Institution: University of Sussex

Unit of Assessment: UoA 30 History

Title of case study: The Newton Project

1. Summary of the impact

The Newton Project transforms public understanding of one of the most significant intellectual figures in history. A pioneering initiative that has set international standards for the digital humanities, it provides an open access online scholarly edition of Sir Isaac Newton's complete writings, making available previously unseen material relating to his ideas about science, mathematics and theology. Under the directorship of Rob Iliffe, the Project has reached a wide variety of benefactors, including secondary schools, broadcasters and the performing arts. Through these creative collaborations, it serves as an outstanding resource for the popularisation of scientific thought.

2. Underpinning research

The Newton Project, co-created by Rob Iliffe in 1998, is dedicated to publishing an open online edition of the 8 million words of Isaac Newton's writings that were left at his death in 1727 [see Section 3, R1]. It displays searchable transcriptions that allow readers to see either a full rendition of the text, including Newton's own amendments, or a cleaned up, readable version. The Project also features commentaries and other ancillary materials.

The Project is now the largest online edition of materials originated in digital form in existence and serves as an exemplar for other projects. It has been a leading exponent and developer of the technical guidelines created by the Text Encoding Initiative that shape practice in the digital humanities. In the last five years, the Project has more than doubled the number of texts available online, adding significant scientific, mathematical and theological texts. Fully searchable texts of all three editions of Newton's *Principia Mathematica* and *Opticks* are now available, along with a number of drafts of each. The mathematical texts available on the site are some of the most significant documents in the history of thought. They record Newton's invention of the binomial theorem and the calculus, and are published in full for the first time. With the help of private funding and support from JISC, the Project has devised novel ways of embedding MathML text in a TEI environment so that browsers can display the meaning and structure of Newton's key work in these areas.

Newton is celebrated for his natural philosophical writings and mathematical works, but the Project also reveals the extent of his interest in religion and alchemy. Over 1.5 million words of Newton's innovative religious writings have also been released for the first time, indicating just how committed he was to the study of prophecy, Christology and church history in the very periods that he was writing his most influential scientific work. Iliffe has promoted understanding of Newton's alchemical writings through collaboration with William Newman of Indiana University on the online project *The Chymistry of Isaac Newton*.

Aside from the unprecedented insights it gives into Newton's life and career, the Project addresses fundamental questions about how to present scholarly materials to different sorts of reader. The Project has digitised all the theological manuscripts and most of the scientific and mathematical texts of Isaac Newton according to the latest (P5) version of the Text Encoding Initiative (TEI) Guidelines for XML transcriptions of texts. The Project provides a 'tour' around the general areas of the site as well as introductions to every text, many of which take the form of filmed interviews with scientists and historians. It links transcriptions to high-quality images of originals through partnerships with the National Library of Israel and Cambridge University Library (the JISC-funded Windows on Genius Project). There is also a substantial amount of contextual and expository materials, including a catalogue of all of Newton's manuscripts, an array of manuscript and printed biographies of Newton and early popularisations of texts.

3. References to the research

R1 Newton's Mathematical Papers, Scientific Papers and Religious Writings. Transcription of 5.2 million words of Newton's words. http://www.newtonproject.sussex.ac.uk/

R2 Iliffe, R. (2013) *High Priest of Nature: The Heretical Life of Isaac Newton*. Oxford: Oxford University Press.

R3 Iliffe, R. (2007) *A Very Short Introduction to Newton*. Oxford: Oxford University Press.

R4 Iliffe, R., Keynes, M. and Higgitt, R. eds (2006) *Early Biographies of Isaac Newton: 1660–1885*. London: Pickering and Chatto.

Outputs can be supplied by the University on request.

Research grants

- *AHRC*: £332,000 (1998), £521,000 (2004), £54,000 (2008), £307,000 (2011). The 2008 grant Newton Theological Papers Project was rated 'outstanding' by the Council. A report on the project received in March 2012 concluded that the publication of previously inaccessible texts 'is a major contribution to a range of fields' and that research on Newton's religious work, and its place in his own and broader work 'is enormously enabled'.
- *Cultural Heritage Languages Technologies consortium*: €240,000
- *JISC*: £95,000 (2008), £88,000 (2011)
- *Royal Society*: £20,000 (2006)

4. Details of the impact

The Newton Project enhances public understanding of the role of Newton's work via a huge international audience reached through its own website, through a play, television and radio programmes inspired and informed by the project, and through secondary schools.

Over the last five years the number of unique visits to the Project has increased dramatically, and now stands at almost 2 million page requests per year. Weblog statistics show 9.9 million page requests between February 2007 and February 2013 [see Section 5, C1]. In addition, the Cambridge/Sussex Windows on Genius Project hosted by Cambridge University Digital Library had 495,316 unique and return visitors between November 2011 and June 2012. The total number, including unique and return visitors, was 576,339. The Project's YouTube channel [C2], plus its collaborations with international partners including Indiana University and the National Library of Israel [C3], have further enlarged and diversified the reach of the Project.

The Project has contributed to cultural life by inspiring new forms of artistic expression

In 2011, the playwright Craig Baxter wrote an acclaimed play about Newton entitled *Let Newton Be!* [C1]. Commissioned by the Faraday Institute at Cambridge, the play is based entirely on biographical materials and other sources from the Newton Project. It has been performed across the United Kingdom and North America to a total audience of around 4,000, including, on opening night, Professor Stephen Hawking and the President of the Royal Society, Martin Rees. More than entertaining audiences, the play has enhanced public understanding of the development of scientific knowledge. The journal *Science*, for instance, applauded the play for representing Newton in a way that 'will awe and move modern audiences'. A laudatory review in *Times Higher Education* also explicitly acknowledged the play's indebtedness to the Newton Project, praising the 'rich historical sources' that informed the 'entertaining script' [C4]. *Let Newton Be!* has also contributed to public knowledge by inspiring publication of *The Isaac Newton Guidebook*, a book aimed at popular audiences edited by Denis Alexander, with a preface by Stephen Hawking. The

book is accompanied by a DVD featuring a filmed version of the play and includes a contribution from Iliffe among the eight newly commissioned essays.

A further impact on cultural life is the commissioning and broadcast of radio and television programmes that utilise the content of the Newton Project and feature Iliffe as an academic authority.

Iliffe's status as a leading authority on Newton has led to him acting as an advisor to, as well as appearing on, numerous broadcasts. This includes his appearance on BBC Radio 4's *In Our Time* to discuss Newton's Laws of Motion on 3 April 2008. The programme has a weekly audience of around 2 million [C5]. The collaborative project with William Newman of Indiana University on Newton's alchemical works inspired *Newton's Dark Secrets*, a television documentary produced by WGBH in Boston. The documentary was aired as part of PBS's science series *Nova* on 15 November 2005 and is also available on DVD [C6]. Iliffe additionally featured in the episode on Newton's Prism that formed part of the BBC 4 series *The Beauty of Diagrams* [C7], broadcast on 2 December 2010 and repeated on 2 December 2011; in a documentary about Newton's role as Master of the Mint shown on Central China TV-1 to an audience of 9.1 million on 10 December 2012; and in *Isaac Newton: The Last Magician*, broadcast as part of BBC 2's *The Genius of Invention* season on 12 April 2013 to 1.52 million viewers [C8]. These programmes' exploration of how Newton simultaneously made his scientific breakthroughs while obsessively pursuing the arcane practices of mysticism and alchemy draws directly from materials available through the websites of the Newton Project and *The Chymistry of Isaac Newton*.

The Newton Project also promotes the teaching of mathematics in secondary schools

Project team members have worked closely with the British Society for the History of Mathematics and Dr Snezana Lawrence (Director of Mathematical Education at Bath Spa University) to engage with pupils at both state- and independent-sector schools in Sussex and the South West. Lawrence and the Newton Project co-organised a training day at the Royal Society in September 2009. The event, attended by 31 teachers and 35 pupils, assessed how the historical materials available on the Project website can be used to enhance the interest of experienced mathematicians in the history of mathematics, as well as to stimulate interest in mathematics in schoolchildren.

5. Sources to corroborate the impact

C1 Newton Project web statistics: http://www.newtonproject.sussex.ac.uk/stats/year.html

C2 NewtonMSSProject's Channel: http://www.youtube.com/user/NewtonMSSProject

C3 The National Library of Israel Digital Collections: http://dlib.nli.org.il/R/?func=collections&collection id=7586

C4 http://www.timeshighereducation.co.uk/415635.article

C5 *In Our Time: The Laws of Motion*, Radio 4 broadcast, 3 April 2008: http://www.bbc.co.uk/programmes/b009mvj0

C6 *Newton's Dark Secrets*, PBS broadcast, 15 November 2005: http://www.pbs.org/wgbh/nova/physics/newton-dark-secrets.html

C7 *The Beauty of Diagrams*, BBC4 broadcast, 6 episodes, November–December 2010: http://www.bbc.co.uk/programmes/b00w5675

C8 Audience data for *Isaac Newton: The Last Magician*: www.barb.co.uk/viewing/weekly-top30?_s=5&period[]=201304060114