

THOMAS HARRIOT IN GLOBAL AND LOCAL CONTEXTS: A QUATERCENTENARY CONFERENCE

ABSTRACTS

Amir Alexander (UCLA) “Thomas Harriot, Baconian Mathematician”

Thomas Harriot and Francis Bacon were near-exact contemporaries who moved in similar circles. Yet other than a single mention in Bacon’s memoranda we have no indication that the two ever crossed paths. Bacon, after all, was famously critical of mathematics, whereas Harriot was the leading mathematician in England. Yet a close look at Harriot’s unorthodox brand of mathematics that reveals it addresses some of Bacon’s key concerns about the field. Was Harriot responding directly to the Lord Chancellor’s critiques? Or were Bacon and Harriot both drawing to broader intellectual trends?

Jim Bennett (Linacre College, Oxford): “The Mathematical Seamen of Elizabethan England”.

Thomas Harriot was a mathematician who went to sea, albeit relatively briefly. His experience forms part of an engagement between mathematics and the practice of navigation that was shaped differently from the pioneering, institutional programmes of Spain and Portugal. The established Iberian activity was part of the context for English ambition and for the approach adopted to becoming a seafaring power, but so too were the efforts of a range of individual mathematical seamen, whose achievements, original as they were in Harriot’s case, can be better appreciated in association.

Philip Beeley (Faculty of History, University of Oxford) “Fallacies, Fictions, and Half-Truths. On Thomas Harriot’s reception in later seventeenth-century scientific discourse”.

As is well known, the enemies of Descartes gleefully took up and spread the false rumour that he had derived substantial parts of his *Géométrie* through reading Harriot, that is to say, the English mathematician’s *Artis analyticae praxis*, published posthumously and confusedly by Walter Warner in 1631. Although John Wallis, Savilian professor of geometry at Oxford, was not the original source of the rumour, he did most to establish the conviction of its truth in the minds of contemporary scholars. It is less clear how far Descartes’s supposed plagiarism and the surrounding discussion impacted on Harriot’s scientific legacy in the Republic of Letters in the second half of the Seventeenth Century. Drawing on unpublished manuscripts and contemporary publications, the talk will seek to provide an initial answer and assessment.

Norman Biggs (LSE) “Harriot, Money, and Mystery”

In 1604 Harriot devoted some of his time to studying the current coins of England. The background was that the new king James was preparing to introduce a unified coinage for his kingdoms, and Harriot’s patron, Henry Percy was a member of the Privy Council. Harriot

studied the purity of the gold coins, and the 'ratio' of the values of gold and silver. This required precise experimental work, for which he used the hydrostatic method, weighing in air and in water, and complicated calculations, where he was aided by his expertise in symbolic algebra.

After the trauma of the Gunpowder Plot, Harriot seems to have lost interest in matters of national policy. However, there are indications that his work on coinage was known to, and highly regarded by, influential people. After his death in 1621 his papers fell into the hands of Thomas Aylesbury, a rising star in the administration. Aylesbury was made a Master of Requests and a baronet in 1627, and in 1631 he was appointed as 'sole maker of money weights for gold coins'. It is possible that his familiarity with Harriot's work played a part in this appointment, and his subsequent elevation to become joint Master of the Mint in 1635. Around this time, Aylesbury's colleague Walter Warner produced several essays on monetary matters. One group of essays found its way to the estate of the Cavendish family in Nottinghamshire, and is now among the Harleian MSS at the BL. (In 1642 William Cavendish, Lord Newcastle, was authorized to make coins at the royalist mint in York, and his initials appear on weights used to check silver coins.) Another group was acquired by the antiquarian Sir Justinian Isham of Lamport Hall in Northamptonshire, and yet another was at one time in the possession of Herbert Thorndike, prebendary of Westminster.

Warner's monetary essays covered matters that do not feature in Harriot's 1604 work, as now published online. In particular, Warner discussed the relevance of the 'ratio' to the exchange of foreign coins, and the implications for the nation's store of precious metals. So, the question arises: are these discussions original with Warner, or are they derived from work of Harriot, now lost?

Pascal Briost (Centre d'études supérieures de la Renaissance, University of Tours) and **Jean-Jacques Briost** (Independent scholar): "Harriot's reading of French scientific authors."

Thomas Harriot's scientific method was nourished with the reading of French authors whom he quoted in his manuscripts –François Viète, Monsieur de Foix, Gaston du Clo(s). Harriot's patron, Henry Percy, who stayed in France in 1582, and possessed diverse French books in his library, was a documentary basis which helped Harriot to develop mathematical demonstrations and to solve problems on "rums" and "nautical triangles", as well as to get information on specific gravities. This communication aims to identify Harriot's French sources and express their contribution to his thought, especially regarding the way in which problems concerning the sphere could be reduced to plane geometry.

Hilary Gatti (La Sapienza, Rome) "'They shall have cause both to feare and love us": Thomas Harriot in the new found land of Virginia.'

Thomas Harriot's *A Brief and True Report of the New Found Land of Virginia* was something of a best-seller in his own day, and is still prized as a scientifically objective first-hand account of the 1584-85 voyage to Virginia sponsored by Sir Walter Raleigh. Much of this prolonged consensus is due to the beautifully life-like engravings of the native American community based on paintings by John White, added to the second and subsequent editions of the text published in Amsterdam by Theodore de Bry in 1590. But here we are celebrating

Harriot, and I shall be concerned only with the first edition of the text, without illustrations, published in London, probably by Robin Robertson, in 1588. My attention will be focused above all on the third and final section of Harriot's Report, or his description of "the nature and manners of the people of the country", which I shall be reading in the light of contemporary attitudes towards the budding British colonial enterprise with special attention to two Italian exiles present in England in 1584-1585: Alberico Gentile and Giordano Bruno.

Robert Goulding (Notre Dame) "Walter Warner, Custodian of Harriot's Secret of Refraction".

In 1634, the mathematician Walter Warner introduced himself to Sir Charles Cavendish -- brother to the Duke of Newcastle, accomplished experimental philosopher, and generous patron of the sciences. Warner, now in his 70s, had worked since his youth with Thomas Harriot, and became custodian of his vast manuscript remains after Harriot's death in 1621. He had witnessed Harriot's experimental determination of the law of refraction, extensively (if chaotically) documented in the manuscripts. Warner's own interests remained fixed on optics and this mathematical law which, as far as Warner was aware, was known to no one else in the world. His erstwhile patron, Sir Thomas Aylesbury, had tried to keep him working at a table of antilogarithms, forbidding him from optical research until they were completed. Now Warner was seeking patronage from Cavendish for the theoretical and experimental investigation of light. He promised Cavendish an optical machine that could see things at a great distance and burn ships from afar; moreover, he would also reveal the working of the machine, and the secret law of refraction on which it was constructed. Cavendish and his associates, Robert Payne and Thomas Hobbes, were skeptical of the machine, which Warner perhaps might have expected. But to his utter surprise, this little philosophical circle in Nottinghamshire was already very familiar with the secret of refraction, having been informed of it by one of Cavendish's clients, the Parisian mathematical practitioner Claude Mydorge, who had discovered it in collaboration with Descartes. There followed a rapid exchange of information between France and England, in which these two previously separate groups of refraction researchers learnt of each others' existence, methods, and theories for the first time. Warner's papers, both published and unpublished, are a valuable resource not only for Harriot's unsung research into refraction, but also shed light on Descartes' path to the law of refraction, published by him in an idealized form three years later in his *Dioptrique*. They are also a fascinating record of the social world of early-modern refraction theorists, navigating a line between revealing and putting to use a new physical law, and keeping it secret as a currency of patronage.

Dana Jalobeanu (University of Bucharest), 'Whose practice? Francis Bacon's rules of *experientia literata* in context'.

In the first decades of the seventeenth century, Francis Bacon invented two arts intended to contribute to the invention of new arts and sciences. One was his famous *novum organum*; the other the equally popular (and prominent) *experientia literata*, the learned or literate experience. This latter art was often taken to be a crossbreed of skill and methodology of

scientific investigation. It was codified in several modes of experimenting and exemplified in numerous of Bacon's natural and experimental histories. And yet, there was always something a bit vague and mysterious about the source, evolution and various stages of this art of experimenting which underwent a number of changes from 1608 to 1626. In this paper I intend to tackle the issue of the learned experience starting from a different angle, i.e., from the assumption that its origin is in a set of practices. Starting from this assumption I will offer a re-reading of Bacon's comments in the *Commentarius solutus* and other early writings, discussing his interest for reaching out to other experimenters with a keen and critical eye for their recipes and for their practices. I will show how some of the modes of experimenting seem to codify the exploratory practices we can find in the optics of Thomas Harriot. I will also conjecture that Bacon's investigations into the connection between light and heat and the ways in which one can use light to heat up and transmute matter could have been inspired by the investigations undertaken by Thomas Harriot.

Vera Keller (University of Oregon) 'The Virginia Company in the History of Projects'.

Several historians have situated early colonialism in Virginia amid, to use Karen Ordahl Kupperman's phrase in *The Jamestown Project*, "a welter of colonial projects." The Virginia Company, I argue, proved to be far more of an advocate for projecting than did a close comparator, the East India Company, notwithstanding considerable overlap in their respective memberships. This paper explores the ways that Virginia Company publications promoted emergent knowledge practices of projecting, despite abundant, widespread social opposition and the greater skepticism evinced by other joint-stock companies.

Annaleigh Margey (Dundalk Institute of Technology) "Thomas Harriot and Ireland: surveying and mapping in sixteenth-century Munster".

The late sixteenth-century saw the advent of a new phase in England's interaction with Ireland. Following the end of the Desmond Rebellion in Munster, significant areas of land belonging to the earl of Desmond and his supporters became forfeit to the Crown. The extent of forfeited lands led to proposals for formal plantation in the province. This plantation created plantation estates, or seignories, across the province of 12,000, 8,000, 6,000 and 4,000 acres

Led by men of note, known as undertakers, who were granted plantation estates, English settlers arrived in large numbers to the province. Amongst the early estate holders was Sir Walter Raleigh. His estates fell in the lush lands of the Blackwater Valley in the Waterford and Cork borders. Raleigh's estate became home to early industry, with timber forming the backbone of the early estate development. The estate also became home to multiple settlers from amongst Raleigh's acquaintances, such as John White and Thomas Harriot, who had previously been part of Raleigh's expeditions to the New World. During his tenure in Munster, it is believed that Harriot may have produced a fine map of the Blackwater Valley, on which scholars have identified his coded narrative.

This paper will seek to situate Harriot's potential cartographic output in the context of surveying and mapping during the Munster Plantation. Beginning with an overview of pre-plantation mapping in the province, the paper will continue to explore cartography, as it became an aid to plantation. In this guise, maps became part of reconnaissance, planning and estate and urban development.

Alexander Marr (University of Cambridge), "‘I flamed amazement’: The Identity of Isaac Oliver's *A Man Consumed by Flames*."

This paper will propose an identification of the sitter in Isaac Oliver's *A Man Consumed by Flames* (c. 1610; National Trust). The portrait is an intriguing example of an *impres*a miniature, of the kind commissioned by Harriot's patron, Henry Percy, from Oliver's teacher and competitor, Nicholas Hilliard. My discussion of the miniature will touch upon the Virginia Company, the Mermaid Tavern, and the iconography of sacred and profane love in Jacobean England.

Makiko Okamura (Kyoto University) "Thomas Harriot's Concept of the Universe considered in his 'De Infinitis' manuscripts."

Thomas Harriot, in his unpublished manuscripts 'De Infinitis,' (BL Add MS 6782, fols, 362^r-375^r), starts his discussion with Aristotle's idea of continuity and tangent, and proceeds to his discourse on infinity and infinitesimal in mathematical theory, both in algebra and geometry. He, from the viewpoint based on Aristotle's theory, advances his discussion to suggest, against Aristotle, that infinity exists not only in possibility but also in reality. He also considers the 'mystery of infinity,' 'finitum' and 'infinitum,' and, 'minimum' and 'maximum,' which, he writes, concerns both space and time, and in the end he goes forward to the traditional problem of cosmology, whether the world is made from nothing or not. In another manuscript (BL Add MS 6785, fol.436), he argues that infinity is generated from the finite, and that infinity is composed with the finite. These discussions lead him to his theory, that the infinite universe is made of the indivisible infinitesimal, atoms. In order to clarify his concept of the universe in the transitional period from natural philosophy to astronomy, I will examine other Harriot manuscripts, especially those concerning contemporary astronomers and their theories, and will examine his acquaintance with various astronomers, both in person and in his reading.

Cesare Pastorino (Ca Foscari University, Venice) "Harriot and Kepler on the Specific Weight of Substances: A Difference of Experimental Traditions."

In the first decade of the seventeenth century, both Thomas Harriot and Johannes Kepler produced important investigations of the specific weights of substances. It is possible to trace significant connections between these two experimental projects. For one thing, Harriot and Kepler relied on a very similar set of sources. Also, Kepler's numerical scale of

specific weights was based on Harriot's experimental results and numerical determinations. However, these similarities should not be taken as signs of the identity of their methods.

On the contrary, these two authors adopted substantially different experimental methodologies. Harriot was guided by the hydrostatic principle of Archimedes, while Kepler followed non-hydrostatic methods that were common among early experimenters on the weight of substances. Why was this the case, and what can their different approaches more generally tell us regarding the sixteenth-century experimental traditions to determine specific weights? This paper will situate Harriot's and Kepler's experimental investigations on this subject in this broader context.

Jennifer M. Rampling (Princeton): "Signs and Tokens: Thomas Harriot and English Alchemy"

In early modern England, the practice of alchemy was closely bound up with the study of medieval texts. This paper investigates the evidence for Thomas Harriot's attempts to extract and test practical information from the writings of earlier generations of alchemical authorities, including the fifteenth-century canon of Bridlington, George Ripley. These sources describe a variety of physical effects, or "tokens," observable in the alchemical work—signposts to successful practice that included changes of state and colour, which later readers were keen to replicate. Traces of these tokens in Harriot's own collections and experimental notes offer enticing evidence for how he read and reproduced the advice of past adepts, while testing them against his own experience.

Matthias Schemmel (MPWIG): "The Place of Thomas Harriot in a Global, Long-term History of Knowledge".

The study of Thomas Harriot's extensive and rich manuscript legacy and the comparison of his life and work with that of other early modern pioneers of science such as Galileo, Kepler and Descartes offer rare insights into the transformations of the early modern European knowledge system often broadly referred to as the Scientific Revolution. On the other hand, the very notion of a Scientific Revolution raises questions in the context of a global, long-term history of knowledge, such as: Why did it take place when and where it did? What is the role of individuals in this transformational process? Were there alternative historical pathways? In what sense was it a revolution? To what extent did it prepare the kind of dependency of society on science that characterises our present world? In this lecture on the occasion of the quatercentenary of Harriot's decease, I will try to connect some of the advancing results of Harriot scholarship with such fundamental questions in the overall history of knowledge.

Misha Teramura (University of Toronto) "Hotspur's Skepticism: Harriot, Percy, Shakespeare"

This paper begins by asking why the scribe of "Notae ex discursu Thomae Hariotae" (British Library, Add. MS 64078) recorded several extracts from Shakespeare's *1 Henry IV* on the same manuscript. While the extracts themselves have received attention from Shakespeare

scholars, the connection between the manuscript's two items has gone overlooked: not only is *1 Henry IV* a play about the ancestors of Harriot's patron—Henry Percy, ninth earl of Northumberland—but the extracting reader was specifically interested in Henry “Hotspur” Percy's skepticism of Glendower based on natural philosophy, an exchange unparalleled in Shakespeare's historical sources. Using the “Notae” manuscript as an invitation to track the reputations of Harriot and Percy in the 1590s, and drawing on printed dedications and the documented interest of the Percy family in Shakespeare's history plays, this paper proposes that Percy's well-known scientific pursuits and developing relationship with Harriot informed Shakespeare's characterization of Percy's direct ancestor.

Kevin Gerard Tracey (Maynooth University). “‘Chymicus’, ‘mathematicus’, ‘sometime student of this college’: Tracing the life and work of Nathaniel Torporley through his Sion College bequest (c. 1633/36).”

Though only briefly affiliated with Sion College in the final years of his life, the clergyman and mathematician Nathaniel Torporley (1564–1632) nonetheless saw the newfound establishment as a worthwhile home for his personal collection of texts on theology, mathematics, astronomy, alchemy and medicine. Most commonly thought of today in reference to either his friend and confidant Thomas Harriot (c.1560–1621), or to the French analytical algebraist François Viète (1540–1603), for whom he briefly acted as amanuensis, appreciation of Torporley's mathematical capabilities and his wider scholarly interests has been dimmed by the light of his two more famed contemporaries: an overemphasis which serves to obscure both Torporley's own unique contributions to early modern intellectual culture, as well as the opportunity his bequest to the Anglican community provides to historians of science, religion, education and the book. Offering a partial reconstruction of the scholarly library of this early modern mathematician and clergyman, this paper offers insights into Torporley's reading and collecting habits; a fresh appreciation of his multiple scholarly identities and associated intellectual practices; and a brief treatment of his sole published work, the baroque *Dicliides coelometricae seu valvae astronomicae universales* (London: Felix Kingston, 1602).

Jessica Wolfe (University of North Carolina at Chapel Hill) "Realms of Gold: George Chapman and the School of ---?"

This paper will offer a thoroughgoing reappraisal of the quasi-mythical literary and scientific coterie known as the School of Night, instead tracing a set of intersecting and evolving academic, diplomatic, and scientific communities from Oxford in the mid-1570s, to Paris in the 1580s, and back to London from the early 1590s up through the establishment of both the Virginia and East India companies at the turn of the seventeenth century. These communities were united not so much by a shared interest in esoterica or the deliberate cultivation of obscurity but rather by disciplinary and political commitments ranging from geography (and other practical sciences in the service of colonial enterprise), to the collection and dissemination of travel narratives, to the enlisting of classical literature in the service of a nascent British empire.

Lauren Working (Faculty of English, Oxford) 'Thomas Harriot and the Material Atlantic'.

Harriot's *A briefe and true report of the new found land of Virginia* (1588; expanded 1590) is full of objects – desired, lost, and found. From cedar bark to a necklace of pearls strung for Queen Elizabeth, the raw goods and Indigenous artefacts that circulated between North America and London informed how the English envisaged and identified with the colonial project. Although studies on English colonialism often focus on settlement, this paper explores the portable objects that were transported into London, such as furs, tobacco, pearls, and deerskin mantles. It argues that tracing the lives of displaced objects from their country of origin to new contexts of use can shed light on how gentlemen in early seventeenth-century London fashioned themselves and endorsed the colonial project. But such artefacts can also, like Harriot's text, be used to revisit the multiple layers of encounter and knowledge-transmission, disrupting English ideas about 'improvement' and industrial refinement with other cadences and ways of seeing.