Science*, 77.3 (2020), pp. 253–348, doi:10.1080/00033790.2020.1808700.

[112]Cf. also Sander, 'Magnetism for Librarians'; King, 'The Natural Philosophy of William Gilbert and His Predecessors'.

[113]Cf., as a starting point, Grafton, *Inky Fingers*; Blair, *Too Much to Know*; Paul Nelles, 'Libros de Papel, Libri Bianchi, Libri Papyracei. Note-Taking Techniques and the Role of Student Notebooks in the Early Jesuit Colleges', *Archivum Historicum Societatis Iesu*, 76 (2007), pp. 75–112.

philosophy.[114] It was not read as a 'groundbreaking work,' but as a Latin treatise on magnetism that began by laying out the *status quaestionis*, i.e., exactly what a traditional reader would have expected and known how to engage with. Gilbert's pejorative framing of this conventional literature review did not override established reading and annotation habits. By contrast, what was genuinely novel within this genre was the extended descriptions of instrument design and use, along with the explanations of the natural-philosophical principles underlying their operation. It may have been precisely this more disruptive material that readers found harder to respond to, a difficulty for which the relative absence of readers' marks may itself provide material testimony.

This essay aims not only to contribute to the history of science in the narrower sense by presenting insights from a descriptive census of one of the most important works of early modern natural philosophy. It also seeks to inspire methodological advancements that lie primarily in the creation of open-access, well-documented research data that facilitate, if not initiate, cooperative studies and boost transparency and replicability.[115] Past attempts to collaboratively document the phenomenon of reading annotations in the digital realm likely failed or stopped primarily due to the challenge of providing a unified working environment and overarching platforms capable of integrating heterogeneous data from different research teams.[116] Census data published in print remain a valuable resource, but a digital dataset could serve as a pivotal catalyst for the fields of book history and, by extension, the history of science. While the rhetoric and promise of an ever-growing and perpetually updated dataset may rarely be realized in practice, the potential for comparative analysis of non-perfect datasets using computational methods is far more attainable and realistic. The editors of the Vesalius census have already begun to follow this avenue of research:

> How did readers approach the *Fabrica* and what parts did they consult most frequently? One can answer the question not only through the case study of an exemplary reader, but also with the help of statistics. […] How can one use such a database that contains information on hundreds of annotators? […] By visually tracking how frequently each page of the *Fabrica* was annotated in our corpus, we are able to see where readers tended to turn their attention, and we can combine this quantitative analysis with a careful consideration of the variety of marginalia that decorate these pages.[117]

[114]Cf. Lynn Thorndike, 'Newness and Craving for Novelty in Seventeenth-Century Science and Medicine', *Journal of the History of Ideas*, 12.4 (1951), pp. 584–98, doi:10.2307/2707487; Andrea Sangiacomo and others, 'Mapping the Evolution of Early Modern Natural Philosophy: Corpus Collection and Authority Acknowledgement', *Annals of Science*, 79.1 (2021), pp. 1–39, doi:10.1080/00033790.2021.1992502.

[115]On the need for replicable research in the humanities, see e.g. Rik Peels, 'Replicability and Replication in the Humanities', *Research Integrity and Peer Review*, 4.1 (2019), p. 2, doi:10.1186/s41073-018-0060-4.

[116]See esp. the seminal project of Earle Havens and Anthony Grafton, 'The Archaeology of Reading', 2014 <https://archaeologyofreading.org/> [accessed 31 October 2022]. See also Richard Calis and Arnoud S. Q. Visser, 'Building a Digital Bookwheel Together: Annotated Books Online and the History of Early Modern Reading Practices', *Bibliothecae.It*, 2014, pp. 63–80. A useful implementation for collaboration is available as per Katherine O. Acheson, 'BookMark', Early Modern Marginalia Research Network, n.d. <https://earlymodernmarginaliaresearchnetwork.com/bookmark/> [accessed 11 February 2025].

[117]Margócsy, Somos, and Joffe, *The Fabrica*, p. 61. See also Margócsy, Somos, and Joffe, *The Fabrica*, p. 56: 'A solution to this problem has recently begun to emerge from the large-scale, quantitative studies of marginalia that Bill Sherman, Heidi Brayman Hackel, Monique Hulvey, Alison Wiggins, Ada Palmer or Richard Oosterhoff have conducted.' To be fair, there is a website: Dániel Margócsy, 'Updates: A List of New Copies', The Vesalius Census, 2018 <https://www.vesaliuscensus.com> [accessed 11 February 2025]. While this is a useful resource for its updates to the printed census, it is hardly a database.

Their fabulous volume offers many statistical insights through charts or percentages, but it remains computationally simplistic, and their data is not public (yet). None but the authors can reproduce their results. More importantly, their data cannot be used for federated analysis, including other data.

Despite the supposed value of these digital datasets emphasized here, the qualitative and philological analysis of the very objects—the individual copies—and ideas manifested through them must not be neglected. This essay has therefore attempted to strike a balance. This balance involves a qualitative description of the phenomenon, which has been partly verified and reinforced through quantitative methods and partly inspired by them beforehand. In this way, it has been demonstrated through different methods and perspectives that readers from diverse contexts, with vastly different thematic focuses, engaged with Gilbert's work, sometimes annotating it extensively, while many copies show little to no signs of active reading. While this conclusion represents a research finding in its own right, the more intriguing question—namely, the extent to which this profile aligns with that of other comparable seventeenth-century editions—remains insufficiently answered. To conduct such a comparison systematically and methodically, it is not sufficient to juxtapose similar qualitative conclusions or assessments in existing literature. Scholars in the field of marginalia studies have identified many 'patterns' in their corpora but none of their analyses can easily be reproduced nor can their data be used in a federated investigation.[118] For this to be possible, the phenomena themselves, the– readers' marks,– must be represented in a sufficiently homogeneous manner as semantic data and analysed using transparent methods that are vetted by the scholarly community.

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[118]Cf., e.g., Gingerich, *An Annotated Census of Copernicus' De Revolutionibus (Nuremberg, 1543 and Basel, 1566)*, p. XVI: 'In fact, a quite unexpected result has been the discovery of patterns of annotations that are found in multiple copies of the book. Several of these families of annotations will be described in this section.' Margócsy, Somos, and Joffe, *The Fabrica*, p. 56: 'The availability of such large corpora of annotated books has allowed scholars to identify the reading patterns of even those annotators who left only one or two marginalia here and there.' Cf. also Sherman, *Used Books*, pp. 5–15, with a chapter named 'Patterns of Use'. Cf. also ibid., p. 18: 'Only with a much more comprehensive survey of marginalia in surviving books will statistical patterns become more reliable.' Cf. also Jackson, *Marginalia*, p. 6: 'For reasons that will be elaborated later, the sample set of works has no claim to being exhaustive or representative or even statistically significant. It is large and diverse enough, nevertheless, to expose basic patterns in readers' practice'. Also ibid., pp. 173, 252. Cf. also Ada Palmer, *Reading Lucretius in the Renaissance*, I Tatti Studies in Italian Renaissance History (Harvard University Press, 2014), p. 45: 'Patterns in the notes make it possible to tell which interests were common and which rare. […] I concentrate on patterns present in at least one-quarter of manuscripts.'.

Louise Amazan, Mark Emanuel Amtstätter, Angela Anselmo, Amanda Arceneaux, Steven Archer, Mark Armstrong, Karen Attar, Bettina Augustin, Jette Bahnson, Nicole Baker, Margaret Wood Balch, Ildikó Balogh, Raffaella Barbierato, Carlotta Barranu, Milena Bassoli, Massimo Baucia, Flavia Benfante, Giovanna Bergantino, John Bidwell, Katie Birkwood, Lucy Blaxland, Barbara Bobak, Maria de Fátima Bogalho, Mirna Bonazza, Giulio Bonechi, Fra Carlo Bottero, Antoine Boustany, Guillaume Boyer, Amy Boylan, Lucinda Boyle, Regina Braun, Carmen Broermann, Agnès Calza, James Capobianco, Philippa Cardy, Hendrikje Carius, Laura Carnelos, Alexandra K. Carter, Cristiano Casalini, Guillaume Champion, Sarah Chard-Cooper, Florence Chaudoreille, Anne Chesher, Thomas Chisholm, Francesco Cignoni, Ilhan Citak, William Claspy, Mattie Clear, Vicky Clubb, Ian Coates, Diana Codogni-Lancucka, Cait Coker, Nicola Cook, Brianna Cregle, Adam Crothers, Jamie Cumby, Sarah Cusk, Catherine Dack, Henrietta Danker, Pauline Darleguy, Jason Dean, Bianka Deckert, Niamh Delaney, Franca Denotti, Albert Derolez, Alexander Devine, Deborah Diamanti, Susanne Dietel, Alexander van Dijk, Paul Dijstelberge, Andreas Dix, Jack Dixon, Elisabeth Dlugosch, Ann Morgan Dodge, Cathy Dorin-Black, Thomas Thibault Döring, Emily Dourish, Estela Dukan, Anne Dutton, Juan Manuel Lizarraga Echaide, Charlotte Epple, Jesse Erickson, Karina Falk, Silvia Fanti, Marina Ruiz Fargas, Nadine Férey-Pfalzgraf, Rocío Blasco Fernández, Silke Findorf, Adrian Fischer, Moira Fitzgerald, Sophie Floate, Ingeborg Formann, Debra Francis, Agnieszka Franczyk-Cegła, Elizabeth Frengel, Fabian Fricke, Britta Funck-Januschke, Michelle B. J. Gait, Francesca Galligan, Chloe Gerson, David Gibis, Claudia Giobbio, Wolfgang Göldi, Tünde Gottschling, Raphaëlle Goyeau, Julie Greenhill, A.B. Grigoriev, Daniele Guerrieri, Lucy Gwynn, Rita Haffner, Mary K. K. Hague-Yearl, Sanne Hansler, Stawell Heard, Ortwin Heim, Adam Hexley, Zoe Hill, Jakob Povl Holck, Melanie Howard, Lavinia Iazzetti, Anna Iezzoni, Maria Rosaria Imbriani, Cristina Ion, Andrew Isidoro, Juliette Jestaz, Leah Johanson, Eric Johnson-DeBaufre, Rosslyn Johnston, Nicolien Karskens, Peter Keitz, Conor Kerr, Amy K. Kimball, Neil Kirkham, Gabriele Kirschner, Nina Knabe, Beatrix Koll, Felix Kommnick, Franziska König, Kristina Krasny, Berthold Kreß, Angela Kugler-Kießling, Birgit Kühnen, Sven Kuttner, Andrea Langner, Ashley Larson, Brigitte Laude, Florence Launay, Judith Leitz, Sam Lemley, Grażyna Lenarczyk, Carla Lestani, Cindy Lim, Daniel Lipson, Kate Long, Yannick Van Loon, Hannah Lowery, Simona De Lucchi, Lucia Lucchini, Kerry V. Magruder, Patricia Martins Marcos, Federico Marcucci, Lucia Marinelli, Manuela Massa, Jamie Mastrogiacomo, Nicole Matter, Shane Mawe, Alessio Mazzini, Elias Mazzucco, Leanne McCredden, Helen McGinley, Dawn McInnis, Ulrike Mehringer, Lucia Meidinger, Pedro Mesquita, Christiane Michaelis, Christian Michel, Loredana Minenna, Elena Modena, William S. Monroe, Georgie Moore, Katrin Müller, Lucille Munoz, Pamela Murray, Alina Nachescu, Fiona M. Neale, Nic Nicolaou, Tim Noakes, Kim Nusco, Kasper van Ommen, Cristiano Osti, Martyna Osuch, Joachim Ott, Juliette Oulevey, Oreste Palmiero, Verity Parkinson, Alberto Partida, Jacek Partyka, Patrick Perratt, Giuseppina Petroccia, Philomène Picart, Sophie Pittock, Cassidy Polack, Francesco Poppi, Tiziana Porro, Silvia Pozzebon, Aaron T. Pratt, Florian Preiß, Peter Prokop, Marta Puszka, Jamie Rees, Immanuel Reisinger, Evert Jan Reker, Paolo Renzi, Elisa di Renzo, Suzanne Reynolds, Emerson Richards-Hoppe, Michael Richardson, Melissa Rickman, Liz Ridolfo, Bastien Rissoan, Kyle Roberts, Nicholas Rogers, Alessandro Romanello, Anne Rothfeld, Christelle

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Data availability statement

Relevant data is published online: Christoph Sander, 'Magnetic Margins. A Census and Annotations Database', 2022, doi:10.48431/res/qk19-bj96/magmar; Christoph Sander, 'Magnetic Margins: Analytical Data' (Zenodo, 2025), doi:10.5281/zenodo.14851167, version v0.1.0 at submission time: doi:10.5281/zenodo.14851170; Christoph Sander, 'Magnetic Margins: Analysis', 12 February 2025 https://github.com/ch-sander/raramagnetica/tree/main/analysis/magnetic_margins. A human-readable laid-out and shortened version of the census data is published with this article as an appendix.