

‘The Admonitions of a good-natured Reader’: Marks of use in Georgian mathematical textbooks

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Abstract: The large numbers of mathematical textbooks that survive from Georgian Britain bear rich evidence of use in the form of marks made by their early readers. Such marks, from a selection of titles, are examined for the information they can yield about modes of mathematical reading. The evidence clusters around practices of correction and of selection and rearrangement, and around the use of white space in margins and on flyleaves for private rehearsal of the mathematical content. These practices are interpreted as evidence of the ways books were physically handled and of the cognitive processes involved in their study and use.

Keywords: Marginalia; annotations; history of reading; history of textbooks; mathematical reading; mathematics education

Introduction

Mathematical books were printed in Georgian Britain in large numbers, and they survive in large numbers. Many of the surviving copies bear evidence, more or less conspicuous, for the ways in which the books were used during the eighteenth century: for some, early owners can be identified; for some, detailed patterns of reading or other types of engagement can be reconstructed.

Almost any mark on a page is evidence that the book has been opened to that page. Even the types of detritus which have become wedged between the pages – sawdust and nails, dried petals – provide information about the locations in which a particular book was opened for use of some kind.

This chapter mines this evidence for what it can tell us about the readers or readership of mathematical books in the period. It is based on perusal of 366 copies of a selection of successful mathematical books of the eighteenth century, including arithmetic primers, general guides to mathematics, school and university editions of Euclid’s *Elements*, algebra textbooks and manuals of mensuration, surveying, navigation, accounting, architecture and

fortification. They are listed in the appendix to this chapter. The copies seen were divided between physical copies in libraries in Oxford and London and electronic facsimiles.

Basic results

Overall, about 2.2% of the pages examined proved to bear deliberate marks of some kind: that is, around one page in 45. (For the purpose of the statistical remarks in what follows, endpapers and boards are always included in the count of pages, while library stamps, shelfmarks and other marks made after about 1850 – or not showing that the book was read – are disregarded.)

More than 85% of the books seen in this study bore deliberate marks; this is very high compared with the rates of marking reported in other studies of early modern marginalia: ‘very few’ in books of epigrams, ‘more than one in five’ of the Renaissance books in the Huntington collection and a similar proportion of Bibles and prayer-books in a survey by William Sherman; ‘perhaps the majority of surviving children’s books’ in Matthew Grenby’s magisterial study of the eighteenth-century child reader; 70% of copies of Sidney’s (1590) *Arcadia*.¹

Who owned (and marked) these books? A total of 44 owners proved to be identifiable as to social status, but they were spread without apparent pattern across most of the possible combinations of book and social level. Identifiable annotators of John Ward’s 1707 *Young Mathematician’s Guide*, for instance, spanned the social scale from King and Duke to joiner.² Much the same may be said about age, profession, location, or gender (only 14

¹ Randall Ingram, ‘Lego Ego: Reading Seventeenth-Century Books of Epigrams’, in Jennifer Andersen and Elizabeth Sauer, eds., *Books and Readers in Early Modern England: Material Studies* (Philadelphia: University of Pennsylvania Press, 2002), 160–176, at 161; William Sherman, *Used books: marking readers in Renaissance England* (Philadelphia, 2008), xii, 10, 73; Matthew O. Grenby, *The Child Reader 1700–1840* (Cambridge: Cambridge University Press, 2011), 25. We should heed Sherman’s warning (p. 18) that ‘the findings in one collection have a disturbing habit of contradicting those in another’.

² London, British Library, 49.a.9 (Ward, *Guide* (1724)) (owned by King George III); James Robson, *A catalogue of part of the valuable library of His Grace the Duke of Newcastle* [London, 1769], 24 (Thomas Pelham-Holles, 1693–1768; duke of Newcastle upon Tyne and first duke of Newcastle under Lyme); Oxford, Radcliffe Science Library 1874 e.96 (Ward, *Guide* (1724)) (owned by John Phillips, joiner at Chipping Norton).

female owners can be identified as against 228 males, and there is no clear pattern as to which titles they owned).³ The examples discussed in more detail below confirm that readers or those who controlled the reading of mathematics books did not always obey the stratification of the market attempted by authors and publishers.

With the books in one's hands it feels as though there are, distinctly, lightly marked books and heavily marked books. This can in fact be borne out by a statistical analysis. Of the books that were marked at all, most were marked on fewer than one page in fifty. A few per cent were marked on more than one page in eight. Intermediate degrees of marking are rare.

Light annotation

For each of the titles studied, light marking was the norm, in the sense of deliberate marks on up to one page in twenty in any given copy.

For example, a 1715 copy of Cocker's *Arithmetic* now in the Bodleian library is lightly marked in this sense.⁴ The title page verso bears the signature 'Mary Elizabeth Cambridge' and the date 1 October. Mary Elizabeth added what seems to be a mathematical word problem and some – presumably related – arithmetical jotting to the reverse of the frontispiece; she doodled or perhaps tested a pen on pages 27 and 203, the latter being the verso of the book's final leaf. And she added an arithmetical jotting to page 67. In all she marked six pages out of more than two hundred.

A 1731 copy of the Oxford Latin edition of Euclid's *Elements*, now also in the Bodleian Library, provides another example.⁵ An anonymous reader noted on the front endpaper that the book was bought 'Of Parker' in Oxford in 1731 for a price of one shilling. On page 21 a marginal tick was added, but otherwise the main part of the book was not marked. The appendix on trigonometry, however, received corrections on three pages (31, 36 and 37), of a cross-reference, a geometrical letter and a word. The rear endpaper was used to test pens; both the rear endpaper and the rear board bear pencilled geometrical

³ Compare Grenby, *The Child Reader*, 57: 'girls' inscriptions dominate almost every category of book'; arithmetic is one of the few exceptions.

⁴ Oxford, Bodleian Library, Vet. A4 f.2128.

⁵ Oxford, Bodleian Library, Bliss B 152.

diagrams, and working in ink concerned with ratios.

Types of annotation

A common type of annotation in all early modern books is the ownership inscription: a handwritten name, sometimes with a date or a location, or a pasted-in label or bookplate, ranging from the small plain slip of Thomas Jennings of Wantage to the full-page armorial bookplates of Sir Thomas Neave, Bart or of King George III.⁶ Front boards, title pages and the versos of title pages and frontispieces were favourite locations, but schoolchildren (like some modern libraries) tended to repeat their names somewhat at random throughout a book.

Occasionally anxiety to avoid theft – or to avoid being thought a thief – was more explicit, with imprecations against anyone who should purloin ‘this my book’ or elaborate accounts of how the volume had passed into the owner’s hands. Sometimes a sequence of different ownership inscriptions tells a similar story, or records the use of a single textbook by a series of siblings or even a series of generations.

None of this was specific to mathematical books, and I do not think ownership inscriptions are specially distinctive of mathematical reading. What is distinctive is a second common type of mark, in fact the most common. Straightforward correction⁷ is almost overwhelming by its presence in mathematical books: present in over 80% of the books I have checked. So common, indeed, as to suggest that readers were encouraged to do it by their teachers, tutors or others instructing them in the proper use of books. Sometimes authors themselves encouraged it, by admitting the possibility of imperfections in the text:

I must still beg of every candid and judicious Reader, that if he should by Chance find a Transposition of a Letter, or a false Figure, to excuse it; for notwithstanding

⁶ Oxford, Bodleian Library, Vet.A4 e.2563 (Ward, *Guide* (1747)); University of California QA152 .S3 (Saunderson, *Algebra* (1740): Google Books xq8rAQAAAJ, Hathi Trust uc1.31822038210845); London, British Library 60.b.21 (Saunderson, *Algebra* (1756): Gale Document Number CW3309596979).

⁷ Some of the proposed taxonomies of readers’ marks are discussed at Sherman, *Used Books*, 16–17; see also Roger Stoddard, *Marks in Books, illustrated and explained* (Cambridge, MA: Houghton Library, 1985).

there has been great Care taken in Correcting, yet Errors of the Press will inevitably creep in, and some may also have slipped my Observation: ... In either of which cases, the Admonitions of a good-natured Reader will be very acceptable.⁸

Errata slips, sometimes lengthy, conveyed a similar message,⁹ as perhaps did the title-page promises made by some editors of ‘new’ ‘revised’ or ‘corrected’ editions.¹⁰ So did the annotations of previous readers: many people – perhaps even the majority – who acquired a copy of one of these books during the eighteenth century must have acquired a second-hand copy that had already been written in by its previous owner(s). That point is driven home by the fact that the copy of Ward’s *Guide* acquired for George III in the later eighteenth century was a second-hand one, already bearing emendations and supplements on about a dozen pages.¹¹ For all these reasons, readers of mathematical books seem to have felt particularly free to engage in negotiation about what the text should say.¹²

As well as claiming ownership of the physical volume, readers quite often claimed intellectual ownership of its contents too, in marks whose purpose was to record which sections they had studied, which exercises they had completed, and so on. (To some degree the correction of selected sections served a similar purpose.) Ticks, crosses, filling-in of answers or the placing of discreet marginal lines or brackets all seem to have been used to this end.¹³ A signature at the end of a section, particularly with a date, could also serve.¹⁴

⁸ Walkingame, *Assistant* (1757), vii.

⁹ For example Keil, *Elements* (1723), leaf inserted after Y3 in some copies.

¹⁰ See Walkingame, *Assistant* (1796), A1^v.

¹¹ London, British Library, 49.a.9 (Ward, *Guide* (1724)): it is a matter of conjecture that these marks pre-date the book’s acquisition for George III, but it seems unlikely that the monarch made them himself.

¹² On expectations and experiences of error, variation and imperfection in early modern print see David McKitterick, *Print, Manuscript and the Search for Order 1450–1830* (Cambridge, 2003), 97–165; Anthony Grafton, *The culture of correction in Renaissance Europe* (London, 2011), mentions mathematical books only in passing.

¹³ Oxford, Regent’s Park College, 24.g.33 (Ward, *Guide* (1771)), A4^r and A4^v; Oxford, Bodleian Library, Vet. A3 f.189 (Cocker, *Arithmetic* (1681)), A4^v.

¹⁴ London, British Library, 1507/1058 (Hawney, *Measurer* (Dublin, 1767): Gale Document Number CW3308037566), 334: apparently a triumphant record of completion on 18 August 1786. Oxford, Bodleian Library, Rigaud e.131 (*Euclidis Elementorum, sex libri priores, cum notis, curâ T. Elrington* (Dublin, 1789)),

Marginal exclamation marks may record a reader's sense that some exercises were remarkable in some way, but it can be hard to say in what way: worth attention? difficult? easy? ludicrous?¹⁵ Apart from such cases, directly expressed remarks on the text – agreement, disagreement, abuse of the author, all common elsewhere – are extremely rare in mathematical books.¹⁶

This type of mark is not always easy to distinguish from marking-up for extraction. Common practice in schools was for students or teacher to copy out individual mathematical exercises into a 'cyphering book', where the student would work them more or less neatly.¹⁷ This practice was analogous in some ways to commonplacing, and resulted in a similar volume of subject-categorised material from, potentially, a range of different sources.¹⁸ Examples of cyphering books are not uncommon, but unambiguous cases of printed books marked for such use are quite rare.¹⁹

A third common type of annotation consists of marks which restructure or reorganise

7, 9, 15, 19, 24, 30, 36, 38, 41–43: pencil marks possibly recording the days of the week on which certain sections were completed; p. 44 (the end of book 2): 'Friday'. See Grenby, *The Child Reader*, 216–226 on marginal marks recording reading progress.

¹⁵ London, British Library, 8506.bb.11 (*Cocker's Arithmetic* (1731): Gale Document Number CW3310331946), 103–6, 109–11, 118, 121: marginal exclamation marks.

¹⁶ A rare exception: Princeton University Library 8169.331.18 (Whiston, *Elements* (1714): Hathi Trust njp.32101044597969), 45: marginal note – 'Lie' – referring to the printed assertion that 'This Book is small in Bulk'.

¹⁷ Relevant descriptions of mathematical classroom practice appear in Walkingame, *Assistant* (1751), a2^{r-v} and the 1798 edition of Hawney, *Measurer*, A2^r.

¹⁸ The American case has so far received more attention than the British: see Nerida Ellerton and M.A. Clements, *Rewriting the History of School Mathematics in North America 1607–1861: The central role of cyphering books* (Dordrecht, 2012); also their *Abraham Lincoln's Cyphering Book and Ten other Extraordinary Cyphering Books* (Dordrecht, 2014). For a brief summary see John Denniss, *Figuring It Out: Children's Arithmetical Manuscripts, 1680–1880* (Oxford, 2012) and Denniss's review of Ellerton and Clements, *Rewriting ...* in *Bulletin of the British Society for History of Mathematics* 29 (2014).

¹⁹ Oxford, Regent's Park College, 24.g.33 (Ward, *Guide* (1771)), 194, 198 (sections marked with quote marks), 31, 63, 64, 78–9, 100, 103, 132, 166, 182, 200–1, 203 (sections marked with vertical lines). Oxford, Bodleian Library, Vet. A3 f.189 (Cocker, *Arithmetic* (1681)), 83 (passage marged with marginal quote marks). Oxford, Bodleian Library, Rigaud e.129 (Whiston, *Elements* (1747): Gale Document Number CW3309026289), 42, 47, 142, 145 (passages marked with marginal braces).

the printed text. A development, perhaps, of marking some sections for attention, these could take the form of marking up the index or table of contents to draw attention to some sections rather than others, or exceptionally of supplying a manuscript index.²⁰ They could also take the more explicit form of the addition of cross-references from one part of the book to another, or to other books, or of the addition of reference numbers to certain sections.²¹ Some readers added extra sections of text as footnotes or in other areas of white space.²² Some booksellers, some schools, and quite possibly some individual readers too, lightly customized copies of these books by pasting in extra printed material such as mathematical tables.²³

²⁰ Ann Arbor, MI, University of Michigan, QA35.W259 1771 (Ward, *Guide* (1771): Internet Archive youngmathematic01wardgoog, Hathi Trust mdp.39015063872017), A4^v (illegible supplements to contents list, probably reporting the page numbers of the logarithms appendix: 3 items), rear endpaper (scarcely legible notes, possibly outlining a programme of study based on this book). London, British Library, 08535.a.70 (Ward, *Guide* (1758): Gale Document Number CW108836754), Qqq1^v–2^r, 3^r–4^r: index marked up with marginal lines.

²¹ London, British Library, 8533.b.26 (Keil, *Elements* (1728): Gale Document Number CW3308929265), 13, 39, 46, 51, 53, 54, 56, 57, 65, 98 (supplementary cross-references), 123–127 (illustrative numbers added to diagrams). National Library of Ireland LO.5102 (Hill, *Arithmetic* (London and Dublin, 1736): Gale Document Number CB3326612120): numbers added beside headings throughout; p. 177: possible cross reference to another book.

²² Ann Arbor, MI, University of Michigan, QA35.W259 1724 (Ward, *Guide* (1724): Google Books 1dg2AAAAMAAJ, Internet Archive youngmathematic02wardgoog and Hathi Trust mdp.39015063871993), 456 and two rear endpapers: 8 additional problems. William Andrews Clark Memorial Library (UCLA) *AG104.F53 1742 (Fisher, *Instructor* (1742): Gale Document Number CW3312306229), 63, 196, 230, 284–5: inserted footnotes dealing with factual errors. Oxford, Bodleian Library, Savile J 6 (*Euclidis elementorum libri priores sex* (Oxford, 1715)), 8: added footnote containing supplementary proof; a slip on which this was drafted appears between pp. 8–9.

²³ Ann Arbor, MI, University of Michigan, QA35.W259 1724 (Ward, *Guide* (1724): Gale Document Number 1dg2AAAAMAAJ, Internet Archive youngmathematic02wardgoog and Hathi Trust mdp.39015063871993), interest table and school advertisement, dated 1741, pasted to title page verso. Oxford, Bodleian Library, Savile Mm. e.56 (Cocker, *Arithmetic* (1758)): ‘All the Useful Arithmetical Tables’, in two parts, pasted to front and rear boards. London, British Library, 1568/5767, London, British Library, RB.23.a.9107, National Library of Scotland Grindlay.123, London, British Library, 8503.de.30 and London, British Library, 8503.df.29 (copies of Walkingame’s *Assistant* (respectively 1792, 1793, 1795, 1797 (York) and 1800 (York):

These three types of purposeful and engaged annotation were not the only kinds of writing these books attracted. Some readers merely doodled in the margins: drew pictures, added facetious remarks, spilled ink.²⁴ It was not uncommon to copy out the running head on certain pages: possibly as no more than handwriting practice.²⁵ More interestingly, some readers used white space for rough mathematical working: sometimes relating to the adjacent exercises, sometimes not.²⁶

A notable phenomenon in even the most lightly marked books is the appearance of ink smudges on certain – sometimes many – pages. Very occasionally these take the form of inverted impressions of identifiable letters or geometrical shapes, and this provides a clue to their genesis. It seems likely that as well as or instead of marking the printed pages themselves, many readers made notes on separate sheets of paper, which might, at the end of a work session, be placed inside the book and the book closed. If the ink was still wet, smudges or legible impressions could result.²⁷ Actual notes slips only rarely survive with the books themselves in libraries; I saw six in the course of this study.²⁸

Gale Document Numbers CB3326200235, CB3330331424, CB3326511785, CW3308705485, CW3309363418) all have similar tables pasted in.

²⁴ On ‘graffiti’ see Jason Scott-Warren, ‘Reading Graffiti in the Early Modern Book’, *Huntington Library Quarterly* 73 (2010): 363–381; on the tension between different types of marking see Seth Lerer, ‘Devotion and Defacement: Reading Children’s Marginalia’, *Representations* 118 (2012): 126–153.

²⁵ Oxford, Bodleian Library, Vet. A5 f.2813 (Fisher, *Instructor* (1779): Gale Document Number CW3309315163), 31, 194–5, 211: running head copied out. Oxford, Radcliffe Science Library, 1802 e.395 (Walkingame, *Assistant* (York, 1806)), 65, 126, 127, 155: running head copied out.

²⁶ Oxford, Bodleian Library, 8° B 182 Art (Cocker, *Arithmetic* (1697)), rear endpaper: jotted list of prices or brief account. National Library of Scotland NG.1201.b.25 (Hill, *Arithmetic* (1777): Gale Document Number CB3326265663), 105, 148, 149: extra calculations, possibly domestic accounts.

²⁷ For example, London, British Library, 530.d.12 (Keill, *Elements* (1723): Gale Document Number CW3309192289), 18, 117, 142 and plate facing p. 326 (the last appears to have the impression of geometrical diagrams including circular arcs); Oxford, Bodleian Library, Vet. A4 f.1802 (Fisher, *Instructor* (1740)), 33: clear impressions of large copied letters.

²⁸ Oxford, Radcliffe Science Library, 1874 e.120 (Ward, *Guide* (1771)): slip inserted between pp. 46–7, containing a long division. Oxford, Bodleian Library, Vet. A4 d.342/1 (Saunderson, *Algebra* (1741)): slip inserted between pp. 476–7 containing numerical working. Oxford, Bodleian Library, Savile J 6 (*Euclidis elementorum libri priores sex* (Oxford, 1715)): slip inserted between pp. 8–9 containing draft for supplementary footnote (see note 27 above). Oxford, Radcliffe Science Library, 1810 c.2 (vol. 1) and c.1

Quite often it is clear from smudges and blots, sometimes appearing rather densely, that even lightly-marked books or certain sections of them were studied quite fully. I believe that smudges of this kind may be somewhat more common in geometrical than in arithmetical books, reflecting the fact that the making of usable geometrical diagrams demands more space than is available in the margins of most printed books.

Heavily marked books

Some readers went much further than the norm in the marking of their books, thereby recording much more detailed information about their ways of reading. The types of marking to be found are the same as those in lightly marked books: correction and supplementation, ownership inscriptions, and reorganisation of the printed text. By making the decision to mark their books very frequently, readers left much clearer evidence that their reading was selective: certain sections or chapters bear annotation on virtually every page while others are untouched. Within chapters, certain exercises are marked, others not. Yet typically even the sections which bear no deliberate marks show evidence of having been paged through: smudges, ink blots, thumb marks.

One typical heavily marked book is a 1714 copy of Whiston's *Euclid*.²⁹ The title page bears the signatures of John Sanders and Sam Price, and a third, deleted signature of 'Nigel' (surname illegible). The first page bears the signature of Thomas Monday. A further signature on p. 10 has been thoroughly scraped out.

One or more of these four or five hands made many other marks throughout the book. These include quite a number of geometrical diagrams sketched in the margins, mostly in pencil, and intended to aid comprehension of the material at several different levels.³⁰ Some are labelled, some unlabelled, and some are accompanied by numerical working (and sometimes there is numerical working with no diagram).³¹ On some occasions the

(vol. 2) (Kersey, *Algebra* (1717)): slips inserted between pp. 62–3 and 186–7 (vol. 1) and 2–3 (vol. 2) with dense algebraic working/jotting in ink and pencil.

²⁹ Oxford, Bodleian Library, Vet. A4 e.2174.

³⁰ a8^v, 2, 5, 47–51, 55, 60, 81, plate facing p. 98, pp. 104, 105, 121, 125, plate facing p. 138, p. 158; p. 7 (second pagination).

³¹ pp. 6, 15, 126; pp. 38–9, 43 (second pagination).

geometrical letters in the text were modified to match those that had been added to the new diagram.

In certain sections there are marks apparently recording which sections of the text were studied and with what success: pencil crosses by certain items in some places;³² symbols including tick, cross and perhaps theta in another.³³ There are a few corrections, mostly of geometrical letters in the text.³⁴ There are also a few remarks on the wording of the text.³⁵ The most assertive annotation in the book is the remark that ‘This is no demonstration’ referring to the proofs of theorems 2 and 3 in book 1;³⁶ in another place a supplementary proof is provided as well as some changes to the text.³⁷

There are a few doodles,³⁸ and on a couple of pages the book has been used for anarchic extra matter: the gnomonic ‘GIVE MY’³⁹ and an evocative ‘Graves swire by his soul he would play 6 tunes of the flute before the end of long Vacation’.⁴⁰ In total more than one page in five is marked.

A second example is a 1752 copy of Ward’s *Guide* now in a private collection in Oxford. The front endpaper and title page bear the signature of one William Hemsley. The rest of the book bears fairly dense emendations in a single small, neat hand. These include more than fifty minor emendations to the mathematics, which occur in every section in the book: changes to numbers, geometrical letters and algebraic working and symbols. They also include about a dozen emendations to cross references by both page and line, limited to roughly the second half of the book. There are just two emendations of words.⁴¹

More substantial changes include about a dozen places where verbal rules or

³² pp. 1–5 and plate facing p. 44.

³³ On pp. 47–51 and the plate facing p. 98.

³⁴ pp. 33, 81, 82.

³⁵ pp. 4, 91; also added or corrected words on pp. 30, 102, and (in the second pagination) p. 45.

³⁶ On p. 8.

³⁷ p. 131; also remarks or supplementary words on pp. 31, 97.

³⁸ A2^r, p. 8.

³⁹ p. 41.

⁴⁰ p. 50 (second pagination), the last leaf of the book.

⁴¹ pp. 382 and 444.

discussion are translated into algebra in notes added to the margin:⁴² these are confined to the sections on advanced arithmetic and elementary algebra. At their very first appearance in the book, the basic arithmetical signs are, conversely, supplied with verbal equivalents.⁴³

Such translations are rare; they were apparently done by some readers as an exercise to aid, consolidate or demonstrate comprehension of the material.⁴⁴ Renée Raphael has demonstrated such practices in mathematical marginalia of the mid-seventeenth century, and suggests persuasively that such translations were an important and overlooked part of scholarly and pedagogical practice in the period.⁴⁵ More generally, mimicry of the author in annotation is potentially a way of learning a style, a way of working.

Additionally, there are about twenty places where the text is supplemented by the addition of extra geometrical labels⁴⁶ or extra lines of algebraic working.⁴⁷ Two larger sections of additional working are neatly written onto the final endpaper.⁴⁸

On average about one page in seven is marked, although the appendix on logarithms received no annotation at all. I have not been able to identify William Hemsley. The density and neatness of the corrections in this book strongly suggests the work of a schoolteacher, who wished to have an accurately corrected and supplemented copy of Ward's *Guide* from which to work in the classroom.

Occasionally books were heavily modified by the insertion of extra text and even extra sheets.⁴⁹ An example relevant to this study is a copy of W. Brown's *Problems in*

⁴² pp. 74, 79, 127, 132, 136, 137, 159.

⁴³ pp. 4, 5.

⁴⁴ Oxford, private collection (Ward, *Guide* (1752)), 74, 79, 127, 132, 136–7, 159: translations of verbal rules into algebra. London, British Library, 1608/1162 (*Euclidis Elementorum libri priores sex* (Oxford, 1747): Gale Document Number CW3307270997), 40–44: translations of geometrical results into algebraic equivalents.

⁴⁵ Renee Jennifer Raphael, 'Galileo's *Discorsi* as a Tool for the Analytical Art', *Annals of Science* (2014): 6–18 (examples), 18–21 (conclusions).

⁴⁶ pp. 406, 412, 420.

⁴⁷ pp. 378, 409, 413–8.

⁴⁸ pp. 137, 454.

⁴⁹ For examples of interleaved and extended books see D. R. Woolf, *Reading History in Early Modern England* (Cambridge, 2000), 87 with note 19 and Grenby, *The Child Reader*, 246. Another example is Smithsonian Institution Libraries QA33 .N67 1659, a copy of the surveying book *Norwood's Epitomie*

Practical Geometry (Birmingham, 1748, 1753) which a teacher, Samuel Davis, apparently obtained unbound.⁵⁰ He inserted about 20 additional leaves containing his own supplementary material: explanations, working, extra examples. He also added his own name to the title page, drawing attention to his joint authorship of the volume. Once it was bound, the volume was presented to Cosmas Nevill of Holt, presumably Davis's student. Evidently the customizations met the specific needs of this particular student–teacher relationship.

At the other extreme, some books survive completely clean, with few deliberate marks at all and sometimes little or no evidence that they have been read at all: no dirt, no smudges, blots or inky fingerprints. A proportion of books (but by no means all) owned by members of the nobility fall into this class; that is, they possess armorial bookplates pasted onto an endpaper, but no other marks.⁵¹ The same may be said of some copies acquired by institutional libraries,⁵² although not all such libraries prevented, or attempted to prevent, readers from marking their books in the eighteenth century. Indeed, very lightly marked books are rare; completely clean books extremely rare.

Annotation by genre

Having said something about the main ways a mathematical book could be annotated in this period, it remains to discuss whether there are identifiable patterns of annotation as to work, genre, location or type of reader.

Table 9.1. Rates of annotation.

(London, 1659), extended with extracts from other books on practical mathematics and surveying; see Silvio A. Bedini, 'History Corner: Roger Sherman's Field Survey Book', *Professional Surveyor Magazine* 21 (April 2001). I am grateful to Yelda Nasifoglu for information about this volume.

⁵⁰ The copy in question is in the author's collection.

⁵¹ London, British Library, 8506.bb.17 (Hawney, *Measurer* (1717): Gale Document Number CW3306627582), armorial bookplate of Thomas Weld Esq, of Lulworth Castle; University of Michigan TA 544 .L897 1744 (Love, *Geodæsia* (1744): Hathi Trust mdp.39015065434410), armorial bookplate of William Nisbet of Dirleton, Esq.

⁵² Notable examples are the Radcliffe Observatory and the Patent Office.

<i>Work</i>	<i>Mean pages marked</i>	<i>Genre</i>
Walkingame	5.27	Arithmetic
Whiston	4.04	Geometry
Cocker	2.96	Arithmetic
Fisher	2.72	General
Euclid	2.68	Geometry
Ward	2.64	General
Kersey	2.62	Algebra
Hawney	2.32	Practical: Mensuration
Love	1.81	Practical: Surveying
Keill	1.77	Geometry
Hill	1.71	Arithmetic
Muller (Elementary)	1.59	Practical: Fortification
Saunderson	1.17	Algebra
Pardies	1.11	Geometry
Atkinson	1.10	Practical: Navigation
Palladio	1.04	Practical: Architecture
Muller (Practical)	1.03	Practical: Fortification
Vernon	0.88	Practical: Accounting

Table 9.1 shows the mean proportion of pages marked for each of the works studied. At the upper extreme, copies of Walkingame's *Assistant* were marked on average on more than 5% of their pages, and copies of Whiston's *Elements* on around 4%. For each of the other works considered the average rate of marking was below 3%, and for Vernon's *Compting-house* it was less than 1%.

Elementary books

Elementary books on arithmetic, geometry, and mathematics generally are the most heavily marked. Those books intended for use in schools – the three arithmetic primers, Fisher and Ward, and Whiston's *Euclid* – have together a mean rate of marking distinctly higher than the average. Reading these elementary books appears to have been often an active practice, done with pen in hand and with the aim not of passively assimilating an authoritative text but of getting involved in detail in what the text ought to say.

Such elementary books typically contain aggressive ownership inscriptions,⁵³ and typically also contain corrections and additions to the text. (This despite the fact that some of them – notably Cocker’s *Arithmetic* – have narrow margins and a somewhat cramped layout which surely did something to discourage annotation.) Many copies were also re-used in part as scrap paper, with extra calculations or remarks scribbled in margins and on endpapers, whose relationship to the printed text is at best unclear.

Within the category of elementary books certain titles seem to have received slightly different treatment. Cocker’s *Arithmetic* was treated with marked disrespect quite a high proportion of the time, with multiple, aggressive ownership inscriptions, frequent re-use as scrap paper and often only fairly casual correction of errors. Ward’s *Guide*, on the other hand, seems to have more in the way of careful corrections. These differences may reflect the different price of the books: a shilling for Cocker and from two to six for Ward.⁵⁴ It is also possible that the simpler and easier Cocker was read by people less confident of their literacy or their mathematical skills and thus less willing to make substantive annotations. Or that it was generally read more casually, without the expectation of such re-reading as would make (some kinds of) annotation worthwhile.

Turning to elementary geometry books: here, editorial errors were corrected just as assiduously and extra cross-references inserted just as enthusiastically as in most arithmetic books. As with arithmetic books, certain sections were read in detail while their immediate neighbours were left entirely alone. In many cases this selection was probably guided by a teacher, but it is perfectly possible that some students or other readers could have made their selections autonomously. Printed marginal cross references abound in editions of Euclid’s *Elements*, and although their ostensible purpose is to structure the text and to direct reading, they also facilitated using the material in an order not envisaged by the author or

⁵³ London, British Library, 1578/5353 (Cocker, *Arithmetic* (1701): Gale Document Number CB3327144012), front board: signatures of John Thompson, Gressenhall, Norfolk, 28 Feb 1802 with verse; title page: ‘This was one of my Dear son William[s] Books and therefore belongs to his childr[en]’ (repeated on A3). London, British Library, 1478.c.10 (Cocker, *Arithmetic* (1723): Gale Document Number CW3308789421), title page verso: signature of John ?Goms, 1775 ‘And not Joe’s Book for fear & shame ...’; 1: deleted or scraped-out inscription.

⁵⁴ See Cocker, *Arithmetic* (Edinburgh, 1765), title page.

editor; the addition of supplementary cross references, which is frequent, provides particularly strong evidence of such non-linear attention to the text.⁵⁵

Alterations to the printed diagrams in geometry books, however, are almost unknown, which suggests that reading geometry often involved copying the printed diagrams onto separate sheets, perhaps in a larger size, and that notes and corrections referring to the diagrams were then made on those sheets rather than on the book itself. This is borne out by what seems the relatively more frequent appearance in geometrical books and sections of what look like the impressions from notes folded into the book. This could have been a response to the small size and unhelpful position of the diagrams in many cheap geometry books; some readers adopted the different remedy of cutting up the leaves of printed plates and pasting the separate diagrams into the margins where they were needed.⁵⁶

And where did this elementary mathematical reading take place? Potentially in various types of schools: grammar schools, private mathematical schools or other private academies, parish or charity schools.⁵⁷ The names of various schools can be found in ownership inscriptions; copies of Ward's *Guide* were sometimes acquired by university students.⁵⁸ Also by readers working at home with or without tuition; but the self-directed reader proves elusive in this particular type of evidence. Also perhaps at sea under the direction of a shipboard teacher: one copy of Daniel Fenning's *Young Man's Book of Knowledge* (London, 1764) bears a pencil annotation apparently reporting that it was taken to sea in 1811.⁵⁹ Or, finally, at the mathematical clubs whose numbers increased during this period; but these, too, do not show up in this evidence.

⁵⁵ See Heidi Brayman Hackel, *Reading Material in Early Modern England: Print, Gender, and Literacy* (Cambridge, 2005), 134–6.

⁵⁶ National Library of Ireland 1765(23) (Whiston, *Elements* (Dublin, 1765): Gale Document Number CB3330949517), various pages up to p. 91 (book 3, proposition 27).

⁵⁷ On mathematical teaching in the different types of Scottish school in the eighteenth century see Duncan K. Wilson, *The History of Mathematical Teaching in Scotland to the End of the Eighteenth Century* (London, 1935), 69–79; there is as yet no similar comprehensive discussion for English schools.

⁵⁸ See Ward, *Guide* (1724), A3^v.

⁵⁹ Oxford, private collection (Daniel Fenning, *Young Man's Book of Knowledge* (London, 1764, 1786)), verso of plates leaf facing p. 307.

More advanced pure mathematics books

The two algebra textbooks considered in this study, and the Latin editions of Euclid's *Elements* that were seen (and indeed Keil's English edition of the *Elements*), are on the whole somewhat less heavily annotated than the more elementary books.

In these books readers were less likely to make ownership inscriptions; perhaps they were less often read in circumstances where that was necessary. They were more likely to confine their corrections to those directed by a printed errata slip, or to add to the printed list of errata (some of) the additional corrections they made⁶⁰ (possibly intending to transmit a list of detected errors to other readers or to the author of the book).⁶¹ The individual corrections tend to be more careful and legible; irrelevant scribble is much less common, even in its higher forms such as relevant rough work. Readers were also somewhat more likely to leave the book entirely unannotated, or to limit themselves to just one or two apparently casual marks (or to a pasted-in bookplate).

Non-deliberate or more discreet marks show that these copies were used even when they were not deliberately, obviously marked. Folded-down pages and ink blots and smudges are all as common as in elementary books. These books were used not less but differently.

Where were they used, and by whom? For Keil's Latin version of Euclid's *Elements*, grammar schools and universities, or private study by those with a grammar school education, are the main possibilities. For the algebra textbooks, specialist mathematical academies may be added, and perhaps also study by keen adults either in private or at one of the growing number of mathematical clubs. Some evidence can be provided from annotations, but once again the lone reader and the mathematical societies are conspicuous

⁶⁰ Oxford, Bodleian Library, Savile A 2 (Kersey, *Algebra* (1673)), b4^v: errata table crossed through; one extra item added (in the hand of John Wallis: it seems to have been Wallis's habit to work through and supplement the printed list of errata in this way).

⁶¹ In some copies of John Lawson, *A Dissertation on the Geometrical Analysis of the Ancients* (Canterbury, 1774) 'an extra leaf appealed for interested readers to communicate, resulting in correspondence with Jeremiah Ainsworth (1743–1784), Henry Clarke (1743–1818), and others': Ruth Wallis, 'Lawson, John (1723/4–1779), geometer' in *ODNB*.

by their absence from the direct evidence.

The contrast is striking with the way elementary mathematical books were used, and it allows some deductions. These were more advanced books, necessarily used by older and more mature readers, with more experience of reading and of books than (most) readers of Cocker's *Arithmetic*, say. Possible explanations for the different pattern of annotation therefore include the different general reading habits of these more mature readers, or a difference in what they considered fitting treatment for this particular kind of printed matter.

The price of these larger textbooks may have been a factor too, with some readers more reluctant to annotate a large, expensive book than a small cheap one. But price is a relative matter and we are talking in part about a different class of reader as well as a different type of book; and, if a book is expensive, that might have provided all the more motivation to ensure its text was accurate by making a few corrections. Again, it may be that these more expensive, more advanced books were printed with more care and more accurately, leaving less even for the alert and pen-happy reader to do in the way of correction: but the differences in reading habits to which these books bear witness seem to go beyond that.

A higher proportion of these books may have been owned by institutions such as university colleges, and it is possible that some such institutional owners succeeded in discouraging annotation. But neither part of such an argument is at all easy to document. Although a relatively high proportion of copies of Kersey's and Saunderson's *Algebras* are now owned by Oxbridge colleges as opposed to the libraries of more recent institutions, we do not know what proportion of primers were owned by schools rather than by the students who wrote in them. Nor do we know much about the policing of readers' habits by libraries in this period. On the other hand, there is surely some substance to the idea that more advanced mathematical books were annotated in a calmer style because they were typically read in calmer environments than the eighteenth-century schoolroom.

Possibly the harder mathematics of these books made readers less confident of their ability to emend and correct. This too is a relative matter, and Cocker's *Arithmetic* may have seemed just as hard to an 8-year old as Saunderson's *Algebra* did to a 21-year old. But the evidence from annotations does indicate that readers of more advanced books were

less inclined to impose upon the books their own ideas about their contents. If they made notes or did calculations or working they (at least sometimes) did so on separate pages; if they noted errors they (at least sometimes) corrected them in separate notes or with reference to the printed errata slip. If they marked the book heavily it was to restructure in detail, to revise or to supplement; less often to record the straightforward fact of error in the printed text, and only rarely to add idle abuse or repetitious signatures or doodles.

Whatever the detailed reasons in each case, it does seem that the convergence of the books' physicality and the physical and social locations in which they were read produced a somewhat different culture of reading for advanced mathematical books than for elementary mathematical primers. That culture involved less aggression both towards the physical book and towards its text, with corrections neater and more clearly documented, and additional notes kept more frequently off the printed page itself and on separate sheets of paper. Arguably this reflected, at least in some cases, a more genteel mindset of passive receptivity and reverence for the printed text as against the robust challenges readers customarily issued to Ward, Cocker, Hill and other authors of elementary books.

Practical books

Practical books teaching practical mathematical techniques – measuring, surveying, fortification, navigation and accounting – were often similar in size, price and the quality of print and paper to the longer primers like those of Walkingame or Fisher. To all appearances they were intended to be read by practitioners of the skills described: apprentices, by implication, or those in specialist mathematical schools in preparation for practice or apprenticeship. Muller's books, for instance, were specifically aimed at the cadets he taught at the Royal Military Academy in Woolwich.⁶²

Deliberate marking in these books is distinctly less frequent than the overall norm, and distinctly less frequent than for either elementary or more advanced purely mathematical books. Non-deliberate marks in the form of dirt or foreign objects lodged in the binding (sawdust, nails) occasionally provide evidence that a book was indeed used on

⁶² Muller, *Elementary Fortification*, title page; idem, *Practical Fortification*, title page.

the job,⁶³ but this is the exception rather than the rule. For Hawney's *Measurer* in particular, quite a few copies show every sign of heavy use – smudges, dirt, blots, flicked ink or ink spillages – although deliberate annotation is quite rare.

The range of people and places engaging with these books was perhaps somewhat wider than their authors seem to have anticipated. Hawney's title page asserted that his book was 'Very useful for all Tradesmen, especially Carpenters, Bricklayers, Plaisterers, Painters, Joyners, Glasiers, Masons, &c': but it seems in fact to have been read well beyond this constituency; two of the 18 identifiable owners of the *Measurer* are members of the nobility. The example of Cosmas Nevill of Holt mentioned above confirms that on occasion a member of the nobility could be taught by a private tutor from an ostensibly 'practical' book. Conversely, I have seen precisely one book in this study in which a reader identified himself as a member of a trade (joiner): and the book was not a practical manual but a copy of Ward's *Guide*.⁶⁴

Why this pattern? Surely the incentives for detailed correction of a mathematical book would operate particularly strongly in the case of practical texts. Yet the frequency of corrections in these books is distinctly lower than in arithmetic or general primers.

Perhaps, insofar as these books were used in practical situations, it simply was not feasible to annotate while working. Perhaps those copies that were used in practice were damaged by being opened flat and dirtied by the environments in which they were used, and were therefore more likely to end up being discarded rather than preserved in libraries: thus the survivors are the books that were used less heavily. Or perhaps the people who read and used these books really adopted a lighter habit of annotation.

Another explanation, perhaps the most plausible, is that these 'practical' books, though they were evidently studied at some schools and by some individuals, and perhaps

⁶³ Oxford, Radcliffe Science Library, 1874 e.96 (Ward, *Guide* (1724)): dirt (possibly sawdust) throughout. London, British Library, 1509/4645 (Ward, *Guide* (1747)): sawdust in some openings, e.g. pp. 134–5. Oxford, Bodleian Library, Vet. A4 f.1228 (Cocker, *Arithmetic* (1748)), 52–3: nail wedged into binding. Oxford, Bodleian Library, (OC) 231 b.27 (Muller, *Elementary fortification* (1782)), 38: nail threaded through stub and plate leaf.

⁶⁴ Oxford, Radcliffe Science Library, 1874 e.96 (Ward, *Guide* (1724)), title page: crossed-out signature of 'John Phillips Joyner Chipping Norton'.

sometimes read at home by the keen apprentice or tradesman, were often not of a character to be of real use in a practical situation. Book-training was (is) proverbially no substitute for practical experience, and bringing an actual book into many practical situations – the deck of a ship, the battlefield – would have been anomalous. Books contained information that would need to be internalized in order to be used in practice, or condensed into a much more portable and robust ready reckoner or device. It is to such intermediaries, then, that we should probably look for annotations and alterations made by practitioners.⁶⁵

Examples

An interesting check on some of the interpretations advanced above is provided by two cases in which a single person appears in the data as the owner of more than one book.

Robert Finch (1783–1830), subsequently a noted antiquarian⁶⁶ acquired in 1802, while at Balliol, a copy of Ward’s *Guide* printed in 1771. He recorded this and the price on the front endpaper, and added a mathematical note there too. About a dozen light corrections, supplementary notes, and marginal lines and crosses, are scattered throughout the first 90 pages of the text, and there is an inserted slip containing a long division. Finch’s copy of Saunderson’s *Algebra* is more lightly marked, with no note of the price or date of acquisition: just a few arithmetical jottings on the endpapers and half a dozen corrections, glosses and added lines throughout the first third of the book.⁶⁷

The Catholic landowner and benefactor Thomas Weld (1750–1810) of Lulworth Castle⁶⁸ acquired copies of Ward’s *Guide* and of Hawney’s *Measurer*, and pasted bookplates into both. The former he apparently read throughout, emending algebraic matters in about 20 places. The latter he left totally unmarked.⁶⁹

⁶⁵ Compare Grenby’s general remark that ‘fewer inscriptions and marginalia appear in children’s books at both the cheapest and the most expensive ends of the market’: *The Child Reader*, 33.

⁶⁶ Alan Bell, ‘Finch, Robert (1783–1830), antiquary and connoisseur of the arts’ in *ODNB*.

⁶⁷ Oxford, Radcliffe Science Library, 1874 e.120 (Ward, *Guide* (1771)); Oxford, Radcliffe Science Library, 1810 e.181. (Saunderson, *Algebra* (1771)).

⁶⁸ F. J. Turner, ‘Weld, Thomas (1750–1810), landowner and benefactor’ in *ODNB*.

⁶⁹ London, British Library, 8529.bbb.22 (Ward, *Guide* (1719): Gale Document Number CW109582942); London, British Library, 8506.bb.17 (Hawney, *Measurer* (1717): Gale Document Number CW3306627582). The antiquary and collector Francis Douce (1757–1834) pasted his armorial bookplate into a 1722 copy of

Each of these cases shows a difference in the handling of the two books which matches the patterns I have identified above: elementary books are more heavily marked than practical or mathematically advanced books. This is slender evidence, but it suggests that those patterns may indeed reflect widespread practices in the handling of particular mathematical genres.

A note on patterns of survival

This study has examined little more than one in a thousand of the copies of these titles that once existed,⁷⁰ and perhaps 15% of the copies now in major research libraries. As Sherman remarks of the Renaissance period, ‘Printed images and texts were part of a dynamic ecology of use and reuse, leading to transformation and destruction as well as to preservation.’⁷¹ Heavy annotation may make a book more valuable to its owner; it may also make it more interesting to subsequent readers and favour its preservation. Heather Jackson reports that ‘In catalogues ... dating from the 1740s to the 1820s, the presence of notes is recorded *only* as an asset.’⁷² Yet cleaner books have more recently come to be favoured by libraries and collectors,⁷³ and I think heavy annotation is almost certainly under-represented in this sample as a result. So, I think, are signatures and bookplates in prominent places, the more so since they are relatively easy to spot and scrape out or remove by rebinding. But light annotation in its less obtrusive forms seems to me unlikely to have been significantly discriminated against by purchasers of books, both because it is relatively hard to detect and because annotation is so ubiquitous in the copies I have seen as to make it hard to believe libraries or collectors have been refusing lightly annotated

Vernon’s *Compting-house* (Oxford, Bodleian Library, Douce V 51) and a 1779 copy of Walkingame’s *Assistant* (Oxford, Bodleian Library, Douce W 125), but it is not clear that other annotations in the books (jottings and corrections) were made by him, or indeed by one person.

⁷⁰ Based on a total of about 380 impressions of these books during the eighteenth century, and taking a plausible average print run to be 750 (see James Raven, *The Business of Books: Booksellers and the English Book Trade, 1450–1850* (New Haven, CT, and London, 2007), 304), for a total of more than 250,000 copies.

⁷¹ Sherman, *Used Books*, 6.

⁷² H. J. Jackson, *Marginalia: readers writing in books* (New Haven: Yale University Press, 2001), 271.

⁷³ On attitudes towards readers’ marks among modern collectors see Sherman, *Used Books*, 151–7, in particular p. 157: ‘the cult of the clean book is strongly associated with the growth of institutional libraries’.

mathematics books with much consistency.

On the whole, then, I think the population of mathematical books in Georgian Britain probably contained more annotations, and more heavily annotated copies, than does my sample. A trickier question is whether the *relative* prevalence of annotation, or of heavy annotation, in one title compared with another, or in one mathematical genre compared with another, may have been affected by the mechanisms of non-random survival and preservation. Except for the possible destruction of heavily annotated practical books by their early owners, posited above, I find it difficult to imagine plausible means by which this could have happened; but I certainly do not claim that it is impossible: and this possibility must inevitably count against the robustness of the results presented here.

Conclusions

In 1824 a publication entitled ‘The Ladder of Learning’⁷⁴ gave illustrations of the postures adopted at the different stages in a child’s education. Step 5, ‘Accounts’, involved a uniquely large set of apparatus: a book on a stand, a pen and ink pot, at least one loose sheet of paper, another book (closed) and a slate and slate pencil, which the learner was depicted holding and presumably using.⁷⁵ I think it would be difficult to find a depiction from this period of someone using a mathematical book without a writing implement in hand: ‘reading’ it, that is, in the passive sense in which other genres of literature were and are commonly depicted as being read.⁷⁶ Again, arithmetic primers typically began with a ‘ciphering table’: ‘ciphering’ is an act of writing, not of reading.

That said, mathematical reading habits differed from individual to individual, from book to book and from genre to genre; different books attracted different kinds of attention from different people, and the style of reading chosen could depend on a range of factors. There was surely variation from school to school or household to household in what were considered acceptable ways of writing in printed books; that subject does not seem to have attracted explicit attention at all frequently during the eighteenth century.

Certain of my observations would certainly carry across to other genres of

⁷⁴ In *The Pet Lamb ... to which are added The Ladder of Learning and The Robin* (William Darton, 1824).

⁷⁵ Reproduced at Grenby, *The Child Reader*, 201.

⁷⁶ See Sherman, *Used Books*, xiii–xvi for a discussion of ‘use’ as opposed to ‘reading’.

schoolbooks: aggressive multiple ownership inscriptions, for instance, are hardly specific to mathematical books; pasted-in additional matter may or may not be a distinctively mathematical practice. But, if there was a specific culture of mathematical reading in Georgian Britain some of its characteristics are clearly indicated by this evidence.

That culture was marked by a pen-in-hand approach to the text (and therefore a visual as opposed to an aural experience of the text).⁷⁷ It was marked by heavy annotation, and frequent emendation and supplementation of the text. Elementary books were used most heavily and aggressively: at school, dense annotation was the norm, and the author's text often seems to have been no more than the starting-point for the diverse activities of emending, adding, translating, marking, copying and re-using. Thus, these texts provided opportunities for various modes of learning, which were not always the ones the authors, editors or printers seem to have intended. Ownership inscriptions are frequent, and often verbally or even physically aggressive, as when the name of a previous owner is densely blotted out or scratched off the surface of the paper. Nevertheless, previous readers could also provide important guidance in how to read the text for a reader who studied a second-hand copy, drawing attention to errors or lacunae or directing the attention to certain sections of the text. Certain types of marginal marks record – often ambiguously – some of the modes of sociable reading: the intention to quote, to query, or to teach.⁷⁸ As Jason Scott-Warren puts it, 'The sociable space of the book is a place for marking yourself out', and perhaps nowhere was this more the case than in a mathematical book.⁷⁹ Certainly, readers of an annotated book experienced an unstable text in which the possibility of further intervention and further multiplication of meanings was ever present.⁸⁰

Even more advanced mathematical books, used in calmer environments, also received annotation that was heavy by the standards of other early modern printed texts.

⁷⁷ See Brayman Hackel, *Reading Material*, 43–52.

⁷⁸ See John Brewer, 'Reconstructing the Reader: Prescriptions, Texts and Strategies in Anna Larpen's Reading', in James Raven *et al.*, eds, *The Practice and Representation of Reading in England* (Cambridge, 1996), 226–245 at 240.

⁷⁹ Scott-Warren, 'Reading Graffiti', 381.

⁸⁰ Grenby, *The Child Reader*, 29: 'the marginalia might best be regarded as a sign of an extremely interactive and engaged relationship with text.'

They were treated with a somewhat lighter hand, notes being more frequently made on separate sheets and the printed text often corrected only lightly, sometimes only where the author had invited the reader to do so. Ownership inscriptions were rarer, presumably reflecting a tendency to more private use of this material, and perhaps also use in less busy environments: the library as against the schoolroom.

Practical mathematical books were marked less heavily still. It is possible that this indicates that these books were typically read by amateurs rather than practitioners; that their promises to teach practical skills were in fact replaced in reality by live teaching and ready reckoners: in short, that bulky textbooks only rarely went into the workplace. It is also possible that those textbooks that did go into the workplace were destroyed or rendered uncollectible there, but I am not sure that this can account for the consistent pattern seen in this evidence.

It is quite possible that other sites of mathematical reading produced other types of readerly activity which cannot be clearly separated out in the data used here. Private instruction, for instance, or reading by adults in public at coffee houses (quite a number of coffee houses had small libraries, and at least a few included a copy of Euclid's *Elements*).⁸¹ The social status of readers cannot be determined with sufficient frequency to discern meaningful patterns. Ultimately, of course, isolating the evidence of book marginalia provides at best a fragment of a picture: readers responded in many more ways than this evidence can tell us.

Unanswered questions of course remain. How did these eighteenth-century patterns develop out of sixteenth- and seventeenth-century habits of handling printed mathematics? Where did readers learn how to handle mathematical texts; did any didactic literature address the question?⁸² Finally, what habits of mathematical reading were applied by learned readers to very advanced mathematical books and articles, and how did they relate to the habits of mind and hand learned in the schoolroom?⁸³

⁸¹ M. Ellis, 'Coffee-House Libraries in Mid-Eighteenth-Century London', *Library* 10 (2009): 3–40.

⁸² For a brief discussion of the possibilities of biographical sources for the history of children's reading see Grenby, *The Child Reader*, 12–15.

⁸³ Documented annotations by well-known mathematicians include those of Henry Savile on copies of Euclid and other books now in the Savilian collection at the Bodleian Library; those of John Wallis on a later

Appendix: The books studied

John Ward, *The Young Mathematician's Guide* (15 impressions, 1707–71; French translation 1756). General mathematics textbook covering arithmetic, geometry and algebra. 53 copies seen.

Edward Cocker/John Hawkins,⁸⁴ *Cocker's Arithmetic* (76+ impressions, 1678–1787). Arithmetic primer. 38 copies seen.

John Hill, *Arithmetick both in the theory and practice* (22 impressions, 1713–77). Arithmetic primer also covering some algebra in later editions. 23 copies seen.

Francis Walkingame, *The Tutor's Assistant* (at least 34 impressions by 1800, 1751–).⁸⁵ Arithmetic textbook containing many exercises. 18 copies seen.

Andrew Tacquet, tr. William Whiston, *The Elements of Euclid* (at least 10 impressions, 1714–1772). Elementary geometry textbook containing books 1–6 and 11–12 of the *Elements* and selections from Archimedes. 15 copies seen.

John Keil, tr. Samuel Cunn, *Euclid's Elements of geometry* (9 impressions, 1723–62). Elementary geometry textbook containing books 1–6 and 11–12 of the *Elements* with extra material on trigonometry and logarithms. 17 copies seen.

Certain Latin editions of Euclid's *Elements* from the period, namely John Keill, *Euclidis Elementorum libri priores sex, item undecimus & duodecimus ... in usum*

generation of acquisitions to that collection; those of Leonhard Euler on works by Benjamin Robins and of Joseph-Louis Lagrange on Euler's works. Note also Renée Raphael's work on John Ward and Christopher Wren as readers of Galileo, and Guicciardini (whom she cites) on readers of Newton: Niccolò Guicciardini, *Reading the Principia: The Debate on Newton's Mathematical Methods for Natural Philosophy from 1687 to 1736* (Cambridge, 1999), 179–84. Finally, comparable evidence is assembled in Owen Gingerich, *The book nobody read: chasing the revolutions of Nicolaus Copernicus* (London, 2004).

⁸⁴ Its authenticity as the work of Cocker was questioned by Augustus De Morgan in 1847 but later re-established: Augustus De Morgan, *Arithmetical books from the invention of printing to the present time* (London, 1847), 56–62; compare Louis Charles Karpinski, *The History of Arithmetic* (Chicago and New York, 1925), 75; Ruth Wallis, 'Edward Cocker (1632?–1676) and his Arithmetick: De Morgan demolished', *Annals of science* 54 (1997): 507–522.

⁸⁵ See Walkingame, *New Tutor's Assistant* (1781), A3^r; P. J. Wallis, 'An Early Best-seller: Francis Walkingame's "Tutor's Assistant"', *The Mathematical Gazette* 47 (1963): 199–208; Ian Michael, 'The Textbook as a Commodity: Walkingame's *The Tutor's Assistant*', *Paradigm* 12 (1993).

juventitus academicæ (Oxford, 5 editions, 1701–47) and William Whiston, *V. Cl. Andreae Tacquet ... Elementa Geometriæ planæ ac solidæ, & selecta ex Archimede theoremata* (Cambridge, 3 editions, 1703–22 and Dublin, 1785). *In total 16 copies seen.*

Ignatius Gaston Pardies, tr. John Harris, *Short, but yet plain Elements of Geometry* (10 impressions, 1701–46). Geometry textbook based on Euclid's *Elements*. *11 copies seen.*

John Kersey, *The elements of that mathematical art commonly called algebra* (10 impressions, 1673–1741). Algebra textbook aimed at educated and/or wealthy readers. *13 copies seen.*

Nicholas Saunderson, *The elements of algebra in ten books* (8 impressions; 1740–92; German translation 1798–1805; brief version 5 impressions 1756–92). Deluxe ten-book algebra textbook. *15 copies seen.*

George Fisher, *The instructor: or, young man's best companion* (at least 77 British impressions; 1727–1800). Compendium covering spelling, reading, writing and correspondence, recipes and medicines as well as arithmetic, accounting, mensuration and gauging. *28 copies seen.*

William Hawney, *The compleat measurer* (14 impressions; 1717–98). Primer on (decimal) arithmetic and geometry, and mensuration textbook. *23 copies seen.*

John Love, *Geodæsia: or, the art of surveying* (14 impressions; 1688–1796). Textbook of surveying. *19 copies seen.*

Henry Gellibrand and James Atkinson, *An Epitome of Navigation* (26 impressions; 1701–90). Primer on geometry and trigonometry and textbook of navigation; re-titled *Atkinson's Epitome* from 1736. *25 copies seen.*

John Vernon, *The compleat compting-house* (8 impressions; 1698–1741). Textbook of accounting, business correspondence and financial record-keeping. *8 copies seen.*

Andrea Palladio, *Architecture* (24 British editions during the eighteenth century including 14 of book 1 only). Textbook of architecture; editions ranged from bilingual editions of all four books to English-only copies of book 1 only. *25 copies seen.*

John Muller, *Elementary fortification* (5 impressions, 1746–99); John Muller, *Practical fortification* (3 impressions, 1755–74). Textbooks of military architecture. *12 copies seen (Elementary); 7 copies seen (Practical).*

