

Harriot (Harriot or Harriott), Thomas ^[1]

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by John W. Shirley, 1988

1560–2 July 1621

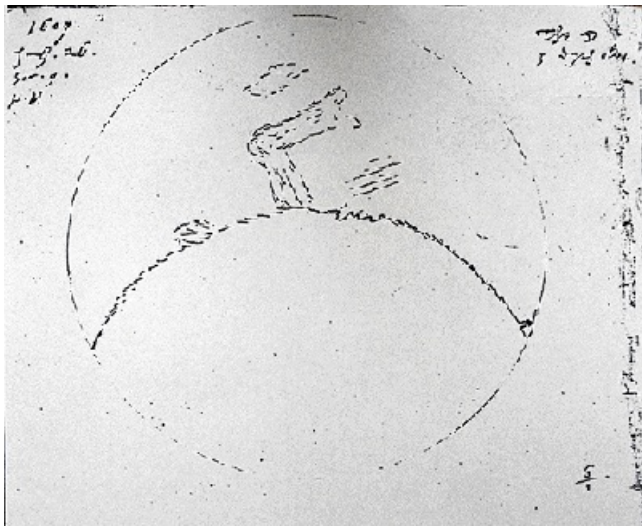


From Oriel College, Oxford University.

^[2]Thomas Harriot (Harriot or Harriott), explorer, navigational expert, mathematician, scientist, and astronomer, participated in Sir [Walter Raleigh](#) ^[3]'s early expeditions to America. His parentage or ancestry are unknown. Records of his matriculation at [Oxford University](#) ^[4] show him to have been born and reared in Oxford, England, and to be of plebeian stock. He entered [St. Mary's Hall](#) ^[5] (a subsidiary of Oriel College) on 20 Dec. 1577, at age seventeen, and was graduated with a bachelor of arts at the Easter Convocation of 1580. Acquisition of this degree gave Harriot the right to call himself "Master Harriot," a title he carefully used for the rest of his life.

Shortly after leaving the university, Harriot entered the household of [Walter Raleigh](#) ^[3], where, according to Richard Hakluyt, he not only instructed Raleigh in the mathematics of navigation but also conducted instructional programs for Raleigh's sea captains, that they might "very profitably unite theory with practice" in their explorations. This teaching (resulting in a navigational text called the *Arcticon* ^[6], which has not survived) further stimulated young Raleigh to follow in the footsteps of his half brother, [Sir Humphrey Gilbert](#) ^[7], in attempting to explore and colonize the New World.

On Gilbert's death in 1583, Raleigh purchased a new ship, renamed it the *Bark Raleigh*, and began to prepare for an exploratory visit to America to seek a site for colonization. Helping to plan this expedition was Thomas Harriot working closely with two other young sea captains in Raleigh's household, [Philip Amadas](#) ^[8] and [Arthur Barlowe](#) ^[9]. Raleigh hoped to command the 1584 voyage himself, but he was by this time a courtier rising in the eyes of Queen Elizabeth and she would not permit him to accept the danger of an ocean crossing where [Sir Francis Drake](#) ^[10] and the Spaniards were still fighting. Possibly Harriot may have gone on this voyage. Though he is not listed among the ten names signing the report, there is some evidence that it was at this time that he learned the Algonquin language, perhaps on the return voyage with the two Indians, [Manteo](#) ^[11] and [Wanchese](#) ^[12]. [John White](#) ^[13] is not listed either, though he later indicates that he was a member of this exploratory party. The return of the first voyage was most successful: Manteo and Wanchese made a great impression on the queen and on the court. Their friendliness and the reports of extensive economic potential in the new land appeared so favorable that the queen granted Raleigh a patent for colonizing, knighted him in January 1585, appointed him governor of the new colonies, and permitted him to name his proposed colony "Virginia" (in her honor as Virgin Queen) rather than the Indian name of Wingandacoa it had previously borne.

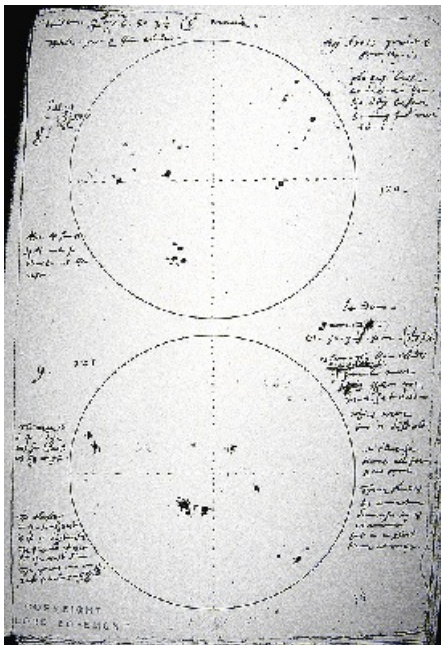


(click for larger) Harriot's moon drawing of 26 July 1609 Julian (5 August 1609 Gregorian). From the Galileo Project.

^[14]During the winter of 1584–85, Raleigh and Harriot made extensive preparations for a colonizing effort in Virginia. Seven ships were assembled with nearly six hundred men, half of them sailors and the other half soldiers and colonists who were prepared to spend at least a year in the New World. On 9 Apr. 1585, under the command of Sir Richard Grenville, this flotilla sailed from Plymouth. Because he could not go himself, Raleigh named Harriot as his official representative and charged him with assessing the economic potential of Virginia and reviewing the nature and inclinations of the natives. John White was assigned to help with the making of maps and to bring back drawings and sketches of the new land and its inhabitants. Both men, along with Grenville as general of the expedition, Ralph Lane ^[15] as high marshal and later governor of the colony, Simon Fernandez ^[16] as chief pilot of the fleet, and a number of other gentlemen who were to make up the council, sailed on the flagship, *The Tiger*.

During the long sea crossing, Harriot made a number of scientific observations. He tested the traditional and crude dead reckoning against the more accurate celestial navigation, probably using the backstaff he had developed for better observation by his sea captains. He noted the variation of the compass, measuring the magnetic north against the position of the pole star. On 19 April, ten days after leaving Plymouth, he must have observed the eclipse of the sun, though the eclipse was not total where he then was, so it could not be used for an accurate calculation of longitude as he had hoped. As the flotilla proceeded through the islands, Harriot gathered fruits and vegetables, sugar, ginger, tobacco, and pearls ^[17] to be returned to Raleigh, along with White's drawings of many of the same things, as samples of the richness to be obtained by colonization.

On 26 June, after repeatedly searching navigable waters with extreme difficulty and much loss of vessels, the fleet anchored at Wococon Island, approximately where modern Ocracoke ^[18] is, and began negotiating with the natives. On 3 July an expedition was sent to Roanoke Island ^[19], the site that had been chosen by the 1584 expedition for colonization, to notify the Indian chief Wingina ^[20] of their arrival. On 11 July Grenville, Lane, Harriot, White, and a few others crossed to the mainland on a voyage of exploration through a number of Indian towns which took them as far as Lake Mattamuskeet ^[21], which the natives called Paquype. Within the next month the settlers had been moved to Roanoke, had unloaded their provisions, and were building a fort and houses and beginning to function like a colonial outpost. Harriot and White began in earnest to survey the land resources, and to draw for a permanent record what they could observe of the people and products of the New World.



(click for larger) Harriot's sunspot drawing of December 1610. From the Galileo Project.

During the whole of the year they spent at Roanoke Island, Harriot and White kept busy at their recording assignments. In addition to studying the people, they took careful notes on commercially profitable plants and mineral resources that might lead to further investment in colonial ventures. So successful was their publicity that more than two decades later, Harriot was working with Raleigh to prevent the importation of Virginia sassafras roots from glutting the market.

In his contacts with the natives, Harriot did not ignore his scientific bent. He exploited the science and technology of his day in such a way that he should undoubtedly be recognized as the first scientist of the New World—not only in his scientific study of the land and its people, but also in introducing scientific artifacts into Virginia. According to him, the native Americans were most impressed with the scientific instruments they first saw in Harriot's possession. Yet with all his frightening guns, magnets, clocks, and "wildefire works" (a compound used in warfare that was difficult to extinguish once set afire), Harriot earned the confidence and affection of the Indians, including Chief Wingina's, whereas Lane, using force to punish any observed unconformity, attracted only their hatred and distrust.

By the next spring, the new colonists were in dire straits; they badly needed the promised relief supplies, and they counted the days until the arrival of Raleigh's second-year colonists who would bring them. The Indians, too, were uneasy. On 10 June, Lane, suspecting an uprising, struck on the mainland, killing Chief Wingina. Additional search actions scattered his men and left them vulnerable to further attack. On the same day, however, Sir Francis Drake, sailing north from his battles with the Spaniards, anchored at Port Ferdinando. The next day he met with Lane, offering him one of his larger ships for reconnoitering the Chesapeake Bay area to seek a safer and more healthful colonial site. Transfer of the vessel had just begun when, on 13 June, a violent storm grounded some of Drake's vessels and blew others, including the one offered to Lane, out to sea where their only safe action was to set sail for England. The remaining ships were too large for Lane's use; and, because their supplies had been depleted, Lane decided that the colonists still at Roanoke should board Drake's ships and return home. The severe weather made boarding difficult, and, as Lane told the story, Drake "sending immediately his pinnaces vnto our Island for the fetching away of fewe that there were left with our baggage, the weather was so boysterous, and the pinnaces so often on ground, that the most of all wee had, with all our Cardes, Bookes and writings, were by the Sailers cast ouer boord." There can be little doubt that the great portion of Harriot's notes and White's drawings were thus lost in the frantic boarding on that day.

When he returned home, Harriot learned that Raleigh was unable to send relief to Virginia because of the Spanish threat to England; moreover, he was already engaged in a new colonial venture, this time in southern Ireland. Harriot, posing as one of the colonists, joined him there and was given for his use the Abbey of Molanna in the county of Waterford, near Youghal. Here, Harriot gathered his remaining notes and prepared for publication the first English treatise on the New World. This book, published in February 1588 under the title *A briefe and true report of the new found land of Virginia: of the commodities there found and to be raysed, as well marchantable, as other for victuall, building and other necessarie uses for those that are and shalbe the planters there; and of the nature and manners of the naturall inhabitants . . . By Thomas Hariot; seruant to . . . Sir Walter, a member of the Colony, and there employed in discovering . . .*,^[23] exists in only eight copies but remains one of the most important early accounts of the country as it was first seen by the English settlers. It attracted immediate attention and was included by Hakluyt in his *Principall navigations* of 1589. The following year, Theodore de Bry^[24] issued elaborate editions in Latin, English, French, and German, adding plates of twenty-one of John White's drawings of the new land and the Indians, for which Harriot wrote headnotes. Though this was the only work Harriot ever published, it was enough to establish Harriot and White as among the foremost authorities on early colonial America.

Harriot was also involved in the preparations for the invasion of the Spanish Armada. Though he was living in Ireland, he frequently visited London, and many of his extant manuscript notes indicate that he was preparing seamen for more

scientific approaches to their craft. It is true that superior seamanship (and God's weather) gave England the victory, and Harriot must have felt some satisfaction in his new science of navigation. Among other activities, he collected for Raleigh and government officials a large number of maps and rutters (sets of sailing directions, tide tables, and carefully drawn profiles of ports or entrances to harbors as seen from the sea, usually the first thing seized from a captured ship), particularly those dealing with Virginia; worked with Emery Molyneux to improve terrestrial globes; and assisted Gerard Mercator in developing more accurate map projections than had been used before this time. But increasingly his interests turned to theoretical and mathematical subjects. Harriot was one of the first of the new scientists to seek a mathematical solution to natural phenomena. His study of the piling of bullets led him to examine the possible atomic structure of matter as one of the earliest of the new atomists. His investigation of the trajectory of bullets and cannonballs led him to consider the laws of motion and falling bodies. In fact, he was performing the same experiments in England that were occupying Galileo [25] in Italy. Both atomic theory and the laws of motion led Harriot to study refraction; he discovered the law of sines many years before Wilebrord Snel (whose name the law bears) and began work on mirrors and lenses that may have resulted in his independent discovery of a telescope some years later.

During this period, Sir Walter Raleigh's fortunes began to decline. His colonization attempts in the New World had yielded only trouble and high costs. The relief vessels for the 1585–86 colony had arrived two weeks too late, and had returned to England leaving only a small contingent at Roanoke Island. The 1587 colonial effort with John White as governor had been extremely difficult to finance, and once landed could not be supplied or rescued. In all, these projects had cost Raleigh at least £40,000 and denied him the possibility of ever visiting Virginia himself. His Irish colonies were disastrous, too. The lands were poor, the settlers unhappy, the natives vicious, and English import duties on Irish products prevented any profit from his plantations. His popularity with Elizabeth, the source of his wealth, had been jeopardized by his courtship of one of the queen's ladies-in-waiting, Elizabeth Throckmorton, whom he married secretly in late 1591 or early 1592, an act that prompted the queen to confine him in the Tower of London and strip him of many of his honors.

In light of Raleigh's predicament, Harriot sought a new patron, and found one in Raleigh's longtime friend Henry Percy [26], ninth earl of Northumberland. Percy was a quiet, retiring, serious-minded young man, intensely interested in the new science of which Harriot was an outstanding exponent. Percy himself was known as "The Wizard Earl," and was beginning to gather about him men with similar interests. During much of Raleigh's imprisonment, Harriot was, according to the kitchen accounts of the ninth earl that still exist, dining regularly at the Wizard Earl's table. Though he continued to be one of Raleigh's closest friends and worked with him to find financial support for Raleigh's ventures, Harriot gradually rose in favor with Percy. In 1593, when Percy received the Order of the Garter [27], he gave Harriot a handsome gift of money. Two years later he granted him a lifetime interest in his landholdings at Brampton in County Durham (now called Barmpton, a rural suburb of Darlington) and established him in a house adjacent to his London residence, Syon House, Isleworth, though Harriot was still using his rooms in Durham House (Raleigh's London residence) when in the city.

By 1597, Harriot was listed as a regular pensioner of the ninth earl at £80 per annum—the same amount received by Percy's younger brothers. In the same year, in a will drawn by Raleigh on 10 July just before he sailed with Robert Devereux, earl of Essex, to intercept the Spanish fleet in the Azores in a dangerous attempt to recoup their fortunes, Raleigh named Harriot as one of the overseers of the will, left him "all my bookes & the furniture in his own Chamber and in my bedchamber in Durham House Togeather with all such blacke suites of apparell as I have in the same house," and arranged for Harriot to be paid an annual pension of £100 from his royal grants. Though this will was never probated, the sums mentioned indicate the kind of support that Raleigh must have been giving Harriot. From these incomes, Harriot could live like a gentleman, keep his own house and servants, and indulge his every whim in the pursuit of scientific knowledge without the worry of income, fame, or reputation.

Shortly after his accession to the throne, King James had Raleigh accused of treason on trumped-up charges, convicted by a hand-picked jury, and again thrown into the Tower of London at the sovereign's pleasure. Two years later, Henry Percy followed him to the Tower because James suspected a remote connection with the Gunpowder Plot [28]. Harriot, who was questioned about the plot and accused by James of having cast his horoscope, was imprisoned for a time, but then released to pursue his scientific research at Syon House [29]. Nevertheless, he remained the main link between Raleigh and Percy in the Tower and the outside world, visited them often, assisted Raleigh in the writing of his *History of the World* [30], and instructed young Algernon, Percy's heir, in the elements of mathematics and navigation, both of which would stand him in good stead in later life when, as the tenth earl of Northumberland, he was Admiral of the Fleet.

Between 1606 and 1608 Harriot corresponded with Johannes Kepler [31]; the two men compared notes on their experiments in the refraction of light, explaining, for the first time, the refraction within a sphere and providing a scientific explanation for the dispersion of light in the rainbow. By 1609, Harriot had in his possession a six-power telescope and began a series of observations of the moon. During the next four years he developed at least eight new telescopes, ranging in power from eight to fifty magnifications. With these telescopes (called by Harriot "perspective truncks") he observed the phases of Venus which proved the validity of Copernican over Ptolemaic astronomy, recorded more than thirty drawings of the moon leading to the first telescopic moon map, and determined the time of quadrature so that he could calculate the distance of the moon from the sun. In December 1610, almost simultaneously with Galileo, he discovered sunspots; during the next four years he made and recorded 199 observations. A few months earlier, in October, he first saw the satellites surrounding Jupiter and after two years of observation was able to calculate the distance of the moons from the planet and to compute the periods of their rotation. He also observed, using a cross-staff, the comets of 1607 (Halley's comet [32]) and 1618, observing their orbits and determining that they followed an elliptical orbit.

During these later years, Harriot suffered from cancer of the nose. Theodore Turquet de Mayerne [33], the king's physician,

was called in as a consultant on 28 May 1615. His notebooks still survive to record his impressions of this visit. He saw Harriot as a very melancholy man, about age sixty (actually Harriot was fifty-five, so his illness must have aged him). He noted that Harriot was the man who first brought tobacco out of Virginia and recorded, for the first time, the possible connection between smoking and cancer. His indication that Harriot had had cancer for about two years appears to be borne out by Harriot's own manuscripts, for except for the comet of 1618 his notes are sparse after 1612. Harriot was able, however, to attend the execution of his old friend and patron, Sir Walter Raleigh, at West-minister on 29 Oct. 1618, and his notes of Raleigh's final speech on the scaffold are among his papers.

Harriot died at the home of Thomas Buckner, a mercer who lived on Threadneedle Street near the Royal Exchange. He may have been on his way to visit Henry Percy, who was still in the Tower, or he may have been visiting an old friend, as "Thomas Bookener" had been with Harriot on Roanoke Island in 1585–86. Harriot was buried in the chancel of St. Christopher le Stocks, on the site of the present Bank of England. His grave, and the monument erected there by Percy, were destroyed in the Great Fire of 1666.

In his will, Harriot left his telescopes and scientific instruments to his executors and his mathematical and scientific papers to his patron, Henry Percy. He requested Nathaniel Torporley, a retired clergyman whom he had known for a long time, to edit and publish his papers. But the records of his visit to the New World are not mentioned. A canvas bag of Irish accounts, "the persons whom they concerne are dead many yeares since in the Raigne of Queene Elizabeth," and another bag of "divers wast papers . . . of my Accomptes to Sir Walter Rawley" he asked be burned. Thus died any additional traces beyond his published book of the personal observer of Raleigh and the author of the first English book about "the new found land of Virginia."

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Thomas Harriot, ECU Libraries: <http://www.ecu.edu/cs-cas/hariot/> ^[36]

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