

AUGUSTUS
DE MORGAN,
POLYMATH



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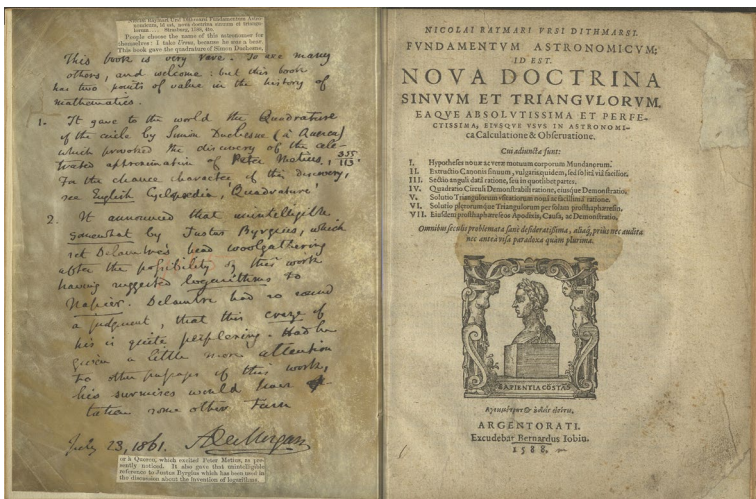
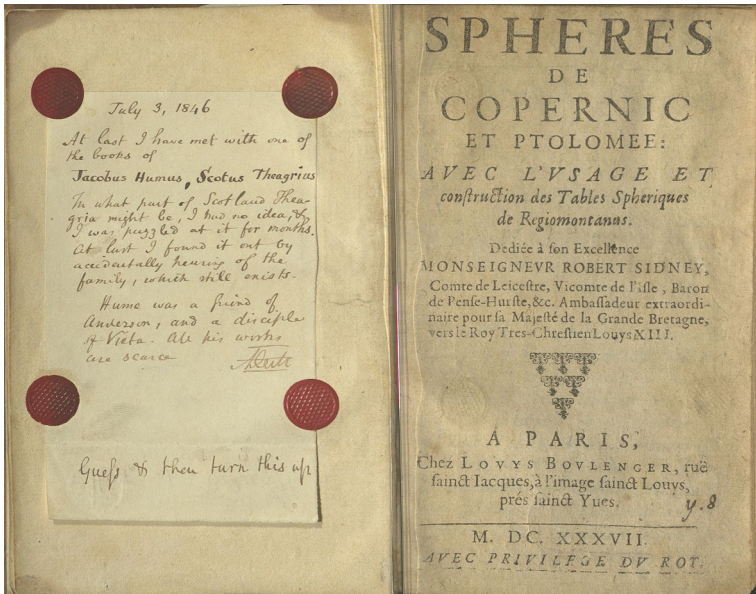


Fig. 14 Two typical examples of the sorts of notes De Morgan made in his books: on the identity of the author (above); and on the rarity and content of the book (below). ([DeM] M [Hume] SSR and [DeM] M [Ursus] SSR, reproduced by permission of Senate House Library, University of London.)

10. Augustus De Morgan's Library Revisited: Its Context and Its Afterlife

Karen Attar

Professor De Morgan's unique mathematical library
... probably contains the most curious books on the
history of mathematics to be found in England.

— *The Spectator*¹

Introduction

No study of Augustus De Morgan's life and work can be complete without a discussion of his mathematical library: the library which was the basis for some of his work, and which has been lauded in both the nineteenth and the twentieth centuries as one of the best mathematical libraries in the United Kingdom.² The library has been described elsewhere, such that a bare outline here will suffice to provide information about its content.³ What has not been studied is the

1 'News of the Week', *The Spectator*, 1 Apr. 1871, p. 371.

2 The quotation in the epigraph reflects a nineteenth-century opinion, while in the twentieth century, the library was called 'one of the best surviving collections of early scientific books formed at this date' (A.N.L. Munby, *The History and Bibliography of Science in England: The First Phase, 1833–1845* (Berkeley: University of California, 1968), p. 12) and 'one of the finest accumulations of books on the history of mathematics in the country.' (Adrian Rice, 'Augustus De Morgan: Historian of Science', *History of Science*, 34 (1996), 201–40 (p. 222)).

3 See K.E. Attar, "'The Establishment of a First-Class University Library': The Beginnings of the University of London Library", *History of Universities*, 28 (2014),

contemporary context of the library, nor how it fared after De Morgan's death and why it continues to stand out. This chapter will seek to address these questions.

The library consists of approximately four thousand titles dating from 1474 until 1870. It holds material on all branches of mathematics, including astronomy, with arithmetic being especially strongly represented. There are associated titles of mathematical biography and bibliography and some philosophy. Important works are present in multiple editions. Euclid's *Elements* provides a particularly salient example, with editions ranging from the *editio princeps* of 1482 to Isaac Todhunter's 1862 edition for schools and colleges: editions abound in different languages, for different audiences, with different commentaries. Titles read to an extent as a roll call of significant mathematicians and works encapsulating landmark mathematical innovations: Michael Stifel, Niccolò Tartaglia, Albert Girard, François Viète and Thomas Harriot on symbolic algebra; Bonaventura Cavalieri on the geometry of 'indivisibles'; John Napier and Adriaan Vlacq on logarithms; Simon Stevin on decimal fractions; Johannes Kepler and Tycho Brahe on astronomy; Pierre de Fermat on number theory and analytic geometry; Jakob and Johann Bernoulli on probability and calculus; and so forth. Alongside these are popularising works and textbooks (by Luca Pacioli, Robert Recorde, William Oughtred, James Hodder, Edward Cocker, John Bonnycastle and others) and a host of relatively obscure works which De Morgan collected to contextualise trailblazing titles, on the principle that:

The most worthless book of a bygone day is a record worthy of preservation. Like a telescopic star, its obscurity may render it unavailable for most purposes; but it serves, in the hands which know how to use it, to determine the places of more important bodies.⁴

Publications range from substantial tomes and multi-volume works to pamphlets, with numerous offprints and journal extracts among the nineteenth-century holdings.

44–65 (pp. 51–52); Karen Attar, 'Augustus De Morgan (1806–71), His Reading and His Library, in *The Edinburgh History of Reading: Modern Readers*, ed. by Mary Hammond (Edinburgh: Edinburgh University Press, 2020), pp. 62–82 (pp. 64–65).

4 Augustus De Morgan, *Arithmetical Books from the Invention of Printing to the Present Time* (London: Taylor & Walton, 1847), p. ii.

De Morgan annotated a significant minority of his books with notes about their rarity, their place in mathematical history, their quality in his opinion, their connection with him, or with anecdotes about their authors, ranging in length between a phrase and a paragraph.⁵ Examples are: 'All the notes were made when I was a student at Cambridge. May 19/49'; 'Found in the *threepenny box* at a bookstall by A De Morgan'; 'Watt mentions no edition earlier than 1799'; and:

The Royal Society published this paper, I may say, with avidity: I had not the least idea that it would be inserted in the Transactions, for which it was never intended. But they refused to publish the account of the manner in which their predecessors had falsified the second edition of the *Commercium Epistolicum*, for which I exposed them in the *Philosophical Magazine* for June 1848. But it is easier to make ink blush than philosophers, and I cannot say that they ever appeared ashamed of themselves. So I blush for them.⁶

Annotations appear on all sorts of books, from pamphlets to incunabula and to such iconic works as the first edition of Copernicus's *De Revolutionibus* (1543). Occasional volumes have notable provenance: for example, the sixteenth-century German Jesuit mathematician and astronomer Christoph Clavius and the seventeenth-century English poet and politician Edmund Waller.

The Contemporary Context

Mathematics was not a major or fashionable subject in which to collect in De Morgan's time, which explains how a professor with a large family and an annual income which seldom reached five hundred pounds could acquire a fine collection, independently of review and presentation

5 For a preliminary analysis of annotations, see Attar, 'Augustus De Morgan (1806–71)'.

6 On De Morgan's copies of the following books respectively: Giuseppe Venturoli, *Elements of the Theory of Mechanics*, trans. by D. Cresswell (Cambridge: Nicholson, 1822), Senate House Library (henceforth SHL) [DeM] N.1 [Venturoli] SSR; James Bradley, *A Letter to the Right Honourable George, Earl of Macclesfield, Concerning an Apparent Notion Observed in Some of the Fixed Stars* (London: [s.n.], 1747), SHL [DeM] M [Bradley]; George Alexander Stevens, *A Lecture on Heads*, new edn (London: G. Kearsley, 1787), SHL [DeM] (XVIII) BBc [Stevens]; Augustus De Morgan, 'On a Point Connected with the Dispute between Keil and Leibnitz about the Invention of Fluxions' [offprint] (London: printed by R. and J.E. Taylor, 1846), SHL [DeM] L° (B.P. 12).

copies among the more modern books and gifts of books of all vintages: books acquired from second-hand dealers (let alone street barrows) were generally cheap. Even auction prices could be modest, especially as De Morgan and other collectors bid directly without impediment, rather than employing agents. In 1809, Thomas Frognall Dibdin both encapsulated and canonised the contemporary attitudes of book collectors when he summarised the subjects on which bibliophiles collected as large paper copies (equated with limited editions), illustrated (i.e. extra-illustrated) copies, unique copies, copies printed upon vellum, first editions (and specifically Shakespeare's First Folio and Greek and Latin classics), true editions (i.e. editions with variants), unopened copies, black letter books, and books printed by Caxton, Wynkyn de Worde and the Manutius family. Little differentiates his list from those of Andrew Lang and Henry Wheatley at the end of the nineteenth century.⁷ Discussions of specific collectors reinforce the message conveyed by general studies. De Ricci's seminal work on book collectors mentions nobody whose subject of interest was mathematics.⁸ The sole collector featured in *The Dictionary of Literary Biography's Nineteenth-Century British Book-Collectors and Bibliographers* who amassed mathematical works was the youthful James Orchard Halliwell (later Halliwell-Phillipps), before he moved on to Renaissance literature, and the chapter is silent about his mathematical collecting.⁹ The auctions of the mathematical collections of De Morgan's Cambridge teacher and lifelong friend George Peacock and of James Orchard Halliwell demonstrate the overall indifference

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- 7 Thomas Frognall Dibdin, *The Bibliomania or Book Madness, Containing Some Account of the History, Symptoms and Cure of this Fatal Disease*, ed. by P Danckwerts (Richmond: Tiger of the Stripe 2007), pp. 56–74; Andrew Lang, *The Library* (London: Macmillan, 1881), pp. 19–21, 76–122; Henry B. Wheatley, *Prices of Books: An Inquiry into the Price of Books which has Occurred in England at Different Periods* (London: G. Allen, 1898), p. 179.
- 8 Seymour de Ricci, *English Collectors of Books & Manuscripts (1530-1930) and their Marks of Ownership* (Cambridge: Cambridge University Press, 1930); see also William Younger Fletcher, *English Book Collectors* (London: K. Paul, Trench, Trübner, 1902).
- 9 Richard Maxwell, 'James Orchard Halliwell-Phillipps', in *Nineteenth-Century British Book-Collectors and Bibliographers*, ed. by William Baker and Kenneth Womack, *Dictionary of Literary Biography*, 184 (Detroit, Washington DC: Gale Research, 1997), pp. 202–18. Even a monograph devoted to Halliwell-Phillipps ignores his mathematical collecting: see Marvin Spevack, *James Orchard Halliwell-Phillipps: The Life and Works of the Shakespearean Scholar and Bookman* (New Castle, DE: Oak Knoll and London: Shephard-Walwyn, 2001).

to mathematical books clearly: Peacock's sale was unusually sketchily described, and Halliwell's fetched exceptionally low prices.¹⁰

This does not mean that no general interest in mathematical books existed, but that interest was based on extra-textual factors and applied only to a small proportion of books. A few mathematical books fell into desirable categories for being printed on vellum (typically some copies of the 1482 Euclid) or on large paper, or for fine bindings. Collectible early printers produced small amounts of mathematics: four on Ptolemaic astronomy from the Aldine Press, all postdating the death of Aldus Manutius,¹¹ and a tiny part of both the Plantin and the Elzevir output. De Morgan possessed all of these works.¹² Books produced by early English printers—such as Henry Billingsley's first English edition of Euclid (printed by John Day, 1570), and especially those in black letter, such as Cuthbert Tunstall's *De arte supputandi* (Richard Pynson, 1522), the first English printed work to be devoted exclusively to mathematics—provided a major competing interest.¹³ Auction catalogues of mathematical books, as of others, highlight these features. That of the book collector John Bellingham Inglis, who gave De Morgan the run of his library, provides particularly good examples of books falling in this last category.¹⁴ The catalogues sometimes drew attention to 'rarity' or 'scarcity', terms which could be aimed at either the general collector or the mathematical connoisseur.

Further mathematical books were wanted insofar as they constituted part of general knowledge. From at least the Stuart period onwards, mathematics comprised one of several branches of knowledge which

10 See Munby, pp. 7 and 18–19.

11 See *The Aldine Press: Catalogue of the Ahmanson-Murphy Collection of Books by or Relating to the Press in the Library of the University of California, Los Angeles, Incorporating Works Recorded Elsewhere* (Berkeley: University of California Press, 2001), nos. 141, 266, 541 and 681. Ahmanson-Murphy provides a brief history of Aldine collecting, p. 13.

12 See Leon Voet, *The Plantin Press (155-1589): A Bibliography of the Works Printed and Published by Christopher Plantin at Antwerp and Leiden*, 6 vols. (Amsterdam: Van Hoeve, 1980-1983), vol. 6 (1983): Indices, p. 2633; Alphonse Willems, *Les Elzevier: histoire at annales typographiques* (Brussels: van Trigt, 1880), nos. 52, 244, 413, 503, 624 and 800.

13 Cuthbert Tunstall, *De arte supputandi libri quattuor* (London: R. Pynson, 1522).

14 Sotheby, Wilkinson & Hodge, *Catalogue of the Principal Portion of the Singularly Curious and Valuable Library of the late J.B. Inglis ...* (London: [Sotheby, Wilkinson & Hodge, 1871]).

would typically be represented in a gentleman's library, if not by a high proportion of books.¹⁵ The desirable books were modern: when title pages of auction catalogues named specific titles for sale, these focused at least partly on comparatively recently published books, such as Francis Maseres' *Scriptores logarithmici* (1791–1807), Leonhard Euler's *Institutiones calculi differentialis* (1755) and his twelve-volume works, and titles by Francis Baily, Charles Hutton and Jean-Baptiste Biot among others.¹⁶

Supply by the book trade implies a certain demand. The bookseller Samuel Maynard made a living from selling specifically mathematical books, advertised as having been sourced from the libraries of deceased mathematicians, at his shop in Fleet Street and later Leicester Square. He was the foremost mathematical bookseller, whose stock after his death was sold by Sotheby's, but at least five others were congregated nearby.¹⁷ Furthermore, auctioneers in De Morgan's lifetime happily sold mathematical collections, which they more often than not described on their title pages as 'valuable'. Sotheby catalogues dominate, possibly as the best preserved, but other examples stem from Hodgson, Lewis, Tait, and Southgate & Barrett, all in London, and Ballantyne in Edinburgh.

The mere fact that specifically mathematical libraries were sold proved that they were also consciously amassed. Giles Mandelbrote has detailed the presence of scientific (sometimes mathematical) books

15 See, for example, David Pearson, *Book Ownership in Stuart England: the Lyell Lectures, 2018* (Oxford: Oxford University Press, 2021), p. 21; Mark Purcell, *The Country House Library* (New Haven and London: Yale University Press for the National Trust, 2017), pp. 125–31.

16 Examples are taken from *A Catalogue of the Valuable Mathematical Library of the late Thomas Leybourn* (London: Hodgson, [1840]) and *Catalogue of the Valuable Mathematical & Miscellaneous Library of the late Reverend John Toplis, Late Fellow of Queens College, Cambridge, and Rector of South Walsham, Norwich* ([London: S. Leigh Sotheby & J. Wilkinson, 1858]).

17 S.L. Sotheby and John Wilkinson, *Catalogue of the Stock of Books of Mr. Samuel Maynard ... which will be Sold ... on Wednesday, 7th January [sic] 1863 and Two Following Days ...* ([London]: J. Davy and Sons, [1863]). For details of other mathematical booksellers frequented by De Morgan, see Karen Attar, 'Augustus De Morgan's Incunabula', in *Spotlights on Incunabula*, ed. by Anette Hagan, *Library of the Written Word*, 118 (Leiden: Brill, 2024), pp. 194–211 (p. 202). They were not the first: John Nichols described John Nourse, a bookseller on the Strand who died in 1780, as 'a man of science, particularly in the mathematical line' (W. Roberts, *The Book-Hunter in London: Historical and Other Studies of Collectors and Collecting* (London: Elliot Stock, 1895), p. 236).

in libraries up until the early eighteenth century, and Judith Overmier has continued the overview to the twentieth century.¹⁸ The words 'mathematics' or 'mathematical' occur for twenty-two libraries between 1810 and 1870 in the SCIPIO database of art auction and rare book catalogues, often as one subject among several in a general library.¹⁹ De Morgan trod a comparatively narrow path, as Overmier states cogently,²⁰ but he was not alone.

As marked-up sale catalogues and the occasional inscriptions in his books show, De Morgan purchased from the libraries of earlier collectors—chiefly mathematicians—sometimes at a remove. Sale catalogues available for the period 1820–1858 which specify mathematics (as opposed to general science) in their title are those of the astronomer Francis Baily; the clergyman George Burgess Wildig; a gentleman identified by De Morgan as the judge William Fuller Boteler; the mathematical teacher, headmaster and rector John Toplis; amateur scientist and mathematical enthusiast Abigail Baruh Lousada; and the mathematicians Thomas Galloway, William Wallace, Thomas Stephen Davies, Thomas Leybourn and John Playfair. The catalogue of the antiquary and literary scholar James Orchard Halliwell is also relevant, as De Morgan bought heavily from it.²¹

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- 18 Giles Mandelbrote, 'Scientific Books and their Owners: A Survey to c. 1720', in *Thornton and Tully's Scientific Books, Libraries, and Collectors: A Study of Bibliography and the Book Trade in Relation to the History of Science*, 4th edn, ed. by Andrew Hunter (Aldershot: Ashgate, 2000), pp. 333–66; Judith Overmier, 'Scientific Book Collectors and Collections, Public and Private, 1720 to Date', in *Thornton and Tully's Scientific Books*, pp. 367–91. Of the collectors covered in this chapter, Overmier devotes paragraphs to Charles Babbage, Augustus De Morgan, and Guglielmo Libri.
- 19 OCLC, SCIPIO: Art and Rare Books Sales/Auction Catalogs. I am indebted to Karen Limper-Herz for searching SCIPIO for me. Ellen G. Wells locates twelve mathematical collectors for the same period: see Ellen G. Wells, 'Scientists' Libraries: A Handlist of Printed sources', *Annals of Science*, 40 (1983), 317–89.
- 20 Overmier, p. 368.
- 21 *Catalogue of the Valuable Astronomical, Mathematical, and General Library of the Late Francis Baily ...* ([London: S. Leigh Sotheby, 1845]); *Catalogue of a Selected Portion of the Scientific, Historical, and Miscellaneous Library of James Orchard Halliwell ...* ([London: S. Leigh Sotheby, 1840); *Catalogue of the Mathematical, Classical, and Miscellaneous Library of a Gentleman, Deceased ...* ([London: S. Leigh Sotheby, 1846]); *Catalogue of the Library of the Late Rev. George Burgess Wildig ... Together with Another Valuable Collection, Including all the Best English and French Mathematical Works ...* ([London: L.A. Lewis, 1854); *Catalogue of the Valuable Mathematical & Miscellaneous Library of the Late Reverend John Toplis*; *Catalogue of the Valuable Astronomical & Mathematical Library of the Late Thomas Galloway ...* ([London: S.

Of these libraries, Francis Baily's was evidently utilitarian. Imprints are chiefly from the nineteenth century (of a sample, 72 per cent) followed by eighteenth-century imprints (27 per cent), leaving just one percent of earlier books. Works on astronomy, annuities and probability predominate, in accordance with Baily's professional interests. Other libraries are more clearly collections. Among the owners, Thomas Galloway has been noted for his 'small but valuable library', primarily for his nineteen Keplers; the reference, which appears in his entry in the *Oxford Dictionary of National Biography*, stems ultimately from De Morgan's note of Galloway's books in his obituary for Galloway.²² All the people named owned some mouth-watering items: even Baily, the most pedestrian amasser of mathematical books, owned the first edition of Copernicus's *De revolutionibus*, and a 'fine copy, in vellum' of Tycho Brahe's *Historia coelestis* (1666).²³

What instantly differentiates De Morgan's library from the others is its sheer size. The quantity of lots is admittedly a crude guide to the size of collections because some catalogues bunch several items into one lot and, quite commonly, titles considered insignificant are noted merely as 'and others'. Yet even allowing for this propensity, De Morgan's library remains markedly larger than the others, the number of whose lots range from 228 (Wildig) to 1384 (Playfair) before one subtracts lots unconnected with mathematics or astronomy.

Leigh Sotheby & J. Wilkinson, 1852]); *Catalogue of the Mathematical, Philosophical, and Miscellaneous Library ... of Miss A.B. Lousada ...* ([London: Sotheby, 1834]); *Catalogue of the Valuable Library of the Late William Wallace, LL.D. Professor of Mathematics in the University of Edinburgh ...* ([London: C.B. Tait, 1843]); *A Catalogue of the Valuable Mathematical and Scientific Library of the Late T.S. Davies ... Professor of Mathematics at the Royal Military Academy, Woolwich ...* ([London: Southgate & Barrett, 1851]); *A Catalogue of the Valuable Mathematical Library of the Late Thomas Leybourn*); *Catalogue of the Library of the Late John Playfair ... Comprising a Valuable Collection of Mathematical, Philosophical, and Miscellaneous Books, Maps, &c &c ...* (Edinburgh: J. Ballantyne, 1820).

- 22 David Gavine, 'Galloway, Thomas (1796–1851)', *Oxford Dictionary of National Biography Online* (Oxford: Oxford University Press, 2004), <https://doi.org/10.1093/ref:odnb/10312>; For Augustus De Morgan's obituary of Galloway, see *Monthly Notices of the Royal Astronomical Society* (1851–52), 87–89. The ODNB entry for Thomas Leybourn notes 'his library of nearly a thousand books', without indicating its content; see Niccolò Guicciardini, 'Leybourn, Thomas (c.1769–1840), Mathematician', in *Oxford Dictionary of National Biography Online*, <https://doi.org/10.1093/ref:odnb/16622>.
- 23 Baily sale catalogue, lots 452 and 227 respectively.

The chronological range of titles is a further differential. Leybourn, Halliwell, Toplis, and Boteler each owned the occasional incunable, but none as many as De Morgan's twenty-one.²⁴ The presence of antiquated elementary textbooks, such as Cocker and Hodder on arithmetic, in De Morgan's library is a third; others barely own such books. The extent to which De Morgan owned multiple editions of books is a fourth. To have possessed more than one Euclid, edited by different editors, is common, and examples are present of owners having two or more editions of another particular work, whereby Galloway's five editions of Newton's *Principia* stand out.²⁵ Yet nobody owned as many multiple editions as Augustus De Morgan with his three editions of Cuthbert Tunstall's *De arte supputandi*, six of Newton's *Principia* (including the first French edition), eight editions of Sacrobosco's *Sphaera mundi*, nine of Robert Recorde's *Ground of Arts*, plus two of his *Whetstone of Witte*, and so forth.

Of mathematical libraries auctioned during De Morgan's lifetime, there remains that of Guglielmo Libri, which far surpassed De Morgan's library numerically, yet has probably received less attention.²⁶ Libri's collection has been tarnished by the method by which he acquired some of his books: he was a known thief.²⁷ Possibly the mathematical section was diluted by the strengths of other areas of Libri's library, just as Halliwell's mathematical collection pales beside his Shakespeareana. Much of the explanation for its lower profile is that, like the other libraries noted above, it has been dispersed. A dispersed library is generally harder to research than an intact one, although Benjamin Wardhaugh's scholarly examination of Charles Hutton's library (considered by De Morgan to be the best of its time), dispersed in 1816, proves that it can be done.²⁸

24 Listed in Attar, 'Augustus De Morgan's Incunabula', pp. 195–96.

25 Galloway catalogue, lots 470–02 and 474–75.

26 *Catalogue of the Mathematical, Historical, Bibliographical and Miscellaneous Portion of the Celebrated Library of M. Guglielmo Libri ...* (London: S. Leigh Sotheby & J. Wilkinson, [1861]).

27 For a full account of Libri and his books, see P. Alessandra Maccioni Ruju and Marco Mostert, *The Life and Times of Guglielmo Libri (1802–1869), Scientist, Patriot, Scholar, Journalist and Thief: A Nineteenth-Century Story* (Hilversum: Verloren, 1995).

28 Leigh and Sotheby, *A Catalogue of the Entire, Extensive and Very Rare Mathematical Library of Charles Hutton ...* (London: Leigh & Sotheby, [1816]); a marked-up copy is in De Morgan's library at Senate House Library, [DeM] Z (B.P.34); Benjamin Wardhaugh, 'Collection, Use, Dispersal: The Library of Charles Hutton and the Fate of Georgian Mathematics', in *Beyond the Learned Academy: The Practice of*

Two further mathematical libraries remained undispersed. Charles Babbage's library of 2,581 lots, described as the best of the time apart from De Morgan's, is at the Royal Observatory in Edinburgh. That of De Morgan's London friend and colleague John Thomas Graves, larger than De Morgan's and sharing its characteristics of breadth, school textbooks, multiple editions and a goodly number of fifteenth-century imprints, is at University College London.²⁹ Neither of Babbage's biographers refer to his library, presumably because it has no bearing on his scientific achievements.³⁰ Graves's library is noted in his entry in the *Oxford Dictionary of National Biography*.³¹ Its comparative obscurity is harder to explain. One reason could be that it made less impact on University College London than De Morgan's library did on the central University of London Library: whereas De Morgan's library was the University of London's founding collection, Graves's, albeit indubitably significant, joined an already respectable library.³²

The remainder of the explanation lies in factors which set De Morgan's library apart from all the others. The first of these is that De Morgan was a leading mathematician who wrote for various audiences, and whose bibliography of arithmetical books (1847) was cited as an authority in contemporary auction catalogues and continued to be respected long afterwards. Secondly, some of De Morgan's writings were closely connected with his own books and made the fact of his

Mathematics, 1600–1850, ed. by Philip Beeley and Christopher Hollings (Oxford: Oxford University Press, 2024), pp. 158–84.

- 29 Described respectively in M.R. Williams, 'The Scientific Library of Charles Babbage', *Annals of the History of Computing*, 3 (1981), 235–40, and in Alison R. Dorling, 'The Graves Mathematical Collection in University College London', *Annals of Science*, 33 (1976), 307–09. Babbage's books were listed in *Mathematical and Scientific Library of the late Charles Babbage of No. 1, Dorset street, Manchester Square* ([London: Sotheby, Wilkinson & Hodge, 1872]); Graves's in *Catalogue of Books in the General Library and in the South Library of University College, London*, 3 vols. (London: Taylor and Francis, 1879), where they are identified as coming from him.
- 30 See Maboth Moseley, *Irascible Genius: A Life of Charles Babbage, Inventor* (London: Hutchinson, 1964); H.W. Buxton, *Memoir of the Life and Labours of the Late Charles Babbage, Esq. F.R.S.*, Charles Babbage Institute Reprint Series for the History of Computing, 13 (Cambridge, MA: MIT Press, 1988).
- 31 Adrian Rice, 'Graves, John Thomas (1806-1870)', *Oxford Dictionary of National Biography Online*, <https://doi.org/10.1093/ref:odnb/11311>.
- 32 See Attar, 'Establishment', p. 44, and especially *Catalogue of Books in the General Library*, pp. iii–v.

library known—above all his *Budget of Paradoxes*, devoted entirely to books he possessed.³³ The third factor, as stated above, is that De Morgan annotated a significant minority of his books, for his own amusement or edification, for posterity, or both: he both enjoyed and discernibly used his collection, putting it to work for the benefit of mathematical history and bibliography. By immortalising some of his books in his writings, especially the *Budget* and his arithmetical bibliography (based entirely on works he had seen and partly on works that he owned),³⁴ De Morgan raised awareness of his ownership of old mathematical books. The resulting prestige of his collection ultimately ensured its long-term preservation and hence an afterlife.

The Afterlife

The afterlife of De Morgan's library began a fortnight after his death with a speculation in *The Spectator* on 1 April 1871:

Would it be impossible, by the way, to secure for the University the late Professor de Morgan's unique mathematical library, which probably contains the most curious collection of books on the history of mathematics to be found in England? ... if it could be obtained, there would be a special fitness in securing it for the University of London, which would then have a really good start towards the formation of a fine classical and scientific library.³⁵

The timing was propitious. The University of London had only recently acquired its own building and thereby space for a library, and Sir Julian

33 Augustus De Morgan, *A Budget of Paradoxes* (London: Longmans, Green, 1872). See also Chapter 7 in this volume.

34 Augustus De Morgan, *Arithmetical Books from the Invention of Printing to the Present Time* (London: Taylor & Walton, 1847). In 1908 David Eugene Smith called this 'one of our best single sources' (David Eugene Smith, *Rara Arithmetica: A Catalogue of the Arithmetics Written before the Year MDCL, with a Description of those in the Library of George Arthur Plimpton, of New York* (Boston and London: Ginn, 1908), p. xii); this bibliography refers several times to De Morgan's. As late as 1967, A. Rupert Hall noted the continuing use of De Morgan's bibliography and described it as a 'minor classic' (Augustus De Morgan, *Arithmetical Books from the Invention of Printing to the Present Time*, intro. by A. Rupert Hall (London: Hugh K. Elliott, [1967]), p. [vii]).

35 'News of the Week', *The Spectator*, 1 Apr. 1871, p. 371; see also 'Miscellaneous', *Birmingham Daily Post*, 7 Apr. 1871, p. 6; 'Multiple News Items', *The Sheffield and Rotherham Independent*, 7 Apr. 1871, p. 3.

Goldsmid had noted the importance for the University of having a library, so that the possible provision met a newly revealed requirement.³⁶ On 10 May, the University Chancellor, Lord Granville, appealed at the annual University of London degree ceremony for books to fill the empty bookshelves of the new University of London Library. That afternoon, a meeting took place to determine how to honour Augustus De Morgan, at which, again according to *The Spectator*, 'There was also a great desire to purchase his rare mathematical library (valued at something like £1,200) on behalf of the University of London'.³⁷ Samuel Loyd, First Baron Overstone, was present. He and De Morgan had moved in similar orbits: Overstone served from 1828 until 1844 on the council of University College London, where De Morgan was a professor, and as a banker could have known De Morgan's actuarial work and his views on decimal currency (upon the introduction of which the two men held opposing views). Whether he knew De Morgan and his activity as a collector personally is a matter for speculation.³⁸ But he was a wealthy member of the University Senate who heard the plea, and he purchased the collection for the University. In June 1871, following receipt of the books, he wrote to the Senate:

It is a source of satisfaction to me to have been the means of preventing the disperssion [*sic*] of this remarkable collection of mathematical Works; and I gladly present it to the London University, as a testimony of my appreciation of the service which that Body has rendered to the extension and improvement of Education in all its branches throughout the United Kingdom, and in the hope that it may prove the first fruits of a Library which shall ere long become such in all respects as the London University ought to possess.³⁹

De Morgan's library not only remained physically under one roof, but its contents were readily identifiable by the note '[D.M.]' at the end of titles

36 Attar, 'Establishment', p. 50.

37 'News of the Week', *The Spectator*, 13 May 1871, p. 563.

38 No correspondence between the two men is present in Samuel Jones Loyd, Baron Overstone, *The Correspondence of Lord Overstone*, ed. by D.P. O'Brien, 3 vols. (Cambridge: Cambridge University Press, 1971).

39 Senate minute 156, 14 June 1871 (p. 49); letter from Lord Overstone to W.B. Carpenter, Registrar, 10 June 1871; cited in *Catalogue of the Library of the University of London, Including the Libraries of George Grote and Augustus De Morgan* (London: Taylor & Francis, 1876), p. [iv].

from his library in the University of London's first printed catalogue, from 1876. The catalogue's very title emphasised the presence of De Morgan's books within the University's library: *Catalogue of the Library of the University of London, Including the Libraries of George Grote and Augustus De Morgan*.⁴⁰ It remains a lasting record: indeed, the only printed record, as provenance was omitted when the catalogue was updated.⁴¹ A specially designed bookplate was inserted into each volume.

As neither the first catalogue nor the books themselves record shelfmarks, we know neither the order in which the books were originally kept, nor whether they were integrated with, or kept apart from, other library holdings. While Reginald Arthur Rye described them in 1908 as a 'special collection', this could refer to provenance rather than treatment.⁴² Certainly many books were borrowable; at the time of electronic cataloguing in the early twenty-first century, circulation labels remained on several eighteenth-century books (some of which had been borrowed as late as the 1970s).

The books were initially held in some disarray. In his arithmetical bibliography of 1908, David Eugene Smith noted of De Morgan's library: 'While some of the books were sold ... most of them were purchased by Lord Overstone and presented to the University of London.'⁴³ Although Smith's phraseology strongly suggests that these were books discarded by De Morgan—for example in a large cull when the family moved from Adelaide Road to 6 Merton Road, near Primrose Hill, in 1868⁴⁴—University of London Librarian Reginald Arthur Rye chose to assume theft from the University. He explained 'that the University Library was at one time uncared for and stacked in the rooms of the Central Building at South Kensington, to which access was readily obtainable for the

40 The Classical historian George Grote, Vice-Chancellor of the University of London, bequeathed his library to the University within months of De Morgan's death.

41 University of London, *Hand-Catalogue of the Library, Brought Down to the End of 1897* (London: HMSO, [1900])

42 Reginald Arthur Rye, *The Libraries of London: A Guide for Students* (London: University of London, 1908), p. 24. George Grote's books were similarly designated as a special collection, despite definitely being dispersed throughout the collections.

43 Smith, p. [498].

44 Sophia Elizabeth De Morgan, *Memoir of Augustus De Morgan* (London: Longmans, Green, 1882), p. 364.

purpose of meetings, examinations, and the like.’ Rye listed 172 missing titles, many ‘of value and interest’, including ‘a few early printed books’.⁴⁵

Had Rye’s enumeration been accurate, University negligence would have been dire. The list included three quarto incunabula: Giorgio Chiarini’s *Libro che tratta di mercanzie ed usanze dei paesi* (Florence: Francesco di Dino, 1481; Rye attributed authorship to the printer); Joannes de Sacrobosco’s influential astronomical work *Sphaera mundi*, with Gerardus Cremonensis, *Theorica planetarum* (Venice: Franz Renner, 1478), and Paolo Veneto’s *Logica parva* (Milan, Christoph Valdarfer, 1474).⁴⁶ It also included an obscure arithmetic manual, entitled *In desem boechelge[n] uyne men ein kurtze[m] wech vn[n] güde manier bald tzo leren rechen mit zifferen nae der konst algorismi* (‘*Algorismus*’) (Cologne, 1526), one of the rarest titles in the collection.

Fortunately, Rye overestimated the loss. The vast majority of items listed as lost, including those listed above, remain safely at the University of London. Many are pamphlets within bound volumes and are hence easy to overlook, especially as the printed catalogues do not state the contents of such *sammelbände*. Minor works by Jacques Philippe Marie Binet, Augustin-Louis Cauchy, Michel Chasles, Sir John Herschel, Charles Hutton and William Whewell all fall into this category, which includes offprints and extracts and in which items, by virtue of their comparatively ephemeral nature, lack title pages. The occasional more substantial item is part of a *sammelband* and therefore also possible to overlook: Petrus Ramus’s 336-page quarto *Mathematicarum libri unus et triginta*, edited by Lazarus Schöner (Frankfurt, 1599) and bound with Ramus’s *Arithmeticae libri duo* of the same year, is an example. But other items are hefty volumes, multi-volume sets, or both: John Bale’s *Index Britanniae scriptorium* (1657) is a two-volume folio of 1,128 pages; Sir John Hill’s *Review of the Works of the Royal Society of London* (2nd edn, 1780) comprises 686 pages, Johann Jacob Grynaeus’s folio *Adagia* (Frankfurt, 1646) is a folio of 946 pages, and Daniel Neal’s *History of the Puritans* (London, 1822) is in five volumes. Inability to find them implies either wilfulness or disorder.

45 Senate House Library, Library Committee minutes, 1901-13, UoL/.UL/1/1/1: minute 113, meeting of 27 Apr. 1908, and minute 123, meeting of 29 June 1908.

46 ISTC ic00449000, ij00402000 and ip00220000, respectively.

However, Rye's accusation bore some substance. Most items wanting can be inferred to be slight from the designation 'n.p., n.d.' ('no place, no date'), or are reports on subjects ranging from Henry Toynbee's *Report to the Committee of the Meteorological Office on the Use of Isobaric Curves* (1869) to a *Sydney College Report of the Syndicate appointed to Consider Whether it is Expedient to Afford Greater Encouragement to the Pursuit of those studies for the Cultivation of Which Professorships Have Been Founded in the University, and, if so, by What Means that Object May be Best Accomplished* (1848). T. T. Wilkinson's *On Some Points in the Restoration of Euclid's Porisms*, listed as an octavo without place or date of publication, appears to be a ghost. Perceived duplicates are salient, when Rye located only one of two copies of a book recorded in the catalogue, and only one copy remains today: the eighth edition of John Hawkins's *The Young Clerk's Tutor Enlarged* (1675), based on the work of Edward Cocker, and Gregor Reisch's *Margarita Philosophica* ([Strasbourg], 1504). Collections did not arrive in the nineteenth century with an obligation to retain all items, and the loss of the second copy in both instances could have resulted from a discreet sale of duplicates.⁴⁷

In the early twentieth century the De Morgan library, along with those in the University Library generally, were classified, following a scheme devised by Reginald Arthur Rye based on the Dewey Decimal Classification.⁴⁸ Dewey had divided mathematics into eight main classes from 511 to 519 (with general mathematical works in class 510): arithmetic, algebra, geometry, conic sections, trigonometry, descriptive geometry, analytic geometry and quaternions, calculus, and probability. Class 518 remained empty. Each class was subdivided: whereby arithmetic and trigonometry, for example, each had nine subdivisions, algebra had 21, while geometry had 41 in the basic geometry section alone. Astronomy occupied numbers 521 to 529: theoretic, practical and spherical, descriptive, maps and observations, earth, geodesy, navigation, ephemerides, and chronology, again sub-divided, and

47 No such sale is recorded in Library Committee minutes. That some books were sold as duplicates is apparent from annotations in the archive copy of the Library's 1900 catalogue (University of London Archive, UoL/UL/8/1).

48 Melvil Dewey, *Decimal Classification and Relative Index: for Libraries, Clippings, Notes, etc.*, 6th edn (Boston: Library Bureau, 1899). For Rye's system, see R.A. Rye, 'Table of Shelf Classification and Arrangement for the General Library', University of London Archive, UoL/UL/8/2.

with general works at 520. Rye followed Dewey precisely for Class M, Astronomy, minus the subdivisions. He adapted mathematics (Class L), changing Dewey's order, reducing the emphasis on geometry, relegating probability to a subdivision, and adding a class to the end, as the table below shows. Both systems placed mathematical bibliography within bibliography.

UL classmark	Subject	Dewey number
L	Mathematics (general)	510
L1	Arithmetic	511
L1.1	Book-keeping	
L1.2	Mensuration	
L2	Algebra	512
L2.1	Probabilities / Group theory	519
L3	Calculus	517
L4	Annuities: insurance	519.5
L5	Trigonometry	514
L6	Geometry: conic sections	513; 515
L7	Analysis and functions	516
L8	Mathematical tables	511.9; 512.9
L9	Weights and measures	n/a

Any classification scheme imposes a certain order on a collection. But with its failure to subdivide, Rye's system (now termed 'Old Classification') was clearly far cruder than Dewey. A large collection devoted to a single subject exposes this drawback mercilessly; why Rye ignored the possibility for greater distinction in a library which began with a rich subject-based special collection is a mystery. Moreover, Old Classification depended heavily on names, verbal descriptions, and dates for further arrangement. The De Morgan Library, with several editions of a single work, suffered. Many books were either undifferentiated, or were differentiated by means of such long, unwieldy classmarks as [DeM] L6 [Apollonius. Pergaeus] or, in an extreme example, [DeM] L6 [Euclid – Elements – English - 1834]. One hundred years later, retrieval remains challenging.

Although De Morgan's library is not distinguished by fine bindings, any large collection is likely to have a smattering of them. Of the eighty-three bindings exhibited from various countries and centuries featured in the exhibition of bookbindings with which the University of London Library celebrated its move from the Imperial Institute in South Kensington to the new Senate House building in London's Bloomsbury area in 1937, ten were from De Morgan's library.⁴⁹ This was the first time the University had promoted printed material in the library in a publication, beyond descriptions in library directories. Manuscripts fared better. Receipt of the Black Prince manuscript in 1921, a medieval manuscript providing an eye-witness account of some battles of the Hundred Years War, provided the incentive to produce a catalogue of the Library's manuscripts. This was published in the same year and made known manuscript material generated by De Morgan and the few other manuscripts he owned.⁵⁰

Some twenty years later, misfortune struck the collection. At about 4.00 a.m. on Saturday, 16 November 1940, a high-explosive German bomb exploded in the Library's strong-room, damaging, among others, several De Morgan books. Only two were considered irrevocably damaged and were not replaced, Bonaventura Cavalieri's *Exercitationes geometricae sex* (Bologna, 1647) and the 23rd, very rare, edition of Francis Walkingame's *The Tutor's Assistant* (London, 1787). Both remain in the Library, with De Morgan's note on the half-title verso of the Cavalieri. Another thirteen books were described as 'books badly damaged, but which could be repaired if they cannot be replaced'; most were sixteenth, seventeenth and eighteenth-century imprints from the De Morgan Library. The Library was able to purchase three books to 'replace' bomb-damaged copies: Francesco Maurolico's *Cosmographia* (Venice, 1543), John Wilkins's *A Discourse Concerning a New World & Another Planet* ([London], 1640) and Blaise Pascal's *Traitez de l'équilibre des liqueurs* (Paris, 1698). The damaged books remain and have attained

49 Reginald Arthur Rye and Muriel Sinton Quinn, *Historical and Armorial Bookbindings Exhibited by the University Library: Descriptive Catalogue* (London: University of London, 1937).

50 Reginald Arthur Rye, *Catalogue of the Manuscripts and Autograph Letters in the University Library at the Central Building of the University of London* (London: University of London Press, 1921). See Chapter 11 in this volume.

a new meaning as memorials to the London Blitz and to the role played by the University of London in the Second World War.

After the war, De Morgan's library was accessible to the extent that any collection was: catalogued in the University of London's card catalogue, and described in standard library directories.⁵¹ Its items of economic interest, for example concerning finance, were included in the printed catalogue of the Goldsmiths' Library of Economic Literature, with notes recording De Morgan's ownership and the presence where applicable of his manuscript notes.⁵² Subsequently, Maxine Merrington of University College London's School of Library, Archive and Information Studies trawled through those of the De Morgan books which had been gathered together at the time to produce a published listing of letters inserted in books in De Morgan's library, enlarging awareness of the circles in which he moved and the respect in which he was held.⁵³ Yet the library's impact was modest. The emphasis of early printed books before the digital era remained their content, and the history of mathematics was a niche subject. When in the 1980s the Library decided to stop acquiring books in the sciences, De Morgan's library was on a limb.

The collection gained a new life when scholarly interest turned to post-production copy-specific features of books. De Morgan's annotations, the distinguishing feature lauded in the nineteenth century, were well suited to late-twentieth-century academic fashion with its burgeoning scholarly interest in the history of books (emphasising post-production history) and of reading.⁵⁴ The London Rare Books School, established in 2007, exploited this, using De Morgan's books for their bindings, evidence of provenance (including text deliberately obliterated) and the nature of mathematical illustrations for courses on historic

51 See J.H.P. Pafford, 'The University of London Library', in *The Libraries of London*, 2nd edn, ed. by Raymond Irwin and Ronald Staveley (London: Library Association, 1961), pp. 140–56; *A Directory of Rare Book and Special Collections in the United Kingdom and the Republic of Ireland*, ed. by Moelwyn I. Williams (London: Library Association, 1985).

52 Margaret Canney and David Knott, *Catalogue of the Goldsmiths' Library of Economic Literature*, Vol. 1, *Printed Books to 1800* (Cambridge: Cambridge University Press for the University of London Library, 1970).

53 Maxine Merrington, *A List of Certain Letters Inserted in Books from the Library of Augustus De Morgan (1806–1871) now in the University of London Library* (London: University of London Library, 1990). See Chapter 11 in this volume.

54 Pioneered in the English-speaking world by D.F. McKenzie, *Bibliography and the Sociology of Texts* (London: British Library, 1986).

bookbindings, provenance and the history of publishing, respectively. A single book, valued by De Morgan for its pioneering content, could be of interest for courses on bibliography, incunabula and the history of collections in addition to those named immediately above.⁵⁵

Censuses, formerly focused on traditional collectable books like Caxtons and Shakespeare quartos and First Folios, are now extending to scientific books, such as Vesalius's *De humani corporis fabrica* (1543). De Morgan owned a copy of both the first and second edition of Copernicus's *De Revolutionibus*, which are included in Owen Gingerich's *An Annotated Census of Copernicus' De revolutionibus* (Nuremberg, 1543 and Basel, 1566) (2002), complete with De Morgan's note on the title page of his copy of the first edition: 'Aug. 4. 1864. I have this day entered all the corrections required by the Congregation of the Index (1620) so that any Roman Xtian may read the book with a good conscience'; De Morgan has annotated his copy accordingly.⁵⁶ All incunabula are being gathered into a census in the CERL database *Material Evidence in Incunabula*,⁵⁷ such that information about De Morgan's fifteenth-century books can feed into general knowledge of how the earliest editions of Euclid, Pacioli, Regiomontanus and others have been read and treated over the ages.

De Morgan's incunabula were recorded on the International Short Title Catalogue.⁵⁸ Online cataloguing of the entire collection in 2004/5, enabled by a grant from the Vice-Chancellor's Development Fund, was a major advance. Sometime before 1998, a De Morgan rare book sequence had been set apart. As a forerunner to online cataloguing, the remainder of the collection was collocated physically.⁵⁹ Bookplates revealed one

55 See Karen Attar, 'Senate House Library and the London Rare Books School' (London: Institute of English Studies, University of London, 2020), about Johannes Widmann, *Behende vnd hubsche Rechenung auff allen Kauffmanschafft* (Leipzig: Konrad Kachelofen, 1489), <http://englishstudies.blogs.sas.ac.uk/2020/06/15/senate-house-library-and-the-london-rare-books-school>.

56 Repeated with an illustration in David Pearson, *Books as History* (London: British Library, 2008), p. 131.

57 Consortium of European Research Libraries, *Material Evidence in Incunabula* (2021), <https://www.cerl.org/resources/mei/main>.

58 British Library, *International Short Title Catalogue (ISTC): The International Database of 15th-Century European Printing* (2016), https://data.cerl.org/istc/_search.

59 Excepted were a couple of De Morgan's own books, interleaved and with substantial insertions and annotations, which had been classified as archival material; these remained *in situ*, with catalogue records in the book catalogue.

half of the books in the mathematical section of the Library's 'old classification' sequence, every one of which was opened, to have been De Morgan's. Further books were found across several sequences. Some were instantly identifiable from a uniform binding of half calf and drab brown cloth, even before the book was opened. Others were not, and books continued to emerge long after the conclusion of the project. Currently 3,852 titles on Senate House Library's online catalogue index De Morgan as a former owner, which tallies well with the four thousand titles estimated by 1908 to be in the collection.⁶⁰ De Morgan's books are all recorded on Library Hub Discover (formerly Copac), the union catalogue of British national and research libraries.⁶¹ Books printed up to the year 1830 have records in CERL's Heritage of the Printed Book Database, raising their profile nationally and internationally.⁶²

As all electronic catalogue records code the date, language and country of publication of each item, online cataloguing of De Morgan's library instantly enabled accurate analysis of his library in terms of these features, singly or in combination. The printed and card catalogues had recorded author, title, edition, format and the place and date of publication. Online cataloguing followed standard rare book cataloguing rules of the time.⁶³ Electronic records routinely included details of publishers and pagination and added notes. They indexed printers and publishers for books printed up to 1700, indexed subjects, noted salient bindings, and described all evidence of provenance and all imperfections. They indexed all former owners, including De Morgan, and the best way to gain an overview of the collection is to search the name index for De Morgan as a former owner.

For the workings of De Morgan's mind and his library, provenance and other copy-specific notes were the most important features. De Morgan himself had several volumes bound and took care about what went into each for uniformity of content and format. It is possible to

60 See University of London, Catalogue, <https://catalogue.libraries.london.ac.uk>

61 Jisc, *Library Hub Discover*, <https://discover.libraryhub.jisc.ac.uk>.

62 Consortium of European Research Libraries, Heritage of the Printed Book Database (2018), <https://www.cerl.org/resources/hpb/main>.

63 Association of College and Research Libraries, American Library Association and Office for Descriptive Cataloging Policy, Library of Congress, *Descriptive Cataloging of Rare Books*, 2nd edn (Washington, D.C.: Cataloging Distribution Service, Library of Congress, 1991).

see the results of his organisation through a note like: 'SHL copy is no. 1 of 8 items on philosophy and economics, 1813-1841, in vol. with binder's spine title: "De Morgan Tracts". (B.P.304)', and then to browse virtually the list of contents of the volume. Provenance notes at their most basic read: 'SHL copy is from the library of Augustus De Morgan'. The fact and date of inscriptions is noted, as is their location: for example, 'SHL copy is from the library of Augustus De Morgan, with his note, 3 Dec. 1857, tipped on p. [3]' (L (B.P.21) SSR). Occasionally the subject of the annotation is noted, as for Thomas Keith's *Complete practical arithmetician* (1788): 'SHL copy is bound with the author's Key to The complete practical arithmetician (1790). Notes on Bonnycastle's Arithmetic and Algebra written on front flyleaf.' Even brief notes serve a purpose, flagging points of interest for potential researchers. Electronic cataloguing further helped to shed light on the circulation of mathematical books in the Victorian era by indicating books which had belonged to mathematicians or astronomers before De Morgan: Francis Baily, Olinthus Gregory, Thomas Galloway and others. The information is incomplete because it relies on either former owners having recorded their names in books, or on De Morgan having noted the method of acquisition, and comparison of his books with marked-up Sotheby sale catalogues shows that he did this only sporadically. However, it opens the field for further research.

Following cataloguing came digitisation, with the facilitation of more research. In 2020 Brill released the first segment of De Morgan's library digitally, 'The Augustus De Morgan Collection'. Digitisation of each book from cover to cover took advantage of the togetherness of a broad mathematical library. De Morgan's annotations provided a unique selling point to justify the reproduction of books which as texts were frequently available from other sources.

With some exceptions such as early editions of Euclid, Newton and Copernicus, the history of mathematics can be a hard sell for outreach purposes. The first book on logarithms or the earliest reference to the decimal point lacks the general allure of the first edition of a familiar literary work, a travel book, a work on magic, or an exquisitely illustrated volume. De Morgan's books have been used for blog posts and displays about the holdings of Plantin and Elzevir imprints, connected with anniversaries of both publishers. A twenty-first-century library

initiative focused on the importance of De Morgan's books as Senate House Library's founding collection: a virtual exhibition of 150 items to celebrate the library's 150th anniversary in 2021 concentrated on post-1871 imprints to emphasise the library's dynamism, but devoted one of its nine sections to the founding collections.⁶⁴ Nine of the fifteen books in that section were from De Morgan's library: primarily obvious treasures, but also Ramchundra's *A Treatise on Problems of Maxima and Minima, Solved by Algebra* (1850), to show De Morgan's interest in Indian mathematics and his support for, and connections with, other mathematicians (letters from Ramchundra to De Morgan are tipped in). Some of De Morgan's books appeared in two treasures volumes. The thirty items in *Director's Choice*, a handy gift for library visitors, included two from De Morgan's library, selected for his annotations: Clairaut's *Théorie de la lune* (1765) and John Leland's *Commentarii de Scriptoribus Britannicis* (1709).⁶⁵ A more substantial volume showcasing sixty items included three from De Morgan's library.⁶⁶ One was the only known complete copy of Bernard de Granollachs's *Lunarium ab anno 1491 ad annum 1550* (Lyon: Johannes Siber, 1491).⁶⁷ Another, John Bonnycastle's *The Scholar's Guide to Arithmetic*, edited by Edwin Colman Tyson (1828), is also scarce, but was more important for De Morgan's annotation of 1857 identifying it as 'the book which suggested the existence of the deficiency to supply which I wrote my own arithmetic in 1830.'

De Morgan's library has been used to meet interest in the history of women, through Abigail Lousada's former ownership of books and through Ada Lovelace's translation and edition of Luigi Menabrea's *Sketch of the Analytical Engine Invented by Charles Babbage Esq.* (1843). The latter proves especially valuable when choosing material to display to honour women computer scientists at the University's annual conferral of honorary degrees. Charles Dodgson's *An Elementary Treatise on Determinants* (1867) or his *Formulae of Plane Trigonometry* (1861; copy

64 Senate House Library, University of London, 'Senate House Library in 150 Items' (2021), <https://www.london.ac.uk/senate-house-library/exhibitions-and-events/exhibitions/senate-house-library-150/senate-house-library-in-150-items>.

65 Christopher Pressler, *Director's Choice: Senate House Library, University of London* (London: Scala in association with Senate House Library, 2012).

66 *Senate House Library, University of London*, ed. by Christopher Pressler and Karen Attar (London: Scala in association with Senate House Library, 2012).

67 ISTC ig00340700.

stamped 'Presented by the publisher') come into their own displayed together with early editions of the *Alice* books Dodgson wrote as Lewis Carroll. The *Scholia in Euclidis elementorum geometriae* by Monachus Isaacus (1573), *Nova de universis philosophia* by Francesco Patrizi (1593) and Simon Stevin's *Oeuvres mathématiques* (1634) are of interest not merely for themselves, but for showing three different ownership stamps of the French statesman and historian Jacques-Auguste de Thou: one when he was a bachelor, and one for each of his two marriages.

To an extent, De Morgan's library is valued today for reasons which he, too, regarded as important. De Morgan was ahead of his time in following up provenance quite broadly, regarding scientific provenance as being as valuable as ownership by renowned bibliophiles. His pioneering bibliographical work demonstrated his interest in the history of the book. Twenty-first-century scholarship centres on these aspects. While widespread availability of titles, primarily through digitisation, has weakened the interest in the content of the books which mattered to De Morgan, their combined value as the library of a major scholar in the subject retains meaning. For the modern scholar, the way De Morgan, as a leading Victorian mathematician and bibliographer, used and interacted with his books has gained a fascination, which even those who shortly after his death commented on the enhancement of his annotations could not have envisaged. To say that the retention of his library as a unit, the multiplicity of levels of interest and the individuality stamped upon it by De Morgan's annotations have kept and increased its significance in a digital age may seem a trite and obvious conclusion. Yet any historic book collection that can increase its relevance over 150 years is impressive. A note De Morgan made on one of his copies of the sale catalogue of Charles Hutton's library, mourning its dispersal, may suggest that he wanted his own to remain intact after his death. One hopes that, could he see it today, he would be pleased.

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