The Newton Project

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Abstract

The Newton Project provides over four million words of diplomatic transcriptions of Sir Isaac Newton's writings. This scholarly digital edition expands public knowledge of Newton's ideas beyond his best-known contributions—his theory of universal gravitation and his discovery of calculus—and elucidates the historical figure's serious commitment to non-scientific traditions. This review assesses the site's editorial aims and methods, content, presentation, and contribution to Newtonian studies, digital scholarship, and textual editing. By complementing high-fidelity diplomatic transcriptions of Newton's manuscripts with a truly magnificent array of contextual documents, The Newton Project emerges as an example of a 'digital research environment', and presents an opportunity to explore how the emergence of these is reshaping the aim, content, and value of scholarly digital editions.

1. Introduction

The Newton Project (hereon TNP) was born in 1998 with the goal of publishing the first comprehensive edition of Sir Isaac Newton's 'non-scientific' papers. Twenty years later, it has become a research environment surrounding an edition of all of Newton's printed and unpublished writings. TNP offers unprecedented accessibility to Newton's private researches and foundational documents in the intellectual development of the West.

Based at the University of Oxford, Faculty of History, TNP is an ongoing team effort under the general editorship of Rob Iliffe, Professor of the History of Science at Oxford, and Scott Mandelbrote, Director of Studies in History at Peterhouse, Cambridge. The team includes technical development & web manager Michael Hawkins, transcription manager Cornelis J. Schilt, translator Michael Silverthorne, as well as transcribers, encoders, and an editorial board. TNP completed two major Arts and Humanities Research Council (AHRC) Research Grants and two Joint Information Systems Committee (JISC) awards.

The main features of the edition are:
- General introduction of TNP's aims, editorial policies, and staff;
- Introductions to types of texts in the edition (religious, mathematical and scientific, mathematical and scientific correspondence, political materials, and historical contextual materials);
- Full diplomatic transcriptions of all manuscript texts authored by Newton, XML-TEI markedup, with editorial notes, translations and manuscript images when available;
- Vast amount of additional primary and contextual material.

The project's general email (newtonproject@history.ox.ac.uk) and physical location (Faculty of History, George Street, Oxford, OX1 2RL) are provided.

2. Scope of the Edition

At its inception, TNP was confined to Newton's historically dismissed 'non-scientific' works. In 2007, the scope of the project expanded to cover all of Newton's printed and unpublished writings. Including all of Newton's works equivalently in this SDE has served to expose Newton's millions of words on theology and other fields as serious scholarship—not simply the hobbyist pursuits of a man of fading intellect (Walsh 2015).

The rationale behind the widening scope is found on the gestation of Newton's works themselves: Newton was "a man who evinced what can only be described as a visceral hatred for print culture" (About The Newton Project), and therefore did not seek or even approve of the printing of his works. Rather, Newton guided his work in the form of private searches, always "works-in-progress", with no final treatises or culmination to his various projects. Thus, hundreds of stand-alone and repeated chapters in different works have created great difficulty in discriminating Newton's works in a useful way.

In this context, TNP is valuable not only as a repository but as a first step towards connecting Newton's writings in a dynamic way. The evolving character of the digital medium of the SDE is itself particularly appropriate to represent the dynamic processes of Newton's thought and research (Iliffe, 2004).

3. Content of the Edition

TNP provides a full diplomatic rendition of all documents written by Sir Isaac Newton, including all amendments produced by Newton himself. These span a wide variety of fields and topics: math, science, optics, alchemy, theology, politics, administration, and Newton's personal and academic correspondence. It also provides translations of many of Newton's most important Latin religious texts, and abundant information regarding Newton's biographical details, historical importance, and intellectual interpretations of his works.

For each manuscript a wide breadth of contextual information is provided, if available, such as any titles of the document, word count, date of composition, account of the contents, reference to all publications or editions, a history of the location and changing ownership, and even prices paid for the manuscript (see Introduction to the Newton Manuscripts Catalogue).

Virtually all transcriptions published in the SDE were produced from manuscript sources (excepting the various editions of *Principia* and *Opticks*). This archive was built upon previous work on Chadwyck-Healey microfilm and digitized images of Newton's manuscripts. The microfilm of Newton's papers, released in 1991, was based upon sets of microfilm prepared by Cambridge University Library, the Jewish and National University Library, and King's College Cambridge. In 2009, The Chymistry of Isaac Newton Project at Indiana University granted access to TNP to digitized (greyscale) images of photocopies that were prepared in the 1970s for Richard S. Westfall. Therefore, TNP's major collaborative work with institutions the Chymistry of Isaac Newton Project at Indiana University, TNP Canada at King's College, Halifax, Nova Scotia, the Cambridge University Digital Library, and the National Library of Israel has been crucial.

The exact nature of the collaboration with The Chymistry of Isaac Newton Project should be more clearly stated in About The Newton Project. After browsing through TNP's alchemy-related texts, I noticed that all 70 of these transcriptions do not live on TNP, but are rather links to The Chymistry of Isaac Newton. This fact is, however, mentioned in the hard-to-reach Introducing Newton's Alchemical Papers page.

4. Editorial Principles and Aims

TNP provides clear editorial principles and aims in various pages of its site. In A Brief Guide to Our Editorial Policies, there is a clear statement of the ultimate diplomatic aim of TNP: "to present detailed, accurate and comprehensive transcripts of all Newton's manuscripts, viewable in a range of formats to suit the different needs and tastes of individual users". This page is, however, not easily reachable and should be added to the *About Us* menu.

Users are provided with a general introduction to crucial topics in the field of scholarly digital editing—editorial policies, definitions, differences between digital archives, digital editions, and digital research environments—in About The Newton Project. This introduction serves both scholars and public users, as it allows both to better understand the philosophy behind--and the goals beyond--the presented project:

> Increasing scholarly attention has recently been focussed on ways of classifying different sorts of 'digital' output. One concern of these discussions has been the question of whether digital editing takes a different form, or has different goals from conventional editing. [...] there are special, distinctive aspects of editions that are hosted online (as opposed to being on CD-ROMs), and in particular, of datasets whose core content is either born-digital text or non-textual data (such as film or music). These features concern, *inter alia,* the manner in which the information is acquired, stored and displayed, the size and complexity of the dataset in question, the nature of the IP agreements required to publish texts in perpetuity, and the potential audiences for the output. It is of course, a peculiar quality of digital text that it can function both as an end-in-itself, i.e., act as a linear narrative that can be read as one would read a print narrative, and also as a searchable dataset.

Although the editors deem it unwise to define TNP too precisely, they self-classify it as a "digital research environment"—beyond both a simple digital archive or even a digital edition. They base this classification on the vast amount of additional primary and expository material in the form of translations, contextual primary sources, editorial notes that accompany the diplomatic translations.

5. Editorial Methods

The SDE follows a strictly diplomatic approach to the transcription process, founded upon the editors' belief that author revisions confer critical evidence of Newton's stylistic habits and thought processes. Their guiding principle is strict fidelity to what Newton actually wrote, and see their transcriptions as "representations, rather than interpretations, of the source material". Accordingly, the transcribed texts' original spelling, punctuation, and grammar are faithfully recorded, with no modernisation, standardization or correction. Seemingly obvious errors are noted with a proposed correction, and all deleted, altered, or added materials are transcribed and markedup electronically.

Concurrently, the SDE provides reconstructed, 'normalized' versions of each diplomatic transcription for the 'modern reader', many times unfamiliar with archaic spellings and punctuation and thus distracted by the indication of deletions, insertions, and so forth. In these, deletions are suppressed, additions are not indicated as such, obvious errors are corrected, and punctuation and spelling are modernised.

The SDE does not provide text criticism. However, the editors do have an eventual aim towards the inclusion of an editorial apparatus surrounding the transcriptions:

> In time, they will be supplemented by wide-ranging editorial apparatus such as explanatory glosses, editorial commentary, hyperlinks to other relevant material, and translation of non-English passages. But the core of the whole structure consists of the texts themselves, and the aim is to enable users to draw their own interpretative conclusions rather than to impose our own. (A Brief Guide to Our Editorial Policies)

It is clear that strict fidelity to the texts themselves will continue to be the focus of the project, as they see this eventual apparatus' aim as still enabling users to draw their own interpretative conclusions rather than to impose the editors'.

6. Data Modelling

The SDE's data modelling is based on the recommendations of the Text Encoding Initiative. The diplomatic and normalized renditions of the transcriptions were generated from exactly the same XML markup. The guidelines were given two major overhauls in 2007-8, to bring them into line with the P4 and P5 versions of the TEI recommendations. TEI P5 is the most recent version of the TEI Guidelines, initially released in November 2007 and updated since then on a six-month cycle, with point releases incorporating maintenance fixes and minor feature enhancements.

The technical implementation of the data model is heavily documented in its 42-page <u>Transcription and Tagging Guidelines</u>, clearly available in the SDE's site. This document is well-organized and contains highly detailed examples. As such, it serves as a resource not only to better understand how TNP was developed, but also to develop transcription and tagging guidelines for other projects that may deal with similar types of materials.

In addition to XML-based TEI, TNP also used another application of XML: MathML, a mathematical markup language used for representing mathematical formulae, based on mathematical notation. This specialized markup languages was necessary because computers normally deal with linear text and more limited character sets.

TNP had "to push to the limits" of TEI-P5 and MathML given the intricacy of the heavily overwritten religious texts and the writings on the exact sciences. Most, but not all, substantial formulae, or those requiring mathematics-specific formatting, were transcribed using presentational MathML, so there is potential for even more growth of TNP's mathematical portions as a valuable and powerful scholarly resource (Cretney, 2016).

7. Publication and Presentation

On the home page, the user is welcomed by an aesthetically cohesive page, a short description of TNP's goal and contents, and four image links to help the user navigate the site: to "Tour" the site, to "Newton's Works", to "His Notebooks", and to "His Correspondence" (Fig. 1). Information about the general editors and contact information is located on the bottom of the home page. The home page also contains a main menu, consistent across all pages of the site, including a general search box. The main menu divides the site's information into five sections: Home, The Texts, About Newton, About Us, and Support Us. Menu items with submenus are easily recognizable by the downward arrow next to each of their names.

The Texts is the section most relevant to the content of the SDE, as it allows users to browse through the texts through six other subsections: *Introduction to the Texts, Newton's Works, His Notebooks, His Correspondence, Browse all texts,* and *Search*. *Introduction to the Texts* contains over 10,000 words describing the context, gestation, and importance of the texts. *Newton's Works* contains its own submenu, allowing the user to browse through the works all at once (1477 works), or to choose to only browse through alchemical (70), mathematical (94), Mint related (1157), religious (78) or scientific works (86). Selected works are sorted by date on a table, which the user can decide to sort in ascending or descending manner. Each of the works in the table is described by the most important metadata and links to the Normalized Text, to the Diplomatic Text, and to the Catalogue Entry, as well as its Newton Catalogue ID (Fig. 2). The same logic and aesthetic is

applied in the subsection *Newton's Notebooks* (containing 7 works) and *His Correspondence* (418), the latter also having subcategories to browse only by mathematical (98), Mint-related (259), or optical (61) correspondence. The *Browse all texts* option allows the user to browse all texts either by author or by category. This function is a very useful tool for users interested in only one specific topic that Newton may have written about (e.g., "Copper Coinage", (Fig. 3). Finally, the *Search* option allows users to filter the texts by name, by a list of categories and by custodian of the text (Fig. 4); these qualifying criteria can be combined by the user. While an incredibly powerful tool, it lacks explicitness, as it is slightly "hidden"—unless it is clicked user, it is not clear that it is any different from the general search box found on the main menu bar.

When a user accesses a text by clicking a link to the Normalized Text, the Diplomatic Text, or the Catalogue Entry, she can easily switch between these three views at the top of the document. Here she can also find additional information, such as the date and process of online publication (its 'revision history') . Advanced users can even see the schema and XML coding that undergird the digital document. For texts with available manuscript images, links to external sites containing them are provided (Fig. 5). The transcriptions are meticulous, with notes for any uncertain points and detailed attempt having been made to represent all legible elements (see Fig. 6). A nice detail is the provision of "Additional Information" > "Notes on the Electronic Edition" at the top of the document, through which the user can understand the differences between the normalized version and the diplomatic one (Fig. 5).

The third section, About Newton, contains the additional bibliographic material about Newton, including a presentation of all the biographical materials written about Newton in manuscript and printed form in the eighteenth and nineteenth centuries, a large amount of textual material relating to the popularisation of Newtonianism in the eighteenth century, a series of podcasted interviews about Newton and his intellectual environs conducted in 2009-11, The Newton-related personal papers of Keynes, interpretive essays on Newton's political and religious writings, and a full description of Newton's library (Fig. 7).

The fourth section, About Us, is a repository of crucial project information, such as the general introduction to the Project, the staff and editorial board details, access to the Tagging and Transcription guidelines, and general acknowledgements.

Finally, the last section, Support Us, provides information to users interested in providing financial support to the project.

8. Conclusion and Further Directions

While TNP may be classified as a Scholarly Digital Edition (SDE), as defined by the IDE, it can even be seen as an example of 'the SDE of the future':
> '[digital] scholarly editing of the future will be aiming [...] at constructing the material foundations for research platforms as digitally explorable knowledge sites dedicated to multi-faceted historical, philosophical, cultural and literary research and criticism.' (Gabler, 2010)

This vision mirrors TNP's self-labelling as 'more' than a digital edition—as a 'research environment', based upon its contextual materials, which the editors believe rival or surpass those on any other scholarly digital site in terms of scale. Indeed, the meticulous presentation of biographical material, a comprehensive editorial discussion, detailed descriptions of transcription policies, and vast contextual material does point towards this direction. Paired with the complexity of the content and style of the manuscript sources, this categorization seems fair.

It is clear that TNP is still, in Newton's own fashion, a "work-in-progress", with multiple catalogue

entries without transcriptions (see an example). Furthermore, the only recent free online access to the Cambridge and Jerusalem images has meant that TNP still has a lot of work to do to provide links to them at the document level. And where links are in fact provided, at present they can only be accessed opening up two separate windows. Even minor improvements, such as image links automatically opening in a new window, instead of redirecting the current page, could bring better usability to the site. Another suggestion regarding images is that, for extensive manuscripts, the links should be to specific pages of the manuscripts, rather than the complete manuscript instead. This is because manuscripts tend to be witnesses to multiple texts, and as such can be of great length and the specific witness hard to locate. Take this example, where a link to the specific page/s of the manuscript of the transcribed text, and not to the whole 935-page manuscript, would be extremely useful for the user.

TNP's commitment to transcribing such a high volume of extremely complex documents is also commendable, as it is becoming clearer that the technical standardization process forces a reexamination of our historical materials (Walsh and Hooper, 2011). Yet, improved searchability and use of markup that already exists would transform TNP's usability and ability to open lines of inquiry and research in multiple fields. The already existing markup contains information that, if made viewable and searchable, could allow users to have more agency over the quantity of information they have access to and visibility of would open.

Giving the colossal effort required to implement these suggestions, co-ownership of the site between academics and non-academics, with participatory transcribing and editing, is a serious alternative to consider. The editors acknowledge the almost requirement of this possibility themselves: "Newton's archive will require many more years along with the handiwork of many individuals, most of whom will not have been trained as scholars." While participatory transcribing and editing can present a wide set of challenges (Deines et al. 2018), the fact that the materials are freely available online opens up the possibility of using the power of the crowd to move the project further.

All in all, this SDE has become an essential resource for Newtonian scholarship. The sheer scale of the SDE, coupled with detailed coding of the born-digital scientific and mathematical texts, supports several forms of research inquiry in the sciences, theology, scholarly editing, and the digital humanities. Importantly, TNP's success in mobilizing the necessary human and material resources to fully transcribe Newton's non-scientific papers has served to 'prove' their historical relevance, and to allow Newtonian scholars to better understand Newton's original intentions and his use of the available cultural resources (Mazzoti, 2007). Already, many important scholarly works have been possible only thanks to TNP (Ducheyne, 2007). Perhaps most importantly, TNP offers anyone with web access the unparalleled opportunity to join the mind-workings of one of the most important characters of global intellectual history.

9. References

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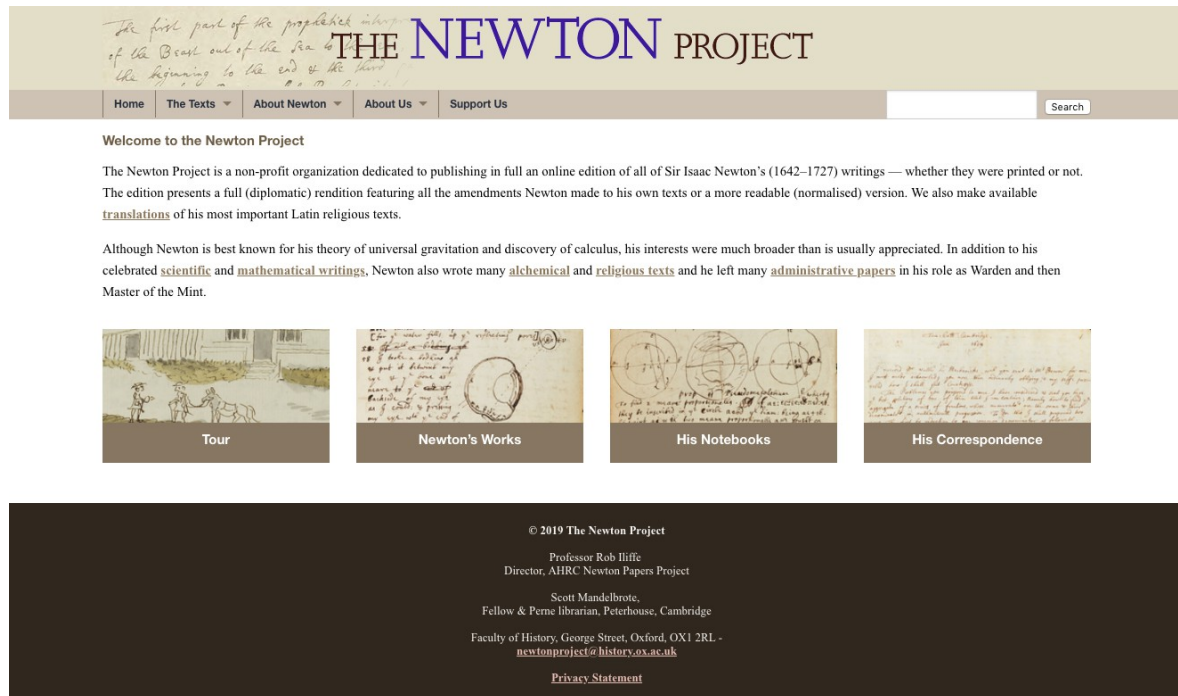
Fig. 1: Home Page.

Fig. 2: Browsing through religious texts.

Fig. 3: Browsing through category (example, "Copper Coinage").
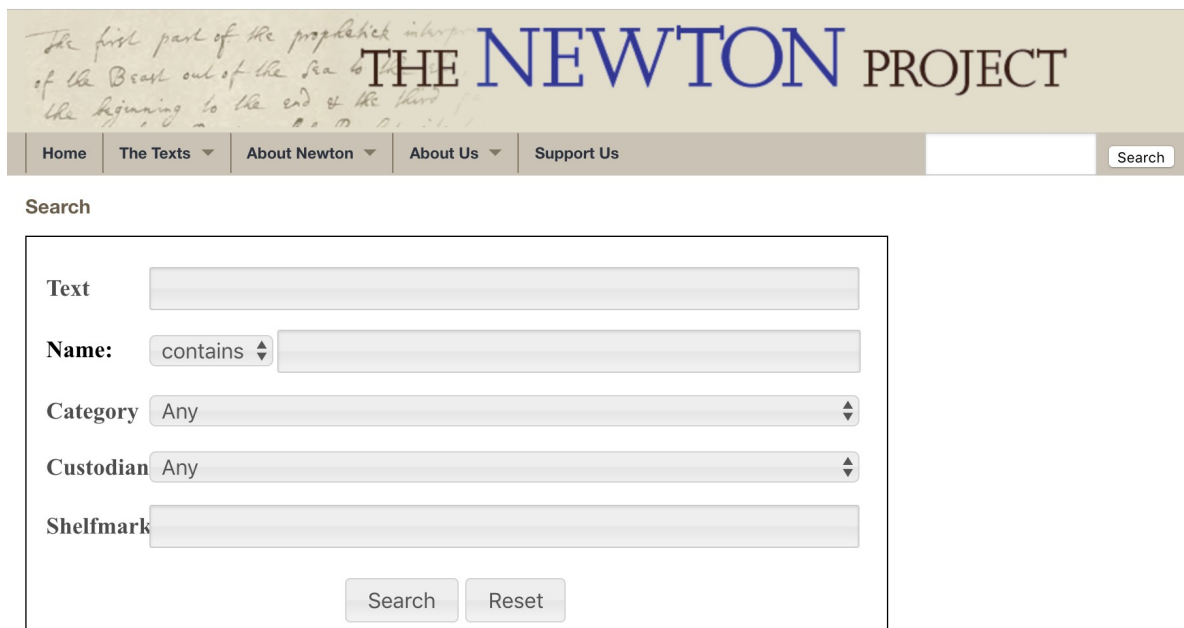
Home   The Texts ▾   About Newton ▾   About Us ▾   Support Us   [Search field]   Search

Search
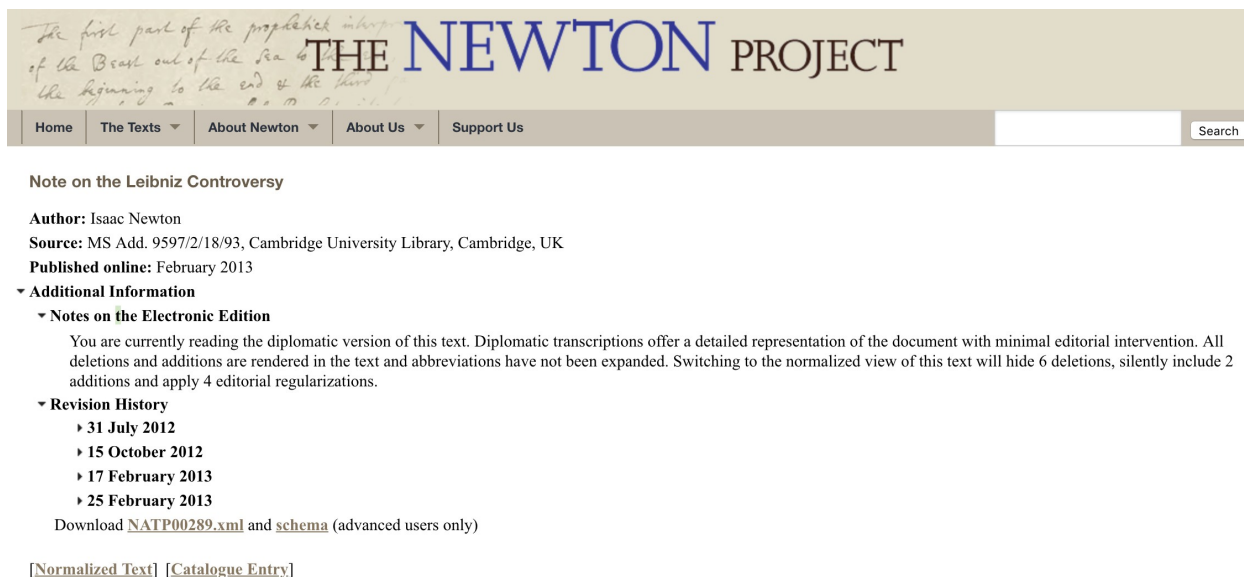
Text	
Name:	contains ⬍
Category	Any ⬍
Custodian	Any ⬍
Shelfmark	

Search   Reset

Fig. 4: The *Search* function.

Note on the Leibniz Controversy

Author: Isaac Newton
Source: MS Add. 9597/2/18/93, Cambridge University Library, Cambridge, UK
Published online: February 2013
▾ **Additional Information**
  ▾ **Notes on the Electronic Edition**
      You are currently reading the diplomatic version of this text. Diplomatic transcriptions offer a detailed representation of the document with minimal editorial intervention. All deletions and additions are rendered in the text and abbreviations have not been expanded. Switching to the normalized view of this text will hide 6 deletions, silently include 2 additions and apply 4 editorial regularizations.
  ▾ **Revision History**
      ‣ **31 July 2012**
      ‣ **15 October 2012**
      ‣ **17 February 2013**
      ‣ **25 February 2013**
      Download **NATP00289.xml** and **schema** (advanced users only)

[**Normalized Text**] [**Catalogue Entry**]

<93r>

If several bodies revolve about a common center & the vis centripeta be reciprocally as the square of the distance \of the body/ from y^e center: the orbs wil described by the bodies will be all of one & the same kind but may differ from one another in species; & such are the Conic Sections. And if the f vis centri{illeg}|p|eta be reciprocally as the cube of the distance the Orbs described will be all of another kind but differ{illeg} from one another in species, such as are the Spiralis Logarithmica, the Spiralis Hyperbolica, & three other species of Curves. And if in either case a man should shew how to describe the Curve which a body shall describe when projected from any given place with any given velocity in any given determination of motion: he would shew how to at the same time shew how to describe all the curves in wch a body can move in that case. Mr Newton in the XVIIth Proposition of his first Book of Principles has done this in the first case, that is, when ye force is reciprocally as the square of the distance, & has found that the Curve is always one of the three Conic Sections. If M^r

Fig. 5: Diplomatic Display of Newton's "Note on the Leibniz Controversy".

cæterisqᵤ Imperij Gothici regionibus quæ ad boreales partes Romæ sitæ erant jacebant, merito statuemus ventum borealem {illeg} {bellis} jam spirare, & Tubam quartam canere, cœpisse.

Sed quo Tubæ hujus historia clarior evadat; \antecedens³/ status Italiæ¹ ab occasu Cæsarum describendus est, et quomodo res Italorum ex eo tempore rursum florere cœperunt.

{illeg} Cùm itaqᵤ Odoacer reliquias Imperij Occidentalis per decennium tenuerat, Theodoricus Rex Ostrogothorum regnum ejus invadit, & bello fatigati regnum inter se dividunt. Deinde Theodoricus occiso Odoacro solus regnat per annos triginta septem, plurimas sub se regiones habens et omnia regens summa cum prudentia et fælicitate ita ut exteris formidini esset. †[1] Tenuit Italiam, Siciliam, Rhetiam, Noricum, Dalmatiam cum Liburnia, Istriaqᵤ & Suevorum ibi parte, Pannoniam illam in quâ Singidon et Sirmium; Galliæ præterea multa, ob quæ cum Francis bella gessit. Pendebant ei tributa Alemanni. Hispaniam autem regebat idem Theod{e}|o|ricus Tutoris nomine pro Amalaricho <2r> suo nepote. Quæ omnia partim apud Procopium, partem apud Cassiodorum videas. Vnde Ennodius in Panegyrico ad hunc Theodoricum dixerit, {objectam} ad limitem suum Romana Regna remeasse. Idem Theodoricus, inquit Cassiodorus, Senatum mirâ affabilitate tractans Romanæ plebi donavit annonas, a[...]s singulos maximâ pecuniæ quantitate, subvenit: sub cujus fælici Imperio plurimæ renovantur urbes, muniti[...]palatia; magnisqᵤ ejus operibus antiqua miracula superantur. Erat Theodoricus, inquit [2]Procopius, famâ [...]mperatoris ferebat, ut qui vel eorum qui a principio ea in dignitate probatiores fuissent, nemini inferior fueri[...] benevolentia, suaps|t|e humanitate prosequebatur, ita ut omnes (quod utiqᵤ difficillimum est) ejus Imp[...]

This text is unclear in the manuscript, but the editor is reasonably confident of the reading.

Cancelled

Hujusmodi Imperio Theodoricus & successore ejus Athalaricus Occidentem per annos 42 vexerunt: ita ut Evagrius Historicus eos vocet Administratores

Books in Newton's Library

Based by kind permission of Cambridge University Press on John Harrison, *The Library of Isaac Newton* [Cambridge: CUP, 1978]. The following entries are in the order that Harrison catalogued them, with their appropriate Harrison-number. These are generally in alphabetical order on author, but follow title when for instance the author is not directly mentioned in the book, or is unknown. With classical authors Harrison in general uses the first name for ordering purposes, e.g. "Dionysius Periegetis" under D. Books that are at the Wren Library in Trinity College, Cambridge, are indicated by "Tr" followed by their shelf-number. Similarly, those books at Cambridge University Library are indicated by "ULC". ? indicates that the current whereabouts of a book are unknown. Since Harrison's volume was published, a number of books from Newton's library have resurfaced at auctions and among rare book collections. The Newton Project has sought to update Harrison's catalogue where possible, and will continue to do so.

[H1]

Abulfeda. *De vita, et rebus gestis Mohammedis...Ex Codice MSᵗᵒ Pocockiano Bibliothecæ Bodleianæ textum Arabicum primus edidit, Latinè vertit, præfatione, & notis illustravit J. Gagnier.* Fᵒ, Oxoniæ, 1723. Tr/NQ.11.23.

[H2]

Account [An] of a Roman temple, and other antiquities, near Graham's Dike in Scotland. [By W. Stukeley.] 4ᵒ, [London, 1720]. Tr/NQ.10.34³.

[H3]

An account of Switzerland. Written in the year 1714 [by T. Stanyan]. 8ᵒ, London, 1714. Tr/NQ.9.39.

[H4]

An account of the affairs of Scotland, relating to the Revolution in 1688. As sent to the late King James II. when in France. By the Right Honourable the Earl of B—[Balcarres]. 4ᵒ, London, 1714. Tr/NQ.9.20².

[H5]

An account of the Court of Portugal, under the reign of the present King Dom Pedro II...[By J. Colbatch.] 8ᵒ, London, 1700. Tr/NQ.9.80. [a few signs of dog-earing].