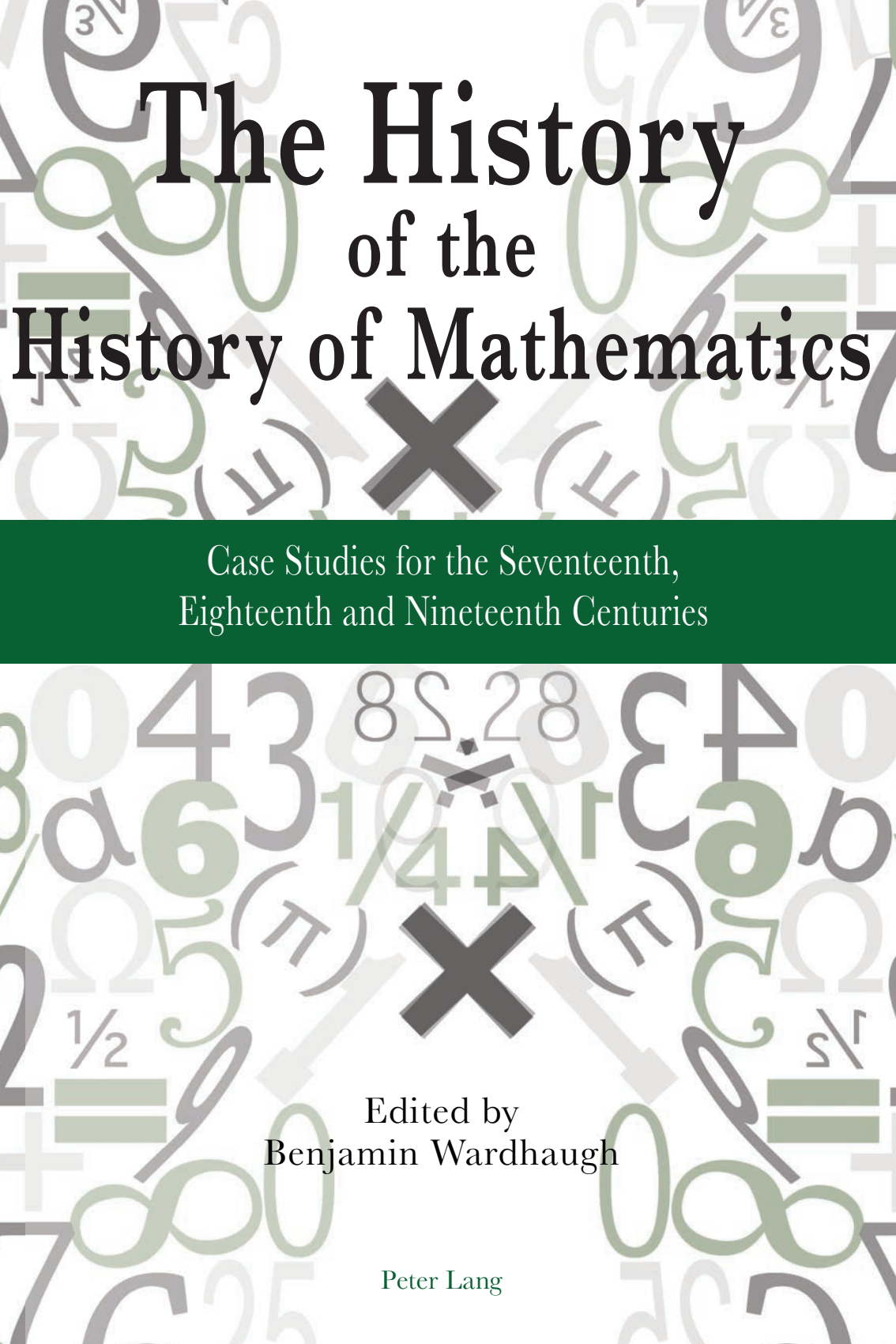
The History of the History of Mathematics

Case Studies for the Seventeenth, Eighteenth and Nineteenth Centuries



Edited by
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The writing of mathematical histories has a long history, one which has seldom received scholarly attention. Mathematical history, and mathematical biography, raise distinctive issues of method and approach to which different periods have responded in different ways. At a time of increasing interest in the history of mathematics, this book attempts to show something of the trajectory that history has taken in the past. It presents seven case studies illustrating the different ways that mathematical histories have been written since the seventeenth century, ranging from the 'historia' of John Wallis to the recent re-presentation of Thomas Harriot's manuscripts online. It considers both the ways that individual reputations and biographies have been shaped differently in different circumstances, and the ways that the discipline of mathematics has itself been variously presented through the writing of its history.

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Introduction

> [O]ur history will embrace *all* mathematicians [...]. And not, moreover, in just a historical fashion – what age they lived in, what manner of life they led, what country they inhabited – but rather mathematically: what they wrote in what field, how well they wrote it and how useful it is for teaching beginners. Since I intended to say this, I could not, without fault, omit a discussion of the whole of mathematics and each of its branches.[1]

Mathematical histories have been written in Europe since the sixteenth century, yet on the whole there has been relatively little reflection on the trajectory which the history of mathematics itself has taken over time. Nor has sustained attention often been given to the historiography of a subject which by its nature involves methodological choices and dilemmas different from those of other kinds of history.[2] Henry Savile's demanding programme for the study of the history of mathematics, set out during his 1570 lectures on Ptolemy at Oxford and quoted above, illustrates the magnitude of the task facing the historian of mathematics. It also illustrates the tendency of mathematical histories to be dependent on particular understandings of the nature of mathematics, and of course to respond to the needs of particular audiences.

1 Oxford, Bodleian Library, MS Savile 29, fols 17^{r}–17^{v}, quoted and translated in Robert Goulding, *Defending Hypatia: Ramus, Savile, and the Renaissance rediscovery of mathematical history* (Dordrecht: Springer, 2010), 97.

2 Notable exceptions are Joseph W. Dauben and Christoph J. Scriba, eds, *Writing the history of mathematics: Its historical development* (Basel: Birkhäuser, 2002) and Amy Shell-Gellasch, 'Introduction: The Birth and Growth of a Community' and Ivor Grattan-Guinness, 'History or Heritage? An Important Distinction in Mathematics and for Mathematics Education', both in Glen Van Brummelen and Michael Kinyon, eds, *Mathematics and the Historian's Craft: The Kenneth O. May Lectures* (New York: Springer, 2005), 3–6 and 7–22.

The history of mathematics in the sixteenth century has been addressed by Robert Goulding in his recent book on Peter Ramus and Henry Savile.[3] Ramus's *Prooemium mathematicum* of 1567 was one of the earliest published histories of ancient mathematics. Widely read at the time, it continued to influence mathematicians and writers on the history of mathematics over the next century, partly because of its comprehensive scope, but equally because of the practical and progressive lens through which Ramus observed, selected and arranged his sources on the history of mathematics. One of the earliest extended critical responses to Ramus's history is found in Savile's lectures on Ptolemy. There, in the early part of those lectures, Savile presented a history of ancient mathematics based almost entirely on his study of Ramus's *Prooemium*, but arguing for an entirely opposite account of mathematics: not practical and changeable, but theoretical and eternal. What Goulding has called the 'malleability' of the evidence available to Renaissance scholars concerning the history of ancient mathematics was manifested most dramatically in the two men's divergent attitudes to that most famous of mathematical texts, Euclid's *Elements*. Where Savile saw a single 'most beautiful body', Ramus wished to 'pull apart the bones, flesh, spirit, and blood' in an attempt to 'cure the disease' he found in a flawed and corrupt text.[4] Thus divergent attitudes to mathematics could lead to radically different textual practices, to entirely opposed understandings of the mathematical past as history, and to wholesale disagreement concerning the interpretation of historical mathematicians and their work.

The mathematical narratives of Ramus and Savile set the stage for the later development of mathematical history writing. Later historians would face some of the same issues and replay some of the same types of disagreement in respect – often – not of ancient but of modern mathematics. Like Ramus and Savile, they would be concerned not just to construct but to use the mathematical past, their agendas shaped by national and local

3 Goulding, *Defending Hypatia*.

4 Henry Savile, *Praelectiones tresdecim in principium Elementorum Euclidis Oxonii habitae MDCXX* (Oxford: Iohannes Lichfield, & Iacobus Short, 1621), 140; Petrus Ramus, *Scholarum mathematicarum libri unus et triginta* (Basel: Episcopius, 1569), 91, trans. in Goulding 177, 170 respectively.

considerations as well as by differing assumptions about the nature of mathematics and mathematicians. This volume presents seven case studies illustrating the diversity which resulted in thinking and writing about the mathematical past from the early modern period until the early twentieth century.

During the second half of the seventeenth century, the growth of scientific communication contributed to major advances in mathematical knowledge, but it also engendered an increasingly bitter spirit of competition, expressed in the numerous disputes over priority in discovery which plagued the Republic of Letters. History of mathematics could effectively become a cover for establishing a certain author's claim to priority, as exemplified for instance by the historical accounts of the cycloid produced variously by Blaise Pascal, Carlo Dati, and Johann Gröning, and it was all too often a self-serving enterprise rather than anything more.

John Wallis, the Savilian professor of geometry at the University of Oxford, was not completely averse to this new kind of historical writing. But in his *Treatise of Algebra* he embarked on a much broader historical mission, seeking to evince the ancient roots of algebra and to show how it had progressed through the centuries to the heights it had attained in his day. His project was arguably a *historia* in an Aristotelian sense, concerned to document facts rather than to discover causes. The results were not entirely free of the biases of party and nation, but Wallis's conception of history was neither unsophisticated nor inherently one-sided. By putting the *Treatise of Algebra* in its scientific and cultural setting, Philip Beeley attempts to resolve the evident tension in Wallis's work between different types of concerns, and thus to reassess his legacy as a historian of mathematics.

By the eighteenth century, an interest in the ancient mathematical past – already evinced by Ramus and Savile, and by Wallis and his contemporaries – was beginning to find a place even in the most popular accounts of mathematical subjects such as arithmetic primers and dictionaries, with consequences for the way mathematical history, and therefore mathematics, were presented to unsophisticated readers. If learners of arithmetic were to be motivated and encouraged they should ideally be presented with a convincing ancient pedigree for their subject: yet the available historical

sources for the earliest mathematics hardly enabled one to be constructed. Writers fell back on unabashed speculation or added a Christianizing spin to a small selection of ancient materials, gravely suggesting even that 'some Method of Numbering was used by *Adam* and *Eve* in *Paradise*', and thereby writing mathematics into history in ways previously unthought of. Benjamin Wardhaugh's chapter considers these popular accounts of the origins of arithmetic written in eighteenth-century England, and asks what they tell us about the developing reputation of mathematics and its history.

Equally important for that reputation, and for the developing genres of mathematical history-writing and of mathematical biography, one of the defining issues in the eighteenth and nineteenth centuries was the treatment of specific prominent mathematicians of the recent past. This was true of no-one more than of Isaac Newton and Gottfried Wilhelm Leibniz. Newton's reputation would come to tower over British science and mathematics, and his quarrel with Leibniz was a locus for a remarkable quantity of historical and biographical assessment. Three chapters in this volume examine different ways in which writings about Newton and about the Newton–Leibniz dispute illuminate the development of mathematical history and biography, from the eighteenth to the twentieth century.

Rebekah Higgitt considers the depiction of Isaac Newton as a mathematician in biographies across that period. As with other aspects of Newton's life and work, the discussion of his mathematics varied over time as views of the discipline and its practitioners underwent significant change. At the same time, national context and disciplinary and personal interests all played roles in shifting perceptions of Newton's life, personality and work, and the relationship between them. While Newton's mathematical accomplishments continued to be revered, there was some criticism, even in biography, of the obscurity of his published work. This issue was particularly important at key periods, such as when the distinctive Continental and British traditions were established in the early eighteenth century, and when they were largely reunited a century later. Alongside such concerns we also find more popular portrayals that largely avoid detailed consideration of Newton's mathematics, effectively sidelining what many considered Newton's most significant work, or contributing to a popular image of the

mathematical genius. Tracking how Newton the mathematician has, or has not, been integrated with dominant themes in Newtonian biography not only illustrates the history of mathematical history; it also provides a window onto changing views about the relationship between mathematics and other branches of science, and the role of mathematics in considering the persona of the man of science.

A work which dealt with the calculus controversy between Newton and Leibniz in particular detail was Jean E. Montucla's *Histoire des Mathématiques*, first published in 1758 and revised with the contribution of Joseph Jérôme de Lalande around the turn of the century. Niccolò Guicciardini considers the image of the calculus controversy conveyed in this monumental history, and draws comparisons with contemporary British historical work, including that of Hutton, Rigaud, and Brewster. He shows how these diverse accounts of the notorious controversy reflect the diverse agendas of the historians concerned. Montucla's was not a nationalistic account, but a balanced one in which the calculus was conceived as emerging from the contributions of many individuals over an extended period. It was shaped by the milieu of the French encyclopedists, for whom history was expected to show the progress of knowledge as a matter of universal, enlightened, cooperation.

Thus differences in national context and intellectual agenda could result not just in different judgements about the narrow issue of Newton *vs*. Leibniz, but also in different understandings of what it might mean to 'invent the calculus', and of what criteria should properly be used to assess matters of intellectual priority and discovery. But despite the existence in print of such sophisticated assessments as Montucla's, British mathematicians in the nineteenth century continued to regard Leibniz as an underhanded plagiarist, an attitude reinforced by the virtual deification of Newton by his British biographers. One of the first to question this view was the nineteenth-century mathematician Augustus De Morgan, who, in a series of works published between 1846 and 1855, attempted to set the historical record straight. Adrian Rice examines De Morgan's research in this area and investigates the motivations that led him to initiate the rehabilitation of Leibniz among British mathematicians. His position as a religious nonconformist and his critical stance towards both the Church of

England and the Royal Society produced a readiness to take the part of the underdog and to – in Higgitt's phrase – pay 'attention to the little men of mathematical history' (a position which converges in some ways with that of Montucla, although emerging from a very different milieu). Although his instincts led De Morgan astray in the notorious case of the scholar/thief Guglielmo Libri, his historical assessment of Newton and Leibniz would come to be widely accepted among British historians of mathematics, changing permanently the perception of both men in Britain.

The changing reputation of Newton, and the impact on mathematical history of nineteenth-century ideas about the nature of intellectual achievement, may be compared with the case discussed by Henrik Kragh Sørensen. The Norwegian mathematician Niels Henrik Abel lived a life that could be called worthy of a romantic hero, neglected and defiant against the background of Norway's struggle for independent nationhood. He was born in 1802, when Norway formed part of a union with Denmark; by the time of his education at the University in Christiania (now Oslo) it had entered into a union with Sweden after a brief spell of independence. Abel's mathematical research, published mainly in Berlin, became internationally renowned, yet he died in 1829, before the Norwegian state (or any other state, for that matter) could provide him with a permanent income. What were immediate, practical issues for Abel became symbols to later generations of Norwegian mathematicians, who used his legacy to position themselves in debates within mathematics and beyond. That legacy developed in various ways in the process.

The celebrations in Christiania for the 1902 centenary of Abel's birth took on a political aspect in relation to the union between Norway and Sweden. The Swedish mathematical entrepreneur Gösta Mittag-Leffler, an admirer of Abel and an adept self-fashioner, seized the opportunity of the celebrations to promote himself and his journal *Acta Mathematica*. Later, during the period of political tension when the union was moving towards its eventual dissolution in 1905, he published his own biographical account of Abel. That biography was both a piece of self-fashioning, a defence of a particular style of mathematical research, and a contribution to contemporary political debates. Thus we once again see the history of mathematics both shaping, and being shaped by, the events which surround

it, as well as interacting with specific national and individual attitudes to mathematics and to mathematicians.

Light is shed on these issues, and on how they are being transformed by technological developments in the twenty-first century, by Jacqueline Stedall's discussion of Thomas Harriot and his editors and historians, a case which spans the whole historical period covered by this book. Harriot's reputation has risen and fallen over the last four centuries: contemporaries and immediate successors admired him, but the posthumous publication of some his work in 1631 obscured the exact nature of his achievements, and searches for his papers later in the seventeenth century drew a blank. Meanwhile John Wallis's history of algebra included controversial claims that Descartes had plagiarized from Harriot. By the time Harriot's papers were rediscovered in the late eighteenth century their historical context was little understood, while a project to publish the papers foundered, defeated by their complexity and disorder. Harriot became a figure of myth in popular history, a position which continued into the late twentieth century. A number of recent publications have now put parts of the Harriot papers into print, and scholarship has begun to recover his achievements. Stedall considers the different approaches that have been taken to Harriot, and wonders whether the current project to digitize his papers will, too, come to be seen as a product of its time and place.

The papers in this volume take the story of the history of mathematics up to the early twentieth century; certain of them also examine more recent developments, and Stedall's considers the transformation of editorial practice which is taking place at the present day. During the last hundred or hundred and fifty years one of the most important processes for the construction of the mathematical past and of the reputations of individual historical mathematicians has been the production of critical editions, in a process analogous to the 'canonisation' of early modern and literary figures by the application to their works of the meticulous editorial procedures originally developed for work on classical texts. This phenomenon has not yet received the critical reflection which it seems to deserve. How, and to what degree, is the mathematical case special compared with the production of critical editions in other fields? What are the implications for the ways – and the circumstances – in which critical editions of historical

mathematics can be created and used, and therefore for the construction of mathematical history on their basis?

At the same time, the audiences for historical mathematics continue to change. In the last half-century national societies for the history of mathematics have been founded in several countries, while the volume and range of writing being produced about the subject have grown considerably. New agendas influence research on the history of mathematics: notably the role of history in the teaching of mathematics at various levels. Debate continues about the value and appropriateness of different approaches to historical mathematical texts, approaches which are intended not just to form and fix the reputations of the authors and the works they concern, but also to speak to different audiences and produce histories or editions suitable for different uses: pedagaogy, the popularization and communication of mathematics, or shaping the reputation of mathematics itself, say. The characteristic concerns of the history of mathematics have thus perhaps shifted somewhat away from considerations of national and personal reputations, and somewhat towards the merits of particular textual practices and their suitability for particular situations.

As this book goes to press a conference on mathematical editing since 1900 is in preparation in Oxford, and it is to be hoped that – as new technologies and new audiences continue to tranform textual practices in every discipline – this will provide a stimulus for reflections which will help to understand the history of the history of mathematics in the twentieth century.

The editor wishes to take this opportunity to thank all of the contributors to this volume, as well as all of the participants at the conference on 'The History of the History of Mathematics' which took place in Oxford in December 2010. He is grateful to All Souls College, which hosted that conference, and to the British Society for the History of Mathematics, the International Commission on the History of Mathematics, the History Faculty at the University of Oxford, and All Souls College, which supported it financially.

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The progress of Mathematick Learning: John Wallis as historian of mathematics

Introduction

Of all the relics the learned and great of former times have handed down to posterity pictorial images are sometimes the most revealing. When John Wallis (1616–1703) sat for the court and society painter Godfrey Kneller in 1701 (see Figure 1), he made sure that a small table in the background was decorated with two of the most powerful symbols of his intellectual prowess: the gold chain awarded to him in 1691 by Frederick III, Elector of Brandenburg for his services in deciphering intercepted letters, and the second volume of his *Opera mathematica*, printed at the Sheldonian Theatre in 1693 with the title 'Algebra' emblazoned on its spine. This was after all a portrait of which he was to be especially proud. Commissioned by his friend Samuel Pepys, it was to be presented to the University of Oxford as a lasting memorial to one of its most renowned scholars who had served as Savilian professor of geometry for over fifty years.

Of the two objects on the table one made perfect sense. As a decipherer, Wallis's achievements stood unparallelled in the second half of the seventeenth century and he was justly seen as Europe's greatest exponent of the art.[1] But it is perhaps less clear why of all his numerous mathematical works

1 Gottfried Wilhelm Leibniz, ed. Prussian Academy of Sciences (and successors), *Sämtliche Schriften und Briefe* (Darmstadt: Reichl Verlag (and successors), 1923–), Reihe 1, vol. 16, p. 726; Philip Beeley, '"Un de mes amis". On Leibniz's relation to the English mathematician and theologian John Wallis', in Pauline Phemister and Stuart

Figure 1: John Wallis,
by Godfrey Kneller, 1701.

he chose the *Algebra* where many, even Wallis himself, considered earlier books such as *De sectionibus conicis* (1655), the *Arithmetica infinitorum* (1656) or the *Mechanica: sive, de motu, tractatus geometricus* (1670–71), to have been his most significant contributions to the growth of the mathematical sciences.

Wallis's *Algebra*, or, to give the complete title, *A Treatise of Algebra, both Historical and Practical*, is a book whose own history is worthy of consideration. Ostensibly an 'Account of the Original, Progress, and Advancement of (what we now call) Algebra, from time to time; shewing its true Antiquity (as far as I have been able to trace it;) and by what Steps it hath attained

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Brown, eds, *Leibniz and the English-Speaking World* (Dordrecht: Springer, 2007), 63–81; David E. Smith, 'John Wallis as a Cryptographer', *Bulletin of the American Mathematical Society* 24 (1917), 83–96 and 166–9.

to the Height at which now it is',[2] the first edition appeared in English in 1685. However, much of the book is considerably older. A substantial part of the hundred chapters (in the second Latin edition comprising most of volume two of his *Opera mathematica* the number increases to one hundred and twelve) was already completed by April 1677, when 'A large discourse concerning algebra' was one of six works which Wallis sent to the mathematical intelligencer John Collins in London with a prospect to being published.[3]

In the following, we consider the *Treatise of Algebra* under three historical perspectives. First, we attempt to reconstruct the history of the book itself from manuscript and printed sources, including Wallis's extensive scientific correspondence. Second, we proceed from here to an historical account of the context in which the *Treatise of Algebra* should be understood. Particular emphasis is given thereby to the expectations of the Royal Society, which in 1683 agreed to underwrite the publication. Third, we seek to elucidate the sense in which Wallis describes his *Treatise of Algebra* as being 'both historical and practical'. In this way, we seek to assess not only the character of Wallis's historical approach in general, but also Wallis's character as a historian of mathematics, if indeed such a description is appropriate.

Finding a publisher for the *Treatise of Algebra*

Although Wallis sent Collins his manuscript discourse on algebra for possible publication in 1677, his intention to produce a textbook on algebra was in fact much older. At the end of his *Mathesis universalis*, or as he preferred

2 John Wallis, '[Account of] A Treatise of Algebra, both historical and practical', *Philosophical Transactions* 173 (22 July 1685), 1095–1105, at 1095.

3 Stephen Peter Rigaud and Stephen Jordan Rigaud, eds, *Correspondence of Scientific Men of the Seventeenth Century* (2 vols, Oxford: Oxford University Press, 1841), vol. 2, p. 607.

to call it, his *Opus arithmeticum*, which grew out of his Oxford lectures and was published in 1657, the Savilian professor pointed out that he had wanted to add something on the doctrine of analysis, but in view of the size of what he had already drafted on the topic he felt it would require a separate volume instead.[4] It is therefore probable that at least the first draft of either part or the whole of what he sent to Collins twenty years later originated from that time.

We do not know why twenty years elapsed before the first steps were taken to realize the intention expressed in *Mathesis universalis*. The most likely explanation is that Wallis tried to find someone in the printing trade willing to take on the work during these two decades, but was unable to meet with success. This would also explain why Collins, who like no other knew the ins and outs of the London mathematical book trade, eventually came to present the only solution. From letters exchanged between Wallis and the man described as the English Mersenne by Issac Barrow[5] we know that Collins offered to serve as Wallis's agent in helping to bring about the publication of his mathematical texts. Wallis was not the only English mathematician who would benefit from Collins's efforts in this regard, but certainly the most illustrious. Shortly before his death in 1683, Wallis noted in a letter to John Aubrey that 'the progress of Mathematick Learning' owed much to Collins's industry.[6]

Collins's task was not an easy one. In contrast to the Low Countries and to Italy, England lacked a strong and established market in mathematical books. Only a handful of the large number of printers in London were prepared to take on the financial risks in producing such books – elementary works excepted – and authors could therefore easily find themselves in the position of the Savilian professor. Sometimes combining more practical

4 John Wallis, *Mathesis universalis: sive, arithmeticum opus integrum* (Oxford: Leonard Lichfield for Thomas Robinson, 1657), 398; John Wallis, *Opera mathematica* (3 vols, Oxford: at the Sheldonian Theatre, 1693–9), vol. 1, p. 228.

5 Isaac Barrow, *Lectiones XVIII, Cantabrigiae in Scholis publicis habitae; in quibus opticorum phaenomenωn genuinae rationes investigantur, ac exponuntur* (London: W. Godbid, 1669), 6.

6 Oxford, Bodleian Library, MS Aubrey 13, fol. 243^{r}.