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Christa Jungnickel and Russell McCormmach: Places



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Chapter 11 Places

Charles Cavendish was remarkably healthy. He experienced the almost universal malady of that time, "gout," but he was not crippled by it,¹ and to judge by his attendance at meetings, he did not suffer from any protracted illnesses. He came to a meeting of the standing committee of the British Museum as late as 7 February 1783.² He was nearly seventy-nine when he died, on 28 April 1783.³ Not yet remembered as the father of Henry Cavendish, his obituary notice in *Gentleman's Magazine* identified him as the great uncle to the present duke of Devonshire, who but for his title was undistinguished. The obituary also said that Charles was ninety, but it got him right when it called him an "excellent philosopher."⁴

For a man so well off, Cavendish's will was extremely brief, as his son Henry's would be too. Unchanged since he made it nearly thirty years before, it left £4000 to Charles's youngest son, Frederick, compensation for what he had taken from Frederick's estate, and ± 1000 for charity. His personal estate went to his oldest son and sole executor, Henry.⁵

At some point, probably when he resettled after his father's death, Henry made an inventory of his and his father's papers labeled *Fathers papers* and *Mine*, which he kept in a tall walnut cabinet with an upper case. His father's personal papers have all been separated and evidently lost, but it was unlikely to have been Henry who lost them; rather he classified and stored them under lock and key. Papers that we do not have but that Henry did include letters of his father's, mother's, and brother's, Ruvigny papers, poetry, genealogy, mathematical papers, pocketbook of experiments, measurements (probably meteorological) taken at Chatsworth, and papers on meteorological instruments, refracting telescopes, crystals, artificial cold, and specific gravity. Papers of Charles's that have survived are mainly legal documents having to do with wills, annuities, titles, rents, dividends, lawsuits, and his marriage settlement. Henry's own papers in the combined classification have to do with much the same things as his father's, which came with their station, properties and lawyers.⁶

Upon the death of Lord Charles Cavendish, there was a small, almost imperceptible change in protocol. In his publications in the *Philosophical Transactions*, Henry Cavendish's name was no longer preceded by "*Hon*," a courtesy title once removed.⁷ From

¹Charles Cavendish to Thomas Revill, draft, 2 Mar. 1765, Devon. Coll., L/31/20.

²7 Feb. 1783, Committee Minutes, British Museum, 7.

³Devon. Coll., L/31/37.

⁴Anonymous obituary of Charles Cavendish (1783).

⁵Charles Cavendish's will was probated on 28 May 1783. "Special Probate of the Last Will and Testament of the Right Hon^{ble} Charles Cavendish Esq. Commonly Called Lord Charles Cavendish Deceased," Devon. Coll., L/ 69/12.

⁶"Walnut Cabinet in Bed Chamber," "Papers in Walnut Cabinet," and "List of Papers Classed," Cavendish Mss Mise.

⁷"The Honourable" followed by a given name and surname was allowed the sons of earls and the children of viscounts and barons. Other than for a duke, who was called "His Grace," and a marquess, who was called "The Most Honourable," the title "The Right Honourable" was given to all peers as a courtesy. The son of a peer, Charles

1783 on, he was Henry Cavendish "Esquire" or simply Henry Cavendish. One year after Charles's death, Blagden commented that "no address is requisite to please Mr. [Henry] Cavendish."⁸

Following his father's death at the end of April, Henry was absent from the first two dinners of the Royal Society Club in May, the only dinners he missed that year.⁹ Writing to Henry in late May, John Michell apologized for imposing on him "so soon after the loss of Ld Charles."¹⁰ As to the meaning of the loss to Henry we can only speculate, but we believe that no one had been as important to him as his father; we base our belief on several considerations.

Cavendish was "educated and trained by his father from very early youth to scientific pursuits," according to a contemporary.¹¹ His father sent him to a secondary school with a modern curriculum and then to a university with a Newtonian curriculum, and at both places his father made social contact with the persons in charge. The year after he left the university, his father began to bring him to dinners with his friends from the Royal Society. Five years after that, Henry began attending meetings of the Royal Society as a guest of his father's. His first recommendation of a candidate at the Royal Society was made jointly with his father. His father was not on the Council during Henry's first term, but because the Council was elected, their separation perhaps could not be helped; they were on it together in 1769. Henry joined the same scientific clubs as his father. His father was present at Henry's early attendances at general meetings of trustees and at meetings of the standing committee of the British Museum. In his work at the Royal Society and the British Museum, Henry showed the same diligence as his father. His early scientific researches at home were done with his father's instruments, books, and journals, and he and his father made observations together. In his penchant for accuracy in his scientific work, he followed in his father's path. Henry had the example of his father before him, and he evidently approved of it, for he imitated it. This is the evidence of his father's importance to him in his life of science.

Despite Charles Cavendish's privileges, his life had a sad aspect. His wife died while he was still in his twenties, leaving him with two small boys to bring up. While in his teens, the youngest boy, Frederick, suffered an accident that left him impaired and dependent on his father, and his oldest son was socially impaired. Charles, it would seem, shepherded and sheltered Henry until he was ready to go into the world.

His life also had its gratifications. Within his family and in the wider society he took on strenuous duties, which he performed admirably. His scientific work was skillful and recognized. Of his achievements, the assistance he provided his intelligent and diffident son Henry was the most consequential. He died with the knowledge that Henry was in charge of his life and master of his chosen work, science.

Cavendish was called "The Right Honourable" or, more often, "Lord," and occasionally "The Right Honourable Lord," both parts of his title being by courtesy and proper. His son Henry was called "Honourable" by courtesy. *Treasures from Chatsworth, The Devonshire Inheritance.* A Loan Exhibition from the Devonshire Collection, by Permission of the Duke of Devonshire and the Trustees of the Chatsworth Settlement, Organized and Circulated by the International Exhibits Foundation, 1979–1980, 24.

⁸Charles Blagden to William Cullen, 17 June 1784, draft, Blagden Letterbook, Yale.

⁹They were dinners on 1 and 8 May 1783. Minute Books of the Royal Society Club, Royal Society.

¹⁰John Michell to Henry Cavendish, 26 May 1783; in Jungnickel and McCormmach (1999, 566).

¹¹John Walker to James Edward Smith, 16 Mar. 1810, Smith (1832, 170–171).

Leaving Home

Charles Cavendish appears on the rate books for his house on Great Marlborough Street until his death in 1783, after which Henry is listed,¹² and for a time Henry evidently used it as his townhouse. In 1782 he rented a country house in Hampstead, located north of London.¹³ William Thornton's guide to London and the surrounding countryside published in 1784 gives us an idea of Hampstead at the time Cavendish moved there: the village "is now of considerable extent. Many of the citizens of London have fine houses here, because the situation is not only delightful, but the air is esteemed exceeding wholesome.... At the north extremity of the village is a heath or common, which is adorned with many handsome buildings, and is so elevated, as to command one of the most extensive prospects of the kingdom."¹⁴ Fashionable Hampstead offered Londoners a vista and an escape from city stench.

Hampstead



Figure 11.1: No. 34 Church Row, Hampstead. Between 1782 and 1785, Cavendish lived in a house at the end of this row next to the church. But for the automobiles, this street with its terraced houses and church looks much the same as it did then. Photograph by the authors.

¹²12 June 1783, Paving Rate Books, Great Marlborough Street/Marlborough Mews, Westminster Archive, D 1260.
¹³Cavendish first appears in the rate books on 3 Jan. 1782. "Hampstead Vestry. Poor Rate," Holborn Public Library, London.

¹⁴ William Thornton (1784, 482).



Figure 11.2: Hampstead Bearings. From his country house in Hampstead, Cavendish took bearings in the direction of London. With a theodolite, he recorded the angular position of tall objects through an arc of about sixty degrees. Prominent among the objects were steeples, as we would expect from the picture of Westminster Bridge above; the London skyline was marked by steeples. On the map of London and environs published by R. Phillips in 1808, I have drawn Cavendish's lines of sight for a number of steeples, labeling them with the angles he measured. From right to left: 1. New houses on the road to Clapham. 2. Streatham steeple. 3. Chelsea steeple. 4. Battersea steeple. 5. Wandsworth steeple. 6. Putney steeple. 7. Hammersmith steeple. 8. Kew Chapel. 9. Acton steeple. 10. Ealing steeple. "Bearings," Cavendish Mss, Misc.



Figure 11.3: Hampstead Environs. From his house at Hampstead, Cavendish made trips into the surrounding countryside, noting milestones and other markers, such as churches and villages, which we indicate by circles on this map of the portion of the County Middlesex directly north of London. Locations and mileages are from several miscellaneous sheets in Cavendish Mss.



Figure 11.4: Mileage Counter. This page was obviously written by Cavendish while moving, the unsteadiness of his hand giving an idea what travel was like then. The abbreviated place names are Red Lyon, about 8½ miles from his home, and Finchley Church, about 2 miles closer. Cavendish recorded several local journeys with a measurer, 35 revolutions equaling 1/10 of a mile. Between places marked on the map of the previous illustration, this table gives the distance in miles. We are not certain what his means of conveyance was when he took these measurements, but we know that he had an "odometer" attached to the wheels of his carriage. Such an instrument could be bought for 7 to 10 guineas, and it was thought to be accurate to within 1%. After Cavendish's death, his "way-wiser" passed to the instrument maker Newman, who presented it to the museum of King's College, London. It was there when Wilson wrote his biography of Cavendish, but according to our inquiry it no longer is. Benjamin Vaughan to Thomas Jefferson, 2 Aug. 1788, in Boyd (1956, 460). The sheet of distances is reproduced with permission of the Trustees of the Chatsworth Settlement.

In the late seventeenth century, Hampstead began to change from a rural to an urban village. A mineral spring was opened, earning the village a reputation for healthiness as well as a good income from its water, which was recommended by physicians who drank it themselves. A popular destination early in the eighteenth century, Hampstead remained a resort, while its continuing growth owed to prosperous Londoners such as Cavendish taking up residence. Cavendish's address was 34 Church Row, the street of choice in Hampstead, where

visitors congregated and persons of "quality" promenaded. In appearance, the attractive, terraced houses have changed little since Cavendish's day (Fig. 11.1).¹⁵

Cavendish's activities were now divided between two locations, the exact separation of which was an astronomical datum: "Hampstead is 1,82 miles or 10.2 seconds of time west of Marlborough street," he recorded.¹⁶ During the first spring at his new country house, he compared the good air of Hampstead with the foul air of the city,¹⁷ assisted by the instrument maker Edward Nairne, who lived a few doors away, at 21 Church Row. During his first winter, he busied himself with experiments on the freezing temperature of mercury. From his house, he sighted on the weathercock of the parish church next door, and from the steeple he or an associate surveyed the countryside with a quadrant. The vista from Hampstead was broad. Cavendish took bearings of the duke of Devonshire's Palladian house at Chiswick; of temples, gazebos, and pagodas; and of the steeples at Walton, Battersea, Hammersmith, Stretham, Acton, Paddington, Chelsea, and Ealing, and of the steeple of the church at Clapham Common, on the far side of London, the location of his next country house (Fig. 11.9).¹⁸ Cavendish's final appearance in the Hampstead rate books is on 17 September 1785. This stage of leaving home lasted three and a half years.

Bedford Square

For a time, Cavendish employed a young man Charles Cullen, exactly in what capacity is unclear, but it involved translating from the Swedish. Charles was a son of the Edinburgh professor of medicine William Cullen, Blagden's teacher and friend. In a letter to Blagden in May 1784, William Cullen spoke of Charles's "circumstances into which he had unluckily fallen," and of his gratitude to Blagden for referring him to Cavendish.¹⁹ Blagden replied that his son had been "totally unacquainted both with the book & the subjects in Mr. Cavendish's line of studies," but that Cavendish had not expressed "any dissatisfaction with your son's conduct, & more cannot yet be expected."²⁰ In November Charles Cullen wrote to Blagden that he was about to part from Cavendish.²¹ In a later undated letter to Blagden, he said that he "felt with much justice the force of the objection made to his deficiency in skill and acquaintance with books." He should have consulted with Blagden and with J.C. Dryander, Banks's Swedish botanist and librarian, "but the truth is the moving from Marlboro Street to Bedford Square had divided his attention from the object to which he

¹⁵Alex J. Philip (1912, 45–46). F.M.L. Thompson (1974, 20–22, 24–26). Stabling could be had in the village, and coach service into London was convenient, there being between fourteen and eighteen return trips a day. Thomas J. Barrett (1912, 1:279–280). "Hampstead Vestry. Poor Rate."

¹⁶Cavendish Mss Misc.

¹⁷Henry Cavendish, minutes of experiments on air, 15 and 16 Mar. 1782, Cavendish Mss II, 5:189.

¹⁸We assume that this Edward Nairne was the instrument maker of that name. 17 Dec. 1782 and 15 Jan. 1783, Charles Blagden Diary, Royal Society, 1. Henry Cavendish to John Michell, 27 May 1783, draft; in Jungnickel and McCormmach (1999, 267–269). Cavendish had help with observations taken from the Hampstead church steeple, or he helped someone, as the angles are written in another hand, 23 and 25 July 1783. The unclassified papers in Cavendish's scientific manuscripts contain a great many sheets of observations of bearings, with dates falling between 1770 and 1792.

¹⁹William Cullen to Charles Blagden, 8 May 1784, Blagden Letters, Royal Society, C.70.

²⁰Charles Blagden to William Cullen, 17 June 1784, draft, Blagden Letterbook, Yale.

²¹Charles Cullen to Charles Blagden, 7 Nov. 1784, Blagden Letters, Royal Society, C.62.

should have applied it and had sketched a plan to accomplish after the house was a little more settled."²² In this section, we look at that unsettling move.

In 1784 Cavendish leased his father's house on Great Marlborough Street and the premises on Marlborough Mews behind it. Joshua Brookes, who lived in the house, continued the local scientific tradition in a bizarre fashion. Holding a "Theater of Anatomy" there in 1786–98, he lectured and exhibited bodies of notorious criminals, and in the garden behind the house, where Charles and Henry Cavendish had measured the Earth and the atmosphere with their delicate instruments, Brookes built a vivarium out of huge rocks, where he chained wild beasts.²³

We do not know why Cavendish did not keep the house on Great Marlborough Street after his father died.²⁴ Perhaps the house he moved to on Bedford Square had better arrangements for the library he intended for it, or perhaps he preferred the location next to the British Museum, where he regularly attended meetings as a trustee. Bedford Square may have had an intrinsic attraction too as the first garden square in London to exhibit perfect uniformity and symmetry in its architecture, features which may have appealed to his mathematical side.

Exactly when he relocated can be clarified. The rate books for the house give the occupants: 1782–84 Dr. Tye, 1784–86 Hon. John Cavendish, and 1786—Hon. Henry Cavendish.²⁵ The second occupant, "Hon. John Cavendish" in 1784–86, would have been Henry Cavendish's first cousin the "Right Honourable," though commonly called "Lord," John Cavendish. However this identification is ruled out by the following exchange. In August 1785, John Cavendish wrote to Henry Cavendish, "The last time I came to Marlborough Street, & found your house so compleately shut up that I took it for granted you had quitted it." Henry Cavendish replied, "I am moved to the corner house of Be[dford] Sq[uare] & Gower street on the East side."²⁶ If Henry had bought the house from his cousin, his explanation would have been unnecessary. The rate books evidently were in error: John Cavendish is not among the occupants of the house. The original ninety-nine-year lease for the house in 1775 was to William Scott and Robert Grews, who in late 1783 leased it to the physician Dr. Michael Teighe for a period of eight years.²⁷ By an indenture between Dr. Teighe and Henry Cavendish, registered on 21 May 1784, Cavendish acquired the house, with an absolute purchase for £3250.²⁸ With this clarification, we see that he moved to Bed-

²²He asked for two or three months to remedy the defect, and if he failed he intended to resign. Charles Cullen to Charles Blagden, "Monday" [1784 or 1785], Blagden Letters, Royal Society, C.63. We assume that the following translation by Charles Cullen came out of his employment by Cavendish: Torbern Bergman, *A Chemical Analysis of Wolfram*, published in 1785. Cavendish was interested in wolfram, or tungsten.

²³"Henry Cavendish to Mr. Joshua Brookes. Counterpart Lease of a Messuage or Tenement with the Apperts No. in Marlborough Street in the Parish of St James Westminster County Middlesex," 1788, Devon. Coll., L/38/35. London County Council, (1963, 256).

 $^{^{24}}$ In his will, Charles Cavendish left his personal estate to Henry; he said nothing about his real estate. He named Henry as his sole executor. In Henry Cavendish, "List of Papers Classed," under "Mine," there is an entry "agreement about house in M.S.," no doubt "Marlborough Street," where his father's house was. We have not found that agreement. Charles Cavendish's will, signed 1 August 1756, probated 28 May 1783, Devon. Coll., Chatsworth, L/ 69/12.

²⁵London County Council (1914, 162).

²⁶John Cavendish to Henry Cavendish, 25 Aug. 1785. Henry Cavendish to John Cavendish, n.d., draft, Devon. Coll.

²⁷Bedford Estate Archive, NMR 16/21/3. We were misled by the rate books in the first edition of this book. Jungnickel and McCormmach (1999, 315).

²⁸Middlesex Deed Register, MDR/1784/2/353.

ford Square when he quit his house on Great Marlborough Street. Five or six months after Cavendish bought the house, Blagden, who was by then Cavendish's associate, moved to a house on Gower Street, just off Bedford Square, a few houses from Cavendish's.²⁹ At age fifty-two, while still a Londoner and still a solitary, Cavendish was less narrowly a Londoner, being at the point of removing his main home permanently to a country suburb, and less solitary, having taken on an associate. In addition, by giving up his father's house and acquiring a new house on Bedford Square, he stepped out of his father's shade, though we have no reason to think that this was a motive.

Bedford Square



Figure 11.5: No. 11 Bedford Square. Front view. This was Cavendish's townhouse from 1784 to the end of his life.

²⁹Charles Blagden to John Blagden Hale, n.d., draft, Blagden Letterbook, Yale. In this letter Blagden told his brother that he was moving to Gower St. at the end of next week. He said that he watched Blanchard's balloon on the day he wrote the letter, which dates it, 16 Oct. or 30 Nov. 1784.



Figure 11.6: No. 11 Bedford Square. Back of house. Photographs by the authors.

Bedford Square was relatively new when Cavendish moved there. Laid out in 1775–80, it was one of a number of squares built in the West End of London starting in the late seventeenth century. An early form of town planning, the squares imposed a degree of order on an otherwise sprawling metropolis. They came about as joint ventures between owners of large estates and builders, who were granted low-rent, long-term leases. According to a historian of eighteenth-century London, Bedford Square, which was built on the estate of the duke of Bedford, a relative of Henry Cavendish's, was "probably the most important of the planned aristocratic building ventures of the century."³⁰ The houses followed a specified design, lending the square a standard appearance from all approaches. They were three-story with

³⁰George Rudé (1971, 14).

basements and attics, terraced, and built of brick, with wrought-iron balconies to the firstfloor windows and entrance doors decorated by Coade stone with rounded fanlights above them. Each side of the square was a block of houses considered as a single unit, the center house set off by an ornamented stuccoed feature. Bounded by broad streets, the square was spacious, 520 by 320 feet between facing houses, with a large garden in the center for use of the residents.³¹

No. 11 Bedford Square, Cavendish's house, which today is used for offices by the nearby University of London, carries a bronze tablet donated by the duke of Bedford identifying it as having once belonged to the chemist. In style the house is the same as that of the blocks of houses, but it does not physically join them. It is an end-of-row house on the northeast corner of the square, on Gower Street, with its entrance on Montague Place (Figs. 11.5–11.6). The neighborhood has long since been densely built-up, but when Cavendish moved there, Gower Street quickly ran into the fields. Today Bedford Square is one of the best preserved garden squares in London.

After Cavendish's death, an appraiser wrote of the house, "I have scarce ever met with a more substantial or better built House, and the whole Edifice is finished with the best material." The floors of the two main stories were made of Norway oak, the staircase was made of Portland stone, and the dining and drawing rooms had carved marble chimney pieces.³² All three stories and the attic for servants had bowed windows in the back looking out over a deep garden leading to the stables and coach house. The house had the quality, elegance, and expense expected of a wealthy Cavendish.

What is unusual is the use Cavendish made of it, a library for his books, which he lent to qualified borrowers. To serve this purpose, he made extensive alterations. When the house on Bedford Square was evaluated for sale after his death, it was estimated that because of its long use as "Libraries, and Museums," it would need renovations costing one third of the value of the house to make it "fit for the residence of a family."³³ We can picture the interior as Cavendish left it from an inventory of the fixtures, furniture, plate, and other contents of the twenty-one rooms. Inside the entrance, a semi-octagonal bay opened onto a hall at the end of which was a staircase leading to the upper floors. Off the hall to the left was a library room, which appears to have been used as a dining room, and to the right was a bow-window dining room, which appears to have been used as a library room, off of which were two smaller bow-window sitting or dressing rooms used for the same purpose. The floor above, the principal floor, consisted of two large drawing rooms, front and back, and a small side bow-window sitting room. The drawing room with the bow window was not used for books, but the rest of the floor was. The next floor up, the two pair floor, consisted of two bedrooms to the front, and a bow-window bedroom and dressing room to the back. All four rooms on this floor, which included Cavendish's bedroom, contained books. Only the attic, which had two bedrooms, a bow-window nursery, and a dressing room for servants, was not used for books. Bookcases were built of handsome uprights, with plinths and cornices, and sliding shelves. There were around 700 sliding shelves all told in the house, the front drawing room on the principal floor holding the largest number, 268. Cavendish's investment in the books

³¹London County Council (1914, 150). Anon., "Bloomsbury Squares & Gardens. Bedford Square" (http://bloomsburysquares.wordpress.com/bedford-square).

³²"J. Willcock's Valuation of House & Stables in Bedford Square," 30 Dec. 1813, Devon. Coll.
³³Ibid.

that filled the shelves was enormous, valued at his death at $\pounds7000$. To put this in perspective, his house on Bedford Square sold for half that, $\pounds3530$.³⁴

The house contained various pieces of furniture, evidently of the same quality as the house, some relating to what readers and writers require. The front drawing room on the principal floor had a pair of low steps, a pair of high steps, and a step ladder for reaching high shelves. It also had a glass-topped table, a column-and-claw table, four cushioned banister back chairs, two side desks, two black Wedgwood inkstands, and a table clock. The library room on the ground floor had in addition to shelving ten banister back chairs, a glass-top table with fly leaves, a table desk, and a black inkstand. The two smaller rooms adjoining it, formerly sitting or dressing rooms, contained in addition to shelving a copying machine with double roller and apparatus by Watt & Co., a cupboard for maps, a bracket minute clock by John Skelton, a barometer, and a thermometer. The hall and staircase had a thermometer and an astronomical timepiece by George Graham. The back drawing room on the principal floor, which had no bookshelves, had twelve Japanned elbow chairs, two oval mahogany tables, one of which was a dining table, and silk-covered fire screens. The dining room on the ground floor, the other large room without bookshelves, contained three dining tables and ten banister back chairs. The interior of the house was unified by the use of the color green throughout: mahogany blinds lined with green transparent canvas, curtains of green moreen, green fire screens and chair back screens, and green chair covers. The furniture was mostly mahogany, the main exception being the sliding shelves, which were made with less expensive deal, or fir. A contemporary of Cavendish's said that the "sole furniture" of his house on Bedford Square was a library.³⁵ This was an exaggeration-two large rooms of the house were used for other purposes, as we have seen-but it gave the correct feel of the house. A visitor touring the house when Cavendish lived in it would have concluded that it was a house of knowledge. It would also have told him that its owner was a wealthy aristocrat who was proud of his family. It contained six paintings, one a landscape, the others all portraits of Cavendishes, one of an earl of Devonshire before there was a dukedom.³⁶

Library

From his father, Henry Cavendish inherited a good library, which he added to until the end of his life. For his work, a personal library was an asset, since scientific books and journals were not conveniently accessible. The British Museum owned and acquired scientific books, but its collection was inadequate for Cavendish's needs, and the library of the Royal Society was very defective in just those subjects that interested Cavendish, works in natural philosophy and mathematics, according to a library inspection in 1773.³⁷

Unlike the Cavendishes, most persons interested in science in the eighteenth century could not afford to buy or to subscribe to many scientific books and journals, relying instead

³⁷24 June 1773, Minutes of Council, Royal Society 6:177–178.

³⁴"6 Sept. 1810. Mr Paynes Valuation of Books £7000"; "29 April &c. 1814 Account Respecting the Sale of a Leasehold House at the North East Corner of Bedford Square," Devon. Coll.

³⁵John Barrow (1849, 148).

³⁶"Inventory of Sundry Fixtures, Household Furniture, Plate, Linen, the Property of the Late Henry Cavendish Esquire at His Late Residence in Bedford Square. Taken the 2nd Day of April 1810," Devon. Coll., 114/74. *The Particulars of a Capital Leasehold House, and Offices Situate at the North East Corner of Bedford Square.*. *Sold by Auction, by Mr. Willcock on Friday the Twenty-ninth of April, 1814,* Devon. Coll. There were in addition to the five family portraits in the house ten damaged ones in the lumber room over the stables.

on private libraries made available to them upon application to their owners. In England, large scientific libraries like Hans Sloane's and Joseph Banks's served the purpose of later public libraries, their owners treating their collections as a "public trust on behalf of learning."³⁸ In this spirit, Cavendish made available the library in his house on Bedford Square, performing a duty of public service as well as promoting science.

At an earlier time Cavendish may have kept his collection at another location. According to his biographer Wilson, he set apart for his library a "separate mansion in Dean Street, Soho."³⁹ The rate books for Dean Street contain no entries for Cavendish from 1783, the time for which we have record,⁴⁰ and we have found no other evidence of a Cavendish "mansion on Dean Street." We know for certain that sometime after he acquired his house on Bedford Square in 1784, he located his library there. John Barrow said that it was there, and we have ample other evidence including the inventory just mentioned.⁴¹

Despite Cavendish's reputation for clockwork routine, he was not particularly good at keeping order in his affairs and possessions. His books being described as in a "bad state of arrangement," it was suggested to Cavendish that he let a certain gentleman who was in need live in his house and organize them. It was this gentleman who began the catalog, a great, heavy volume now at Chatsworth. The entries are in more than one hand, none of them Cavendish's, indicating that the catalog was continued by another librarian after the first left. Cavendish did his part to maintain the order, signing the register for every book he borrowed to take to his other house at Clapham Common.⁴²

The first we hear of Cavendish's librarian is in 1785, the year after Cavendish moved to Bedford Square. He was almost certainly a German by the name of Heydinger, who that fall went to the Custom House to receive a chest of books sent by King's Packet to Cavendish from abroad.⁴³ We hear of him again two years later in a similar capacity, this time seeing to it that a new chemical journal from Germany reached Cavendish.⁴⁴ This librarian was useful to Cavendish in another way; Blagden wrote to Cavendish that he hoped that he had got Heydinger to read a letter in German for him.⁴⁵ Heydinger must have had scientific interests, since at least twice Cavendish brought him to the Royal Society as his guest.⁴⁶ Thomas Young said that after Cavendish's German librarian died, Cavendish himself devoted one day a week to checking out books.⁴⁷ How long he kept up this practice we do not know, but

³⁸Raymond Irwin (1958, 179).

³⁹Wilson (1851, 163), cites Cavendish's early biographers Cuvier and Biot on Cavendish's library. All that Biot says is that Cavendish located his library two leagues, or five English miles, from his residence so as not to be disturbed by readers consulting it. Five miles is roughly the distance from Clapham, the location of Cavendish's country house, to the center of London. Since neither Biot nor Cuvier mentions Dean Street, Wilson supplied this address from unknown sources. Georges Cuvier (1961, 237); J.B. Biot (1813, 273).

⁴⁰Dean Street entries turn up intermittently through the assessment of the poor rates; entries for the years 1783, 1785, 1790, 1795 contain no reference to Cavendish. From 1781 the rate books were split between the wards of King Square, West, and Leicester Fields, West. Westminster Record Office.

⁴¹Barrow (1849, 148).

⁴²Ibid. Cuvier (1961, 237).

⁴³Charles Blagden to Joseph Banks, 15 and 30 Sep. 1785, Banks Correspondence, Royal Botanic Gardens, Kew 1:204 and 207.

⁴⁴Charles Blagden to Lorenz Crell, 7 June 1787, draft, Blagden Letters, Royal Society 7:60.

⁴⁵Charles Blagden to Henry Cavendish, 23 Sep. 1787, in Jungnickel and McCormmach (1999, 641–644). Cavendish read printed German but clearly not German script.

⁴⁶17 Apr. 1788 and 24 Dec. 1789, JB, Royal Society 33.

⁴⁷Thomas Young (1816–1824, 435–447, on 445).

when he died he had a librarian who received a small salary, and it was probably he who dealt with the borrowers.⁴⁸

To a prospective user of the library, Blagden explained the official policy: "Wishing to promote science by every measure in his power," Cavendish made his library accessible "at all seasons of the year." Blagden made clear that what was accessible was the library and not its owner: Cavendish did not want people even to sit in his library but to "borrow such books as they wish & take them home for a limited time."⁴⁹ Ordinarily it was the librarian and not Cavendish who met the public, but this arrangement did not entirely guard his privacy. The journalist Pahin de la Blancherie complained directly to Cavendish about the treatment he received from his librarian. Having requested a history of astronomy, he was told that Cavendish had just taken that book to Clapham Common. When he then asked for a biographical dictionary, the librarian told him that Cavendish had taken it too. The librarian told him to come back, and when he did, the librarian told him that Cavendish still had the books and moreover had great need for them. Having been thwarted at the British Museum and now at Cavendish's library, La Blancherie thought that the British nation owed him damages. He said he knew that Cavendish would not authorize this conduct by his librarian but would condemn it,⁵⁰ but we are inclined to think otherwise.⁵¹

One of Cavendish's librarians was the beneficiary of a remarkable instance of Cavendish's largess. This librarian lived in Cavendish's house until he left his employment and moved to the country. Some while later Cavendish was told that the man was in poor health. Cavendish was sorry to hear it, and when it was suggested that he might help him out with an annuity, he said, "Well, well, a check for ten thousand pounds, would that do?"⁵²

A few years after Cavendish's death, the sixth duke of Devonshire assembled the magnificent Chatsworth library from his own collections and from Cavendish's library, which had been given to him by Cavendish's heir, Lord George Cavendish.⁵³ With the possible exception of about 450 books in their original paper covers⁵⁴ and some books at Holker Hall, Henry Cavendish's library today is bound in leather and dispersed among the other books at Chatsworth, shelved in the beautiful old Long Gallery. Constituting about one quarter of the ducal library, his books are identified both by his book stamp, a simple *Henry Cavendish*, and by his separate catalog number.

The catalog of Cavendish's library is incomplete, extending only to the early 1790s, and because he continued to buy books after that time, we can speak more accurately of the contents of his catalog than of his library. Books in Latin and books in English appear in roughly equal proportions in the catalog, each accounting for about one third of the total, with

⁴⁸"Collingwood, the Librarian, One Years Salary Due Xtmas 1811" in "29th May 1812. Taxes &c. for House in Bedford Square," Devon. Coll.

⁴⁹Charles Blagden to Thomas Beddoes, 12 Mar. 1788, draft, Blagden Letters, Royal Society 7:129.

⁵⁰Pahin de la Blancherie to Henry Cavendish, 23 Sep. 1794; in Jungnickel and McCormmach (1999, 697–698).

⁵¹La Blancherie having found that where he was living Newton once had lived tried to capitalize on it. Three years before he complained to Cavendish, he published a grandiose plan for honoring Newton. Cavendish probably did not like it. There was also a question of his methods of journalism. Blagden believed that he was a victim of the "worst kind of indiscretion" on La Blancherie's part. Charles Blagden to La Blancherie, 21 May and 23 Aug. 1785, drafts, Blagden Letterbook, Yale.

 $^{^{52}}$ Wilson (1851, 174). The librarian was probably not the German. Thomas Young said that after the German librarian died, Cavendish himself checked out the books, and if that is correct the German librarian did not leave to live in the country.

 ⁵³Historical Notice by J.P. Lacaita, July 1879, *Catalog of the Library at Chatsworth*, 4 vols. (London, 1879) 1:xvii.
 ⁵⁴Listed as "Cavendish Tract. Draft Catalog 1966."

books in French coming next, and then, in sharply reduce proportions, books in German and in other European languages. The catalog lists about 9000 titles, representing some 12,000 volumes,⁵⁵ showing that Cavendish had a large library, but not an immense one for the time. Sloane's library, the foundation of the library of the British Museum, was four times as large, and even Cavendish's seafaring friend Alexander Dalrymple had a larger library.⁵⁶ A number of Cavendish's colleagues had substantial libraries, though much smaller than his. Nevil Maskelyne's in 1811 contained 757 "lots," the term used in auction catalogs; John Playfair's in 1820, 1421 lots; Charles Hutton's in 1816, 1854 lots. Large libraries belonging to professional persons tended to be libraries of physicians with an interest in science; William Cullen's contained 3010 lots.⁵⁷

Cavendish's library was open to the qualified public, but its contents were not selected with the public in mind. The largest category in the catalog was natural philosophy, with nearly 2000 titles.⁵⁸ In this same category were many books on medicine, anatomy, and animal economy, very few of which were published after Charles Cavendish died. Mathematics, the second largest category, included in addition to books on pure mathematics, books on natural philosophy in which mathematics was used, such as Newton's Principia and Opticks and Robert Smith's System of Opticks. Astronomy was a category of its own and well represented, including classic works of science by Copernicus, Brahe, Kepler, and others. In the natural history of life, Cavendish had only slight interest, but he was interested in other parts of natural history, buying many books on mineralogy and geology. He took an interest in books on voyages and travels, which related to his scientific work. About half of the books in the catalog were scientific. The category of poetry and plays was as large as that of mathematics, some 1100 volumes, including works by Shakespeare, Dryden, Congreve, Pope, Swift, Gray, and other authors one would expect to find in a literary library. After Charles's death, when Henry alone added to the library, there were no more books of poetry or plays, with the exception of an Indian drama.⁵⁹ Henry had a passing interest in history and antiquities, which were separate headings in the catalog, with several titles having to do with India. His catalog had no division for histories of individual lives, or biographies, though he bought The Life of Samuel Johnson. Its author James Boswell was a guest at dinners of the Royal Society Club at which Cavendish attended,⁶⁰ and Cavendish may have met or seen Johnson, who frequented the Crown & Anchor, where the Royal Society Club met. His catalog had no division for moral philosophy, though he bought Adam Smith's

⁵⁵R.A. Harvey (1980, 284).

⁵⁶Part I of the catalog of Dalrymple's library contains 7190 entries. Part II, containing books on navigation and travel, his specialty, might be even longer. A Catalog of the Extensive and Valuable Library of Books; Part I. Late the Property of Alex. Dalrymple, Esq. F.R.S. (Deceased). Hydrographer to the Board of Admiralty, and the Hon. East India Company, Which Will Be Sold by Auction, by Messrs. King & Lochée ... On Monday, May 29, 1809, and Twenty-three Following Days, at Twelve O' Clock (London, 1809).

⁵⁷Ellen B. Wells (1983, 338, 354, 362, 370).

⁵⁸Harvey (1980) has tallied books in Cavendish's catalog by subject according to whether they were published before or after 1752, the year Henry finished his university education. The results are not very meaningful in the way they are intended. A more useful division for distinguishing Henry Cavendish's interest from his father's is 1783, when Lord Charles Cavendish died.

⁵⁹Cálidás, Sacontula, or the Fatal Ring, an Indian Drama (London, 1790). Not entered in the catalog, because it was too late, under poetry and plays but found in the Chatsworth library, with Henry Cavendish's stamp, is the related work, *The Loves of Cámarúpa and Cámalutà, an Ancient Indian Tale*, trans. W. Franklin (London, 1793).

⁶⁰Boswell's Life is listed under "History" in Cavendish's catalog. Boswell dined at the Royal Society Club twice in 1772, both times with Cavendish in attendance. Archibald Geikie (1917, 118).

Theory of Moral Sentiments. We note that his catalog began with astronomy, mathematics, and natural philosophy, subjects which came first in his life.

Often libraries are revealing through their owners' marginalia. It seems that Cavendish rarely put a mark in a book; in the third edition of Newton's *Principia*, he (or someone) penciled in a few numbers, and in a speculative treatise on attracting and repelling powers by Gowin Knight, he (or someone) made a couple of penciled notations.⁶¹ Cavendish's library holds few surprises. It is confirming, not revealing; it tells us that he was interested in the physical sciences and mathematics and not in literature and languages.

Clapham Common

In his scientific calling, Cavendish followed his father, and as an aristocrat who owned houses he again followed his father. As we know, when Charles Cavendish married, he bought a country estate, and if his wife had lived, we might expect him to have continued the familiar living arrangement of a gentleman, having two homes, one in the city and one in the country. Instead, five years after she died, he sold it and bought a townhouse on Great Marlborough Street, so far as we know living the rest of his long life without keeping a second home in the country. His activities were in the city, and he may have felt that as a single man he had no need for a second home, and there may have financial considerations. His oldest son, Henry, also had two homes, his second one coming late in life. Father and son held to patterns of living fairly common among men of their station and means.

In 1785, Cavendish bought a country house on Clapham Common, which would be his main house to the end of his life. Clapham at the time was a straggling village of handsome homes lying in the Clapham parish, about four miles distant from Westminster Bridge in London. When Cavendish arrived, the village had a population of around 2500 and the parish was growing. The best view of the village was from Clapham Common, a triangular piece of ground consisting of 202 acres with houses around its perimeter, lying partly in Clapham parish and partly in a neighboring parish. Twenty-five years before Cavendish moved there, the Common was a morass and the roads were impassable. Chiefly through the efforts of the resident and justice of the peace Christopher Baldwin, the Common was drained and planted with a large number of native and exotic trees, giving it the look of a park. As evidence of the improvement, Daniel Lysons, in his Environs of London published in 1792, said that a few years earlier Baldwin had sold fourteen acres of land near his house for ± 5000 , or ± 357 per acre.⁶² The buyer, whose name Lysons did not mention, was Cavendish. Property continued to increase in value; in 1810, the year Cavendish died, Robert Thornton sold his land for £500 per acre.⁶³ Clapham Common contained many country seats for wellto-do merchants, gentry, and members of Parliament. Cavendish and a woman referred to as "Lady" were the only aristocrats.⁶⁴

⁶¹Gowin Knight (1748, 11–12).

⁶²Daniel Lysons (1795, 159–161). In the legal documents, the land Cavendish bought is said to be fifteen acres, not fourteen (it is in between). Historically, Clapham Common was common land for two parishes, Clapham and Battersea. Anon., "Clapham Common" (http://en.wikipedia.org/wiki/Clapham_Common).
⁶³T.C. Dale (1927, 1).

⁶⁴Map of Clapham Common, with names of all of the residents. "Perambulation of Clapham Common, in 1800. From C. Smith's 'Actual Survey on the Road from London to Brighthelmston," in J.H. Michael Burgess (1929, 112). Reproduced by permission of the Bodleian Library.

We first hear of Cavendish's interest in Clapham Common from letters that passed between him and Baldwin beginning in the spring of 1784. Both were members of the Monday Club, which may be where Cavendish learned about the property.⁶⁵ The two men met to discuss it, and at the close of a letter following their meeting, Baldwin wrote, "I wish among your other learned & very curious investigations in our atmosphere, you would tell me when I may safely begin hay-making, since you are interested in the attempt."⁶⁶ All business, Cavendish paid no attention to pleasantries and flatteries like this, beside which he knew better than to predict the weather.

Baldwin understood that Cavendish wanted to buy three contiguous parcels of land consisting of about fifteen acres adjacent to his house for the purpose of building a house on it. When he was first approached by Cavendish, he said that he was not interested, and he suggested other owners who might sell him land. When difficulties arose with another property, Wright's farm, Cavendish's agent Thomas Hanscomb returned to Baldwin.⁶⁷ Baldwin asked Cavendish to tell him what he would pay for the land. When Cavendish said £5000, Baldwin said that it did not meet what he called the "market price." Two of the three parcels of land were choice; the remaining "front land" on the Common could not be valued by the acre any more than could land in London or Westminster. Pointing out the beauty, the health, and the convenience of the parcels, Baldwin said that Cavendish should come look at them himself "before it's too late." Baldwin calculated the value for the three parcels separately, the total coming to £5650, which he said was ± 1280 below the market value. To come up with "a few hundreds more" ought to be no consideration, he said, for "a gentleman of your high rank & well-known great opulence," but Cavendish refused to bargain, and in due course Baldwin accepted his offer.⁶⁸ Mortgages on the fifteen acres caused delays in closing the sale until the winter of 1784. The purchase was absolute, the parcels belonging to Cavendish and his heirs and assigns forever. Cavendish named his closest scientific colleagues in London, Blagden, Dalrymple, and Aubert, as trustees to protect the inheritance. Ultimately the money that Cavendish paid Baldwin came from other Cavendishes, and like everything he owned, the Clapham Common property would one day be returned to other Cavendishes.69

As it turned out Cavendish did not build a house for himself on the fifteen acres. Instead he entered into an agreement with builders Hanscomb, Richard Fothergill, and Thomas Poynder, who were bound to spend a specified minimum amount of money within a specified time to erect substantial houses with coach houses and stabling. When the buildings were completed, Cavendish would join with them in granting separate leases for the houses, with covenants prohibiting the building of brick kilns or using any buildings on the property

⁶⁵Verner W. Crane (1966, 215).

⁶⁶Christopher Baldwin to Henry Cavendish, 15 June 1784, Devon. Coll., 86/comp. 1.

⁶⁷Christopher Baldwin to Henry Cavendish, 3 May 1784, ibid.

⁶⁸Henry Cavendish to Christopher Baldwin, n.d. [After 3 May and 2 June 1784], drafts; Christopher Baldwin to Henry Cavendish, 2 and 7 June, 3 July 1784, ibid.

⁶⁹The history of Cavendish's Clapham Common estate is told in a bulky document at Chatsworth, a title search in 1827, beginning with the bargain of sale between Baldwin and Cavendish on 2 November 1784. When Henry Cavendish died, his Clapham Common estate was left to his brother Frederick. When Frederick died two years later his will, which was unchanged, left his real property to Henry. In 1827, Frederick's heir at law William Spencer Cavendish, 6th duke of Devonshire sold the estate. "Abstract of the Title of His Grace the Duke of Devonshire to an Estate at Clapham Common in the County of Surrey," Devon. Coll. 38/78.

as public houses or shops "for carrying on any noisome or offensive trade or business."⁷⁰ The land was to be used for up-scale residences, insuring a proper tone. Cavendish arrived at Clapham Common as an eventual land developer and landlord.



Figure 11.7: Map of Cavendish's Land on Clapham Common . C1, C2, and C3 are three parcels of land, totaling roughly fifteen acres, which Cavendish bought from Christopher Baldwin in 1784. C4 is a slip of land Cavendish bought from Baldwin later. B1 is Baldwin's house and garden. B2, B3, and B4 are fields owned by Baldwin. "Abstract of the Title of His Grace the Duke of Devonshire to an Estate at Clapham Common in the County of Surrey," 2 November 1784, Devonshire Collections, Chatsworth, 38/78.

⁷⁰"Statement of Leases by the Honourable Henry Cavendish of Messuages and Lands at Clapham in Surrey," 1795– 1805, Devon. Coll., 34/10. "Henry Cavendish Esquire and Messrs Hanscomb, Fothergill and Poynder. Articles of Agreement for a Building Lease," 1791, ibid., L/31/45. "Abstract of the Title of His Grace the Duke of Devonshire to the Estate at Clapham Common in the County of Surrey, "ibid., L/38/78. The builders each paid £200 per year rent to Cavendish.

It is unclear exactly what Cavendish's plans were for relocating on Clapham Common. As early as May 1784, at the time he began negotiating with Baldwin over the fifteen acres, presumably to build a house on, he considered buying an existing house, "Mr. Mount's house," which was probably "Mrs Mount's house" on property adjacent to the house that Cavendish bought the following year.⁷¹ What is certain is that his mind was set on moving to Clapham Common, which was not as smokey as London, an advantage when making astronomical observations, and it was healthier, as Baldwin claimed. His house would be a villa, with spacious grounds in a pastoral setting with fine trees, pastures, and ponds, again as Baldwin said. In addition to the peace and quiet of the place and to the privacy it offered, it was also convenient: Baldwin explained that there were good roads, which enabled inhabitants of Clapham Common to travel to London, cross over London Bridge, do business in the city, and return by way of Westminster Bridge, which was no further away from home.⁷²

In June 1785, Cavendish bought a house on another side of the Common from his fifteen acres. Perhaps the house became available only after he bought the land from Baldwin. Perhaps its readiness appealed to him, for by buying an existing house he did not have to wait, and he avoided the aggravation of building, allowing him to return to his researches with a minimum of interruptions. It is also possible that Cavendish intended from the start to develop the fifteen acres rather than to build a house for himself there, though it is unclear why he would want to.⁷³

His house was three-story, double-fronted, and "symmetrically planned and with a central doorway of typical Georgian design," with considerable grounds.⁷⁴ From a plan of the Common in 1800, it appears that with one exception, Cavendish's property occupied the largest frontage of the sixty-odd residences (Fig. 11.12). The lease tells the history of ownership of the house: "Assignment of lease. 18 June 1785. 1. William Robertson of George Yard. Tower Hill, merchant. 2. Henry Cavendish of Bedford Square Esq. Premises on Clapham, for residue of a term of 29 years granted on the experation of a lease of 22 March 1750 made between William Bridges and Henton Brown. Recitals of subsequent assignment. Consideration £3000."75 Henton Brown is thought to be the first owner of the house, perhaps its builder. We know he lived there by 1748, for that year he requested leave of the vestry to fence a pond he had built on the Common opposite his house, where he kept a pleasure boat. This was Mount Pond, probably at first a gravel pit for road making, the water surrounding an existing mound, to which excavated earth was added, making it higher and improving the view. It was a fashion at this time at Clapham to build summerhouses on viewing mounds, and Brown built one in the pagoda style on top of the Mount to entertain his guests. Brown, an owner of a bank in London, died in 1775, and his bank failed a few

⁷¹Henry Cavendish to Christopher Baldwin, n.d. [After 3 May 1784], draft, Devon. Coll., 86/comp 1. Mrs. Mount's house is referred to in Henry Cavendish, "Plan of Drains at Clapham & Measures Relating to Bason," Cavendish Mss Misc.

⁷²Baldwin to Cavendish, 3 May 1784.

⁷³In favor of this alternative might be his interest in buying Mount's house while he was negotiating with Baldwin about buying the fifteen acres. Also Thomas Hanscomb who dealt with Baldwin as Cavendish's agent would build houses for Cavendish on the fifteen acres.

⁷⁴Clapham Antiquarian Society, "Cavendish House," *Occasional Sheet*, Aug. 1757. Eric E.F. Smith (1976, 78). Burgess (1929, 60). According to the land tax record for 1793, Cavendish owned ten acres. Clapham "Land Tax Assessment for Land Alone June 1793," Lambeth Archives.

⁷⁵Surrey Deeds (Index), Lambeth Archives, 14.171.

years after.⁷⁶ A second person named in the lease, William Bridges, was the freeholder or head lessee, who sublet the property to Brown. A third person was a merchant in Surrey, William Robertson, who probably acquired a lease for the property after Brown. In June 1785, he sold his interest in the house to Cavendish for £3000. We see from the document that Cavendish did not buy the house freehold but instead bought a lease for twenty years or so.⁷⁷

Cavendish's house has been called a mansion, but a better description of it from the time is "a tolerable good house, built with red brick."⁷⁸ Later owners of the house greatly changed the appearance of the house inside and out, making it difficult to get an idea of the original layout, the number and uses of the rooms, and other details.⁷⁹ It was made into a structure that could be called a mansion: among the additions were a magnificent reception room, another servants' wing, a terrace along the garden frontage, and an extension for hanging paintings. At some point, the original red brick central block, the house as Cavendish knew it, was stuccoed over. In 1880, the house was described by an auctioneer as containing "an elegant drawing room, noble dining room, handsome library, morning room and billiard room, a large conservatory, and seventeen bedrooms," and the park-like grounds were similarly sumptuous. Cavendish would have been hard-pressed to recognize the sensible building he made into a house of science in 1785. In 1905, the estate was sold and the house was torn down, replaced by rows of red brick villas.⁸⁰ Cavendish Road, originally Dragmire Lane, memorializes the place where Cavendish's house once stood.

We know some of the alterations Cavendish made to the house: from an instrument maker who saw the house, we learn that he converted the drawing room into a laboratory, the room next to it into a forge, and upstairs rooms into an astronomical observatory. A tree behind the house was used as a platform for making scientific observations,⁸¹ and soon

⁸⁰Smith (1976, 78).

81 Wilson (1851, 164).

⁷⁶Before Cavendish's arrival on the Common, a scientific experiment had been performed on Mount Pond by Cavendish's colleague in electricity Benjamin Franklin, who was at the time staying with Christopher Baldwin. Brown's will is in the National Archives, PROB 11/1011/362. Clapham Antiquarian Society, "Cavendish House." Michael Green, "Mount Pond, Clapham Common: Archaeology and History," The Clapham Society Local History Series 7 (http://www.claphamsociety.com/Articles/article7.html).

⁷⁷ In our biography *Cavendish* (1999), we said that Cavendish rented his house on Clapham Common. We correct ourselves here: Cavendish bought a lease for the house. I am grateful to Colin Thom for clarifying the purchase.
⁷⁸ James Edwards, *Companion from London to Brighthelmston* (London, c.1790), 11. Burgess (1929, 57).

⁷⁹There is a document at Chatsworth that we originally thought applied to the house Cavendish bought at Clapham Common, which if so would give us an idea of the number of rooms in the house and their description. Jungnickel and McCormmach (1999, 326). The inventory is a room-by-room list of bookcases, curtains, stoves, and other fixtures, which were to be valued to the person who bought the estate. Mr. and Mrs. E. Collinson had lived in the house, and the fixtures belonged to Mr. Collinson and Mr. Tritton of Clapham. The name Tritton suggests a connection to Cavendish's house: Anna Maria Brown, daughter of Henton Brown, thought to be the first owner of Cavendish's house, married Thomas Tritton (1717–86); she lived on Clapham Common. The year of the inventory was 1732. In pencil, Cavendish located each room in the house: "west wing back," etc. This inventory is pinned to another inventory of fixtures Cavendish bought from the seller of his house on Clapham Common, William Robertson. The items in the two inventories are different. The earlier inventory was of fixtures in another large house at Clapham, not of the one Cavendish bought, as we first supposed. There is no explanation why Cavendish annotated the inventory and why he kept it with papers about purchases for his house. The puzzling document is "An Inventory of Fixtures Belonging to Messr Collinson and Tritton of Clapham in Surrey to be Valued to the Purchaser of the Estate May 13th, 1732." It is pinned to "An Inventory of Fixtures in the House Purchased by Mr.Cavendish of Mr Robertson." A related document is "Sundry Drawing Room Furniture of Wm. Robertson's Esqr Appraised to Cavendish Esqr. 11th June 1785." The general heading is "About Purchase of House & Furn. at Clapham." Devon. Coll., 86/comp. 1. "Anna Maria Brown," "The Peerage."

after Cavendish arrived, he erected an eighty-foot-tall ship's mast, with a horizontal arm, for mounting an aerial telescope.⁸² (Figs. 11.8–11.13). This most conspicuous feature of Cavendish's property would have told the neighbors, if they did not already know, that the new resident on the Common was different. He acquired a local reputation as a wizard.

In the middle years of the decade, the 1780s, Cavendish was kept busy moving from one house to another. He explained to Joseph Priestley that a reason he was so long in replying to a letter was that he had been prevented from making any experiments during the summer by "the trouble of removing my house."⁸³ The move to Clapham was particularly disruptive of his regular life. In June 1785, he postponed the beginning of a journey with Blagden to Wales by three weeks because of repairs to his new house on Clapham Common.⁸⁴ In September of that year, Blagden wrote to John Michell, who had invited him and Cavendish to visit him in Yorkshire, that Cavendish "cannot spare time for another journey this year, as it will give him full employment till winter to bring his new country-house of Clapham into order. He is but just removed thither: & all of his pursuits are interrupted till his books, instruments can be brought out of the confusion in which they lie at present."⁸⁵ Two months later, Blagden wrote to Laplace that "Mr.Cavendish will not soon have another paper ready, his apparatus having been deranged by moving to another house."⁸⁶ Given Cavendish's attachment to scientific activity, his desire to move had to be strong to accept this extended interruption.

In his letter to Laplace, Blagden said that Cavendish would have "conveniences for carrying on his experiments to still greater perfection" in his new house.⁸⁷ That may have been, but Cavendish's most important work was done in his first twenty-five years, when he lived behind his father's house in town. If we think of Cavendish's active career as spanning fifty years, 1760 to his death in 1810, his move to Clapham, falls exactly in the middle. Cavendish filled the last twenty-five years of his life at Clapham, as he had the first in the city, with scientific activity, but with the important exception of his experiment of weighing the world it did not make a notable difference to science.

Cavendish sometimes stayed at his house on Bedford Square, and he kept appointments there, but his needs were less than they were at his country house. He employed seven servants at Clapham Common, and an eighth if an instrument maker is counted.⁸⁸ He employed only three at Bedford Square, and a fourth if the librarian is counted. His two houses supported the two main activities of his life, reading and research. Complementing one another, his Bedford Square house was about scientific knowledge as recorded in publications, and his Clapham Common house was about scientific knowledge in progress. Cavendish kept his books at Bedford Square and his instruments at Clapham Common, and although the division was not absolute, at the end of his life the value placed on his instruments at Clapham Common was £545 and at Bedford Square nothing.⁸⁹

⁸² Edwards, Companion, 11.

⁸³Henry Cavendish to Joseph Priestley, 20 Dec. 1784, draft, in Jungnickel and McCormmach (1999, 598–599). In 1784, Cavendish would have been moving into his new house on Bedford Square.

⁸⁴Charles Blagden to William Lewis, 20 June 1785, draft, Blagden Letter book, Yale.

⁸⁵Charles Blagden to John Michell, 13 Sep. 1785, draft; in Russell McCormmach (2012, 399).

⁸⁶Charles Blagden to Pierre Simon Laplace, 16 Nov. 1785, draft, Blagden Letters, Royal Society 7:733.
⁸⁷Ibid.

⁸⁸In the executor's accounts, the instrument maker William Harrison is listed with the servants, but in Cavendish's will he is mentioned separately from the servants. Copy of the will, Devon. Coll., L/31/65.

^{89&}quot;Extracts from Valuation of Furniture," Devon. Coll.

Other comparisons of Cavendish's two houses reinforce our picture of his life. The value of the furniture in each house was essentially the same, £645 at Clapham Common and £633 at Bedford Square, but his plate, China, and linen at Bedford Square were valued at \pounds 700, and at Clapham Common £168.

Clapham Common



Figure 11.8: Cavendish's House on Clapham Common. Demolished. This was Cavendish's country house from 1785 to the end of his life. We see the back of the house, much altered since Cavendish lived there. Frontispiece to *The Scientific Papers of the Honourable Henry Cavendish* (1921g). All rights reserved: Cambridge University press. Reprinted with the permission of Cambridge University Press.



Figure 11.9: View of Clapham Village from the Common. William Thornton (1784, 490).



Figure 11.10: Plan of Drains at Cavendish's House. Cavendish's house faces Clapham Common at the bottom of the diagram. The separate building to the right is evidently a greenhouse, formerly containing an outhouse, which Cavendish refers to in his notes on experiments on air. To the left is a basin that becomes a pond, 71/2 feet deep, into which the drains from H and K run, and which is filled from the pipe EF, which probably comes from the pond across the road in the Common. G is the valve for letting water into the pond. The other letters stand for: A, a drain sink; B, the gate to the kitchen garden; BC, a drain running from Mrs. Mount's house to the right of what Cavendish has labeled Mrs. Mount's wall; D, a well formerly supplying the pantry or dairy. Water from A eventually runs into a ditch in the field behind the house, and from there it is conducted to the "lane," presumably Dragmire Lane, which bounds Cavendish's property. Next to the pond is a sundial, which Cavendish used as a marker in taking measurements of the basin. Cavendish refers to his walled "courtvard," but he does not indicate its location. This diagram was probably drawn up in connection with renovations Cavendish made before moving into the house in 1785. Cavendish Mss, Misc. Reproduced by permission of the Chatsworth Settlement Trustees.



Figure 11.11: Mast for Aerial Telescope. The drawings accompany computations for an eighty-foot-high mast for mounting the Huygens lenses belonging to the Royal Society. Cavendish erected the mast on his grounds at Clapham Common. Cavendish Mss, Misc. Reproduced by permission of the Chatsworth Settlement Trustees.



Figure 11.12: Map of Clapham Common. Cavendish's house is on the left side of the Common, fourth from the top. "Perambulation of Clapham Common 1800. From C. Smith's 'Actual Survey of the Road from London to Brighthelmston." Burgess (1929, opposite 112). Reproduced by permission of the Bodleian Library.



Figure 11.13: Triangulations around London. Triangles measured by the British surveyors showing their starting point, the baseline of 1783 on Hounslow Heath. The purpose of laying down secondary triangles was to improve plans of London and maps of the country. Cavendish's observatory at Clapham Common, shown at the bottom of the map, is one of the stations. Roy's observatory on Argyll Street is shown, as are Aubert's observatories at Highbury House and at Loampit Hill. Greenwich Observatory is just to the right of Loampit Hill, off the map. Detail from a map by Roy, appended to "An Account of the Trigonometrical Operation" (1790).

He kept his small wardrobe and his carriage and harness at Clapham Common, his pictures and wine (twenty-two bottles of port, tokay, and white wine, and ten dozen empty bottles) at Bedford Square.⁹⁰

A map of the places Cavendish could call home reveals a paramount fact about him: he was a city man. When he lived outside of London as an adult, he was no further away than a suburb, probably within sight of the spires of the city. He owned properties in the countryside, but he had no thought of living there. London offered him the civilized amenities and learned company he needed for his chosen way of life. (Figs. 11.14–11.15).



Figure 11.14: Places Where Henry Cavendish Lived. All of the places on this map are mentioned in the book. It shows that although Henry Cavendish did not always live in London, London was never far away.

Land Developer

Cavendish had further business to settle on Clapham Common. Baldwin owned a small piece of land, about one half acre, lying between the fifteen acres he had sold to Cavendish and Balam Lane, and extending partway onto the lane, which Cavendish wanted to buy to complete his property. Baldwin had incurred legal expenses in connection with it, for which he asked Cavendish to reimburse him, the bill coming to £60. Cavendish offered him £40. Baldwin claimed that he was actually out £124, but Cavendish's lawyer Thomas Dunn told him that Cavendish would file a bill in Chancery against him if he would not take £40. Since Baldwin would then have to file an action against Cavendish to try to recover the rest of his expenses, he could not believe that Cavendish wanted to "go through all this" for a "slip of land." Dunn told Cavendish, "I hope I shall never have any business to transact with such another man as long as I live."⁹¹

The dispute over the £40 was not yet settled when another problem arose. Dunn had heard that the people of Clapham planned to pull down all of the fencing on the Common and that Baldwin knew about it, in which event Cavendish "must not give him a farthing for the piece of ground," since it encroached on the Common. Learning of this objection, Baldwin wrote to Cavendish, "In my whole life I never was so heartily tired of any thing as I am of the un-meaning correspondence into which I have been drawn by you and your attorney... I am buried in the letters founded in error and ignorance." Baldwin was not going to accept £40, and it was not true that the people of Clapham were going to pull down the fences. It was true, Cavendish told Baldwin; moreover, he was informed that the people of the neighboring parish of Battersea planned to tear down the fences on their common unless the owners paid them a "composition." Cavendish said that he was "so confident" of his information that he was no longer prepared to pay Baldwin the £40, but only £40 less the composition. Baldwin warned Cavendish not to stir up the people of Clapham by spreading the idea of tearing down the fences. Cavendish replied that if Baldwin did not accept his offer, £40 less composition, and make over the rights of the property in two or three days, he would take it as refusal and act accordingly.⁹²

Cavendish asked for a "direct answer," but Baldwin's answer was anything but direct. He asked about Cavendish's intention to build a fence between their properties. Even before Cavendish bought the fifteen acres from him, Baldwin had sent him "Hints for Consideration," advising him about building fences.⁹³ Later Baldwin told Cavendish that his fences were ruined, allowing cattle to enter Baldwin's garden from Cavendish's fields. Baldwin ordered Cavendish immediately to procure the oak pailing for the fence between their properties. The fence, Cavendish replied, "would have been put up long before now if I had not waited till the dispute about the ground taken in from the common was settled." He told Baldwin that he would observe his agreement about the fence "but will not be prescribed to about it nor bear your delays or cavils."⁹⁴ He told Baldwin to come to Dunn's on Wednesday

⁹¹Christopher Baldwin to Henry Cavendish, 7 July, 19 Sep. 1785; Henry Cavendish to Christopher Baldwin, [July 1785], draft; Thomas Dunn to Henry Cavendish, 6 Sep. 1785, Devon. Coll., 86/comp. 1.

⁹²Thomas Dunn to Henry Cavendish, 6 Feb. 1786; Christopher Baldwin to Henry Cavendish, 22 and 27 Feb. 1786; Henry Cavendish to Christopher Baldwin, n.d. [After 22 Feb. 1786], draft, and n.d. [after 27 Feb. 1786], draft, ibid.
⁹³Christopher Baldwin to Henry Cavendish, Midsummer's Day, 1784, ibid.

⁹⁴Christopher Baldwin to Henry Cavendish, 8 Feb. [1786]; Henry Cavendish to Christopher Baldwin, n.d. [on or after 8 Feb. 1786], draft, ibid.



Figure 11.15: Map of Cavendish's London (West End). His familiar destinations in London are identified by numbers superposed on Plan of London, with Its Modern Improvements, published by Richard Phillips in 1808 or 1809.

- 1. Royal Institution.
- 2. Great Marlborough Street house.
- 3. Sir Joseph Bank's house.
- 4. Bedford Square house.
- 5. British Museum.
- 6. Royal Society.
- 7. Crown & Anchor.



Figure 11.16: Map of Cavendish's London (East End). 8. Edward Nairne's instrument shop.

- 9. George & Vulture.

or Thursday, where he would be waiting to execute the deed. If he did not come Cavendish would give him nothing for the land. Baldwin wrote back asking Cavendish what he meant by saying that he would observe his agreement about the fence. The correspondence between Cavendish and Baldwin came to an end with a flurry of letters, four of them passing between them on one day, the first Saturday in May 1786. Cavendish wrote: "I can not at all conceive what is the cause of this behavior whether you have any private reason for wishing to delay the agreement or whether you distrust my honour about the pailing & wish to make some further conditions about it. If the latter is the true cause you may assure yourself that I will never submit to make any such conditions or explanation with a person who distrusts my honour."⁹⁵ A few days later the papers were signed conveying the property to Cavendish.⁹⁶ Cavendish's business with Baldwin had taken nearly two years.

Both in the original sale of fifteen acres and in the consequent disagreements over the slip of land, Baldwin misjudged Cavendish. Baldwin thought that money was the issue, and for him no doubt it was, given his large debts. To Cavendish, the matter of Baldwin's legal expenses, £60 or £40 or £40 less composition, was one not of money but of principle. Baldwin's worst error of judgment was to question the honor of Cavendish.

Man of Property

Charles Cavendish owned farms and tithes in Nottinghamshire and Derbyshire, which were his for life as part of his marriage settlement. Living in London, he administered his estate by correspondence with his steward, whose responsibility it was to recommend to him repairs, improvements, and the proper rent to charge; to inform him about the reliability of existing and prospective tenants and what to do when they caused problems, which included eviction; to treat with other landlords and surveyors to settle disputes over enclosures; to influence voting in local elections; and to collect rents. Caught the middle between his distant employer and his tenants, a steward's life was not easy, being required at once to act as pleader, negotiator, spy, and enforcer. Charles's steward was a man named Cotes, who had come with a weighty recommendation from the "Archbishop." This prelate might have been the archbishop of Canterbury, who like Charles was a conscientious trustee of the British Museum, but we suspect he was the archbishop of York, who received money from Cavendish for paying pensions due from the rectory in the parish of Arnold. Cotes was healthy at the beginning, but he soon began to decline irreversibly. Cavendish perceived the "decay of his understanding for some years" without, however, taking steps. "Out of tenderness," and perhaps also with due respect to the archbishop, Cavendish "could not dismiss him abruptly." He wanted Cotes to resign instead, which Cotes eventually did, in 1764. In his place, Cavendish hired Thomas Revill, a choice he almost immediately regretted but which he nonetheless lived with for almost twenty years.⁹⁷ Revill abused his predecessor and evidently Cavendish's tenants as well, and Cavendish came to regard him as a "peevish

⁹⁵Christopher Baldwin to Henry Cavendish, 3 Mar. 1786, Saturday [1 Apr. 1786], Saturday [1 Apr. 1786]; Henry Cavendish to Christopher Baldwin, 1 Apr. [1786], n.d. [1 April 1786], drafts, ibid.

⁹⁶Baldwin deeded to Cavendish the one half acre of land "abutting or bounding" Balam Lane. On the same day he released all claims on the fifteen acres he sold to Cavendish, for a consideration of £80. Christopher Baldwin to Henry Cavendish, 5 Apr. 1786, "Lease" for the one half acre. Christopher Baldwin to Henry Cavendish, 6 Apr. 1786, "Release of a Piece of Land on Clapham Common." Christopher Baldwin to Henry Cavendish, "General Release," for a consideration of £80. Devon. Coll., 38/78.

⁹⁷Charles Cavendish to Thomas Revill, 5 Sep. and 13 Dec. 1764, draft, Devon. Coll., L/31/20.

old man," who created more problems than he solved. Two words appear with impressive frequency in Cavendish's half of their argumentative correspondence, "justice" and "reasonable," positive words he never applied to his steward but to actions his steward did not take and should have.⁹⁸

Charles introduced his eldest son to business as he had to science, turning over the management of his estate to him in the summer of 1782. Charles did not yet formally make it over, and he continued to participate in its management,⁹⁹ but he allowed Henry to receive the income from rents, tithes, and land taxes, which came to around £1600 a year. In his manner of handing over responsibility, Charles repeated his own experience, his father having turned over the rents to him in the first year and in the second year the property itself. From Henry's point of view, it was time to begin leaving home; land, we suspect, was equated by him with independent living.

Henry Cavendish's activity as an absentee landlord gives us insight into his person. Like his father, he had first to settle on a steward. Unsatisfactorily as he had worked out, Revill had an extenuating circumstance, which he had explained to Charles Cavendish. Because of a problem with his throat, he could scarcely speak and was reduced to communicating by writing, though he was helped in his work by a nephew.¹⁰⁰ Revill's attitude, a mix of servility and arrogance, was exasperating, but his difficulty in speaking no doubt helps explain the roundabout way he went about his work. His new master Henry Cavendish, who himself had difficulty in speaking, evidently felt no bond of sympathy, neither making nor accepting excuses for Revill's lapses.

The duke of Devonshire was well served by his agent J.W. Heaton, who recommended William Gould for steward, citing his "integrity and judgment on country business."¹⁰¹ Cavendish settled on Gould as his new steward before he fired his father's steward. Revill had already written that he wanted to collect the next rents, and when Cavendish told him not to because he intended to replace him, he protested. In his reply Cavendish said that he would not have answered him at all but for Revill's concern that his reputation would suffer. There was no cause for such concern, Cavendish said, since it was "so natural" for someone taking over an estate to entrust it to a steward whose judgment he could rely on. If, however, any doubts about his reputation were to arise on this account, Cavendish would direct his new steward to set matters right. Cavendish had meant to end the letter there but changed his mind, adding that although he had no doubt of Revill's fidelity and good intentions, he had good reasons for deploring his actions: "the infirmity of your temper which has made you either quarrel or behave with petulance to so many of those you have had business with & the little information my father could ever get from you concerning the matters under your charge render you very unfit a person to take care of an estate without which cause I should never have thought of employing another steward." To his new steward, Cavendish mentioned Revill's "angry letter," copying out part of his reply to Revill, only in place of "infirmity" of his temper substituting his father's expression, "the peevishness of his temper." For a full year, Revill wrote repeatedly to Cavendish to complain of his firing. Cavendish

⁹⁸Charles Cavendish to Thomas Revill, 19 Sep. and 3 Dec. 1776, 12 Apr. 1777, 18 Mar. 1778, drafts; Thomas Revill to Charles Cavendish, 31 Jan. 1765, Devon. Coll., L/31/20 and 34/5.

⁹⁹Henry Cavendish to William Gould, 30 Dec. 1782, draft, Devon. Coll., L/34/7.

¹⁰⁰Thomas Revill to Charles Cavendish, 16 Dec. 1764, Devon. Coll., L/31/20.

¹⁰¹William Gould to J.W. Heaton, 10 June 1782. Heaton forwarded this letter to Cavendish, adding his recommendation of Gould. Henry Cavendish to William Gould, 8 and 9 Aug. 1782, drafts, Devon. Coll., L/34/7.

neither answered his letters nor entered them in the index of his correspondence. The standard by which Cavendish judged Revill unfit he held up to his replacement. Gould was to give Cavendish's tenants no cause to complain, and he was readily to give Cavendish any and all information he desired. The first item of business was for Gould to make a complete examination "into the condition of the whole estate."¹⁰²

In Nottinghamshire and Derbyshire, the Cavendish family had long counted among the big landlords who bought out the landed gentry and took over their manors.¹⁰³ Charles and Henry's properties were in the neighborhood of the duke of Devonshire's, from which they had been separated off.¹⁰⁴ The duke's main country house was in the region, at Chatsworth in Derbyshire. Family estate records were kept Hardwick Hall, nearby in Nottinghamshire, where Henry Cavendish directed his steward to examine documents.¹⁰⁵ The Cavendish family kept in touch on matters of property. When one of Henry's properties became available a prospective tenant approached him through his first cousin John Cavendish.¹⁰⁶ When pending legislation affected his estate, Cavendish was assisted in Parliament by his principal heir George Augustus Henry Cavendish. Physically, legally, and politically, Henry Cavendish's properties were in the family.

Under the old pattern of farming, tilled land was parceled into strips with mixed ownership, and pastures were subject to common right. To meet changing economic needs, this pattern was replaced by one in which strips were consolidated and common use of land was reduced; the device was called enclosure.¹⁰⁷ The practical intent of enclosure, as Charles Cavendish put it with his usual clarity, was to "lay each person's allotment together as much as can be."¹⁰⁸ If landowners could not agree on enclsure an act of Parliament was required to overcome local resistance. Enclosure was a costly improvement: landowners were out the expense of passing the act; fees for lawyers, surveyors, and commissioners, whose job was to carry out a survey, place the owners' allotments in enclosed fields, see to it that improvements specified in the act were built, and look into damage claims; and a very considerable capital investment in fences, drains, roads, and various structures.¹⁰⁹ Because substantial economic gains could be expected from enclosure, big landlords and farmers were for enclosure. Charles and Henry Cavendish were not big landowners, and they could not avoid conflict.

Their property in the parish of Arnold in Nottinghamshire is an example of the complications attending enclosure. Charles Cavendish was entitled to tithes from the use of the land at Arnold, from which he received rent twice yearly, the total of which, a little over £100, made Arnold intermediate in value among his properties. In the event of enclosure, Cavendish would be expected to forfeit his tithes in exchange for an allotment of land. Just how much and what kind of land were the question.

¹⁰²Henry Cavendish to Thomas Revill, 16 and 28 Aug. and 5 Sep. 1782, drafts; Henry Cavendish to William Gould, 6 Sep. 1782, draft, Devon. Coll., L/34/7.

¹⁰³J.D. Chambers (1966, 7).

¹⁰⁴For example, Cavendish received rent from the tithes of Marston in Derbyshire, the greater part of which parish was owned by the duke of Devonshire. William Gould to Henry Cavendish, 28 Sep. 1782, Devon. Coll., L/34/7. ¹⁰⁵Henry Cavendish to William Gould, 2 Dec. 1787, draft, Devon. Coll., L/34/7.

¹⁰⁶William Gould to Henry Cavendish, 20 Aug. 1785; Arundall Gallway to Henry Cavendish, 21 Aug. 1785; Pemberton Milnes to John Cavendish, 24 Aug. 1785; John Cavendish to Henry Cavendish, 25 Aug. [1785]; Henry Cavendish to John Cavendish, n.d. [reply to letter of 25 Aug. 1785], draft, Devon. Coll., L/34/7.
¹⁰⁷Chambers (1966, 141).

¹⁰⁸Charles Cavendish to Thomas Revill, 8 [9] Dec. 1776, draft, Devon. Coll., L/34/5.

¹⁰⁹William Gould to Henry Cavendish, 25 Mar. 1784, Devon. Coll., L/34/7. Chambers (1966, 78, 199–200).

In 1776, the proprietors at Arnold considered petitioning Parliament to enclose their land. The quantity of land and the amounts given over to different uses were imprecisely known, since there had been no survey. Proceeding from incomplete information Revill made proposals to the proprietors about what share of the common fields and forest Charles Cavendish should receive in return for giving up his tithes. Revill's proposals were ill-received by the proprietors, whose spokesman repeatedly appealed to Cavendish and brought their grievances to him in person. Cavendish wanted the proprietors to deal with Revill, but they objected to him even more than they did to his proposals. Because of the animosity between the people at Arnold and Revill, agreement looked all but impossible. Revill asked for more than was "just," Cavendish said, and he urged reason and negotiation.¹¹⁰ The matter of the Arnold enclosure languished, but several years later, it came up again in the form of a petition for a bill. Having just taken charge of his father's farms, Henry Cavendish inherited a local history of bad feeling.¹¹¹

Henry's new steward told him that recent enclosures had been "attended with great detriment and injury to the estate," by which he meant not the unavoidable "great sums that have been expended on those Inclosures and the Buildings upon them" but the avoidable, absolute loss in the value of the estate owing to the previous steward's inattention. Cavendish entered into a long negotiation with the proprietors at Arnold over the amount of land he was entitled to receive in lieu of tithes, his father's quandary. In principle, the land he was entitled to receive was equivalent in rental value to the tithes he would have received from the improved land after enclosure, but the comparison of values was not straightforward. Depending on how it was figured, either the farmers or Cavendish benefited more. The proprietors took the initiative, offering Cavendish a specified allotment of land to compensate him for the loss of his tithes. Gould calculated the rent Cavendish would receive from the allotment, deducting the interest he would pay for putting up fences and buildings and for vicarial tithes, which he would go on paying, coming out to £169 per year, far below the £250 Gould estimated that Cavendish's tithes would bring. Because of the expenses Cavendish would incur, Gould advised him not to accept an allotment of yearly value less than £360. It was fair, Gould said, but the proprietors would not like it.¹¹² Cavendish did not like it either. If a specific monetary value were proposed, he told Gould, he would come out a loser, because the commissioners routinely overvalued land; instead he wanted them to allot him a certain "proportion" of land, a surer measure of value than money.¹¹³ Gould then wanted to select the location of the allotment on the forest. Cavendish thought that he was being overly zealous, making unnecessary trouble for the commissioners, who might be "less disposed to do me justice," but otherwise he accepted the proportion Gould had calculated for him. The proprietors rejected the proposal; their spokesman said the land would rent for £500, and he knew a man who would pay it. The spokesman complained about Cavendish's steward, who refused to answer letters, attend parish meetings, or receive a delegation, exhibiting "all the insolence of delegated authority."¹¹⁴ Gould, if the proprietors were to be believed, was behaving like Revill. Cavendish did not mention the proprietors'

¹¹⁰Charles Cavendish to Thomas Revill, 3 and 12 Dec. 1776, drafts, Devon. Coll., L/34/5.

¹¹¹Gould forwarded the petition from Arnold in a letter to Cavendish, 28 Sep. 1782.

¹¹²William Gould to Henry Cavendish, 24 Nov. 1784, Devon. Coll., L/34/7.

¹¹³Henry Cavendish to William Gould, Dec. and 24 Dec. 1784, drafts, Devon. Coll., L/34/7.

¹¹⁴Henry Cavendish to W. Sherbrooke, 6 Jan. 1785, draft; W. Sherbrooke to Henry Cavendish, 3 and 18 Feb. 1785. Cavendish also received an anonymous letter from a landholder in Arnold complaining of Gould, Mar. 1785, Devon. Coll., L/34/7.

complaints to Gould, which in any event could hardly have been news to him. He wanted Gould to get more exact information on acreage, rents, and tithes, for only then could they "prove" that their proposals were not "unreasonable." Fairness in this matter depended on reason, facts, and calculations, even though the quantities involved could be no firmer than estimates. Cavendish told Gould that justice all around would be served only if his "estate should be improved in the same proportion as that of the land owners,"¹¹⁵ and his duty to his estate was to ensure that it received this proportion.

The "affair of Arnold," as Cavendish called it, dragged on for years.¹¹⁶ Early in 1789 Gould told Cavendish that enclosure was likely, but a little later he corrected himself; it was unlikely because the vicar wanted more for his tithes on turnips and lambs than the proprietors offered him, and the vicar was a hard bargainer. Gould then learned that the landholders intended to go to parliament without the vicar, leaving the new allotments still subject to vicarial tithes, which meant that Cavendish would have to be given additional land equal to the tithes he must pay the vicar. The amount in question came to around £15 a year. Cavendish pressed Gould for facts on the vicar's turnip tithes, so that he could decide what "part of the turnips are tithable." Cavendish wrote sternly to Gould for not having "explained the matter to me clearly." Gould had given him his recommendations about the turnip tithes without at the same time giving him his "reasons." Henceforth Gould was always to give Cavendish his "reasons."¹¹⁷ Cavendish was not a miser; the money £15 was trifling. The matter of the vicar's turnip tithes had to do with the way his mind worked: in making decisions about his estate, Cavendish needed "reasons."

In its own good time, the Arnold affair came to a close. Following upon the petition, on 2 March 1789 the enclosure bill was ordered, setting in motion an elaborate parliamentary procedure, which was concluded with the royal assent on 13 July. With the exception of two proprietors, all of the parties gave their consent to the bill.¹¹⁸ For Cavendish, as no doubt for the other landowners, the news from Arnold would be bad before it was good again: in the summer of the following year, Gould told Cavendish that he had collected the rents from all but two of Cavendish's tenants but he was not remitting them because the entire amount was expended in the Arnold enclosure.¹¹⁹

Cavendish's early correspondence with his steward shows him to be new to the business. Once the farms were his responsibility, he set out to acquire a total familiarity with the facts of his estate, from which he reasoned on the basis of general principles, including the principle of justice, to conclusions about actions to take. In his approach to the management of his business, we recognize traits we have come to know in the natural philosopher.

Cavendish had a busy life in London with absorbing interests of his own choosing. From the questions he asked of his steward, we get the impression that he never visited his farms. He was burdened with landed property that was far away and that gave him trouble for a relatively small income he did not need. His steward sent him enclosure bills to study, and because he owned many properties, these bills repeatedly demanded his attention. With

¹¹⁵Henry Cavendish to William Gould, 23 Feb. 1785 and n.d. [after 28 Feb.] 1785, drafts; Henry Cavendish to W. Sherbrooke, 16 Feb. 1785, draft, Devon. Coll., L/34/7.

¹¹⁶Cavendish to Gould, 2 December 1787.

¹¹⁷Henry Cavendish to William Gould, n.d [reply to letter of 21 Feb. 1789], draft, Devon. Coll., L/34/12. William Gould to Henry Cavendish, 19 Mar. 1789.

¹¹⁸William Gould to Henry Cavendish, 30 Mar. 1789, Devon. Coll., L/34/12. 2 Mar., 13 May, and 12 June 1789, *Journal of the House of Commons* 44:138, 361, 454, and 456.

¹¹⁹William Gould to Henry Cavendish, 5 June 1790, Devon. Coll., L/34/12.

regard to an enclosure that had been pending for two years, Cavendish wrote to Gould: "You ought to have informed me of it at the time instead of delaying it till lately & then representing it to me as brought in by surprise & without your knowledge [.] I am very sorry to find that you could act in this manner & hope I shall never see another instance of any thing of the kind."¹²⁰ Cavendish suffered irritations like this because they came with his life and its responsibilities. If managing his estate brought no joy, we trust it brought satisfaction of a kind, the performance of a duty. No matter how far his activities in science took him away from his family, in his occupation with landed property he was with them.

Places and Precision

The preceding sections have shown the importance of places in Cavendish's life, and in other sections we have seen the importance to him of accuracy and precision. Here we bring the two together. The occasion was an Anglo-French project to determine accurately the relative locations of the Royal Observatory at Greenwich and the Royal Observatory in Paris. The "astronomical" difference of longitude between the two observatories had been determined by the time difference between the two locations, with an uncertainty said to be as great as eleven seconds, which corresponded to 1700 fathoms, a large distance. More reliable than astronomical observations was a "terrestrial" operation based on "triangulation," by which the longitudes of the two observatories, as determined by astronomical measurements, could be corrected. In 1783 the director of the Paris Royal Observatory C.-F. Cassini de Thury proposed to George III that a series of triangles be laid from London to Dover, there to connect with triangles already executed in France. The proposal was passed to Joseph Banks, who replied that the Royal Society had "people enough [...] capable and willing." The Royal Society recommended to the king a larger project, which in addition to the longitudes of the royal observatories would include a survey of all of Britain corresponding to Cassini's already completed map of France. This survey would be made in the 1790s, but in the meantime the lesser project of connecting the two observatories was undertaken.¹²¹

Banks recommended a fellow of the Royal Society to head the English half of the project, William Roy. Close in age, Roy and Cavendish came together frequently at the Royal Society Club, where we assume they talked about their common penchant for accurate measurement. Roy's successive appointments tell us the kind of technical servant he was: Surveyor-General of the Coast, Engineer of Military Surveys for Great Britain, and Director and Lieutenant Colonel of Royal Engineers. He brought considerable experience to the Anglo-French triangulation project, having helped to make a military map of Scotland after the Jacobite rebellion in 1745, and having proposed a national survey on the grounds of national defense after the Seven Years War in 1763. For a time the government seriously considered his proposal, which would have built on the map of Scotland, but dropped the plan because of the expense. After peace with America was declared in 1783, Roy made small

¹²⁰Henry Cavendish to William Gould, 12 May 1789, draft, Devon. Coll., L/34/12. Gould defended himself against Cavendish's "severe reprimand" and gave his reasons. William Gould to Henry Cavendish, 20 May 1789, Devon. Coll., L/34/12.

¹²¹29 June 1787, Minutes of Council, Royal Society 7:276. William Roy (1787, 213–214; 1785, 389). Charles Coulston Gillispie (1980, 122–123). In 1784, the elder Cassini died, succeeded as director-general of the Paris Observatory by his son Jean-Dominique Cassini, who was appointed by the Paris Academy of Sciences to superintend the French half of the project. He renovated the Observatory, procured new instruments, and oversaw the joint Anglo-French operations.

triangulations in the London area, determining positions of steeples and other prominences relative to each other and to the Greenwich Observatory "to facilitate the comparison of the observations, made by the lovers of astronomy" and to revive the plan of a national survey. He was engaged in writing up this work when Cassini de Thury proposed a triangulation of southeast England, an opportunity for which he had been preparing himself for twenty years. The "chief and ultimate purpose" of measuring a base on Hounslow Heath, as Roy understood it, was "the laying the foundation of a general survey of the British Islands."¹²²

Believing that instruments of sufficient precision for the project did not yet exist, Roy said that it would be necessary to "reinvent them all." Principal among them was a theodolite built by Jesse Ramsden, a perfectionist, who kept the operation on hold while he worked on it, endlessly it seemed to Roy. The 200-pound instrument was fitted with a three-foot circle, which made it highly accurate, allowing a mark seventy miles distant to be read with an error of only two seconds of arc. Roy said that with it, angles would be measured "to a degree of precision hitherto unexampled."¹²³

On 16 April 1784 Cavendish, Banks, and Blagden met with Roy on Hounslow Heath near the Greenwich Observatory to begin preparing a site for the baseline of the triangulation. Because the measurement of the baseline was critical, "infinite pains and care" were taken to see that it was accurate. Accurate bases had been measured in other countries with deal (fir) rods, and Roy intended to use them on Hounslow Heath, though Ramsden provided a choice of instruments, glass rods and steel chains in addition to deal rods. For the wood, Banks applied to the Admiralty, which cut up two masts. Ramsden finished making the roughly twenty-foot-long deal rods on 15 July, and on 16 July Cavendish met with Roy, Banks, Blagden, Smeaton, and Lloyd to start taking measurements with them. Although "extraordinary care" had been taken in the contraction of the rods to ensure that they were "the best which had ever been made," it was found that their length varied with humidity, seriously interfering with the precision of the measurement. The rods were accordingly replaced by a 100-foot steel chain and again by glass rods or "tubes," which despite their great length were so straight that one could see a small object on the axis of the bore at the other end. With the help of a pyrometer with microscopes attached, equations were derived for the expansion of the rods with temperature. Roy was awarded the Royal Society's Copley Medal in 1785 for this accurate work.¹²⁴

From Hounslow Heath, triangles twelve to eighteen miles on a side were set out on a southward course to the coast, the terrain dictating a snake-like progression. The baseline was used for about half of one side of the first triangle. From then on, only angles were measured until the last triangle, which was measured by a second baseline of "verification," laid out on Romney Marsh on the southern coast. To judge the "accuracy" of their operation in determining angles and sides, they found the "error" between the length of one base as computed from the other base and the length of the same base as measured on the ground to be within a few inches. The triangulation was, Roy said, "an instance of exactness as probably never occurred in any former operation of this sort." From the English coast, observations were made to "intersect, with great accuracy," two points on the French coast.

¹²²Yolande O'Donoghue (1977, 41). Roy (1787, 188).

¹²³Roy (1787, 188). Charles Blagden to William Farr, 22 Aug. 1787, draft, Blagden Letters, Royal Society 7:346. Charles Blagden to Dr. William Watson, 22 Aug. 1787, draft, ibid. 7:347. Gillispie (1980, 123).

¹²⁴William Roy (1790, 116, 121, 133; 1785, 391, 394, 425, 430, 441). O'Donoghue (1977, 46).

establishing a "triangular connection between the two countries." Roy hoped that Cavendish would join him there, as he planned to do, but he put off the trip because of bad weather.¹²⁵

The second baseline had been measured with steel chains, which were easier to work with than glass rods, and which had been proven accurate on the first baseline. After Rov's operation, there was some discussion of the error in measuring the two bases by different means, glass rods at Hounslow Heath and steel chains at Romney Marsh. On the principle that every base ought to be "measured twice at least," in 1791 the baseline at Hounslow Heath was ordered re-measured using steel chains instead of glass rods. The new measurement differed from the original by less than three inches. The object by then was a general survey of Britain which was Roy's goal, though he did not live to see it.¹²⁶

Rov's plan did not make use of the conspicuous landmark St. Paul's Cathedral as a station of a triangle because he would have needed to make Hampstead and Harrow stations too, all three of which were inconvenient for what he called the "great instrument," the theodolite. There were other problems with those stations too such as the "smoke of the Capital." In fact, none of the stations Roy used were inside London, though from the stations outside, he could determine accurately the locations of St. Paul's, Hampstead, Harrow, and many other places with steeples within the city. Independently of the Anglo-French project, from the baseline on Hounslow Heath in 1788 and 1789 Roy laid down "secondary triangles" with the object of improving plans of London and maps of England. Cavendish's observatory on Clapham Common was one of the stations, as were Aubert's and Roy's observatories and Maskelyne's Greenwich Observatory (Fig. 11.13). Roy computed the latitude, longitude, and bearing of Cavendish's "Clapham Common, Transit-room":

- Latitude 31° 27' 12.7".
- Longitude from Greenwich 0° 8' 39.2". In time, 0^h 0' 34.613".
- Bearing from the center of the dome of St. Paul's, from south meridian westward 26° 29' 56.1".
- Distance in feet 24563.5.

Commenting on these numbers and those for several other places, Roy said that because he had the best instrument and a better way of measuring bases, the "relative geodetical situations of the stations [...] may be said to be free from sensible error."¹²⁷ Knowing Cavendish's desire for accuracy and precision, it is fitting that his principal home was a geodetic datum, angles expressed to a fraction of a second.

There was a problem. While preparing sheets of Roy's final paper for the Philosophical Transactions, Blagden discovered numerical "blunders," which he pointed out to Roy, who proceeded to find more on his own. Roy's health was poor, and while he was absorbed in the heavy task of discovering and correcting his errors, on 1 July 1790 he died at his house in

¹²⁵Roy requested a British commissioner to join the French commissioners in making measurements across the Straits of Dover, proposing Blagden, who was appointed by the Council of the Royal Society. O'Donoghue (1977,

^{1, 41).} Joseph Banks to Charles Blagden, 13 Oct. 1783, Blagden Letters, Royal Society, B.19. Charles Blagden to Joseph Banks, 12 July 1784 and "Tuesday" [1784], Banks Correspondence, Royal Botanic Gardens, Kew, 167, 171. Charles Blagden to Henry Cavendish, 16 Sep. 1787; in Jungnickel and McCormmach (1999, 634-635). Henry Cavendish to Charles Blagden, [after 16 Sep.1787], draft; ibid., 638-640. Charles Blagden to Benjamin Thompson, 27 May 1787, draft, Blagden Letters, Royal Society 7:55. Charles Blagden to Dr. William Watson, 22 Aug. 1787, ibid. 7:347.

¹²⁶Edward Williams, William Mudge, and Isaac Dalby (1795, 417–418). O'Donoghue (1977, 1, 42). ¹²⁷Roy (1790, 260-261).

London. Roy took pride in his work as a military engineer, the aim of which was accuracy and precision,¹²⁸ earning a solid reputation in a field that had no tolerance for careless error. He regarded the triangulation under his direction as "infallible, because, by means of the base of verification, it will prove itself." The accuracy of it was a point of national and professional honor. Roy's is a case of the gods striking down one they love.

There was concern that more errors lay hidden in the paper, which would be (triumphantly) discovered by the French commissioners of the project, especially by P.F.A. Méchain, who was bound to read the paper carefully. Had Roy's errors been limited to the 1787 paper, they would not have been damaging, since it was only a sketch of the operation to come, but errors in the 1790 paper were another matter, since it was the final report, and the operation was an official undertaking of the Royal Society. Blagden turned for advice to one of the Society's experts on errors. "Conversing a few days ago on this subject with Mr. Cavendish," Blagden told Banks, "he suggested, that the best way of preventing any disgrace which might fall upon the Society on this account would be, to get the paper well examined here, and print such errors as might be discovered in the errata to the present volume of the Transactions, thereby anticipating, as far as possible, the remarks of foreigners."¹²⁹ Roy would have recommended the same course. At a time when the French triangulation had been criticized in Russia as "extremely erroneous," Roy had expressed confidence that the Paris Academy of Sciences would, "no doubt, vindicate the credit of their own operation."130 To vindicate its own, the Royal Society acted as Cavendish proposed. Roy's assistant Isaac Dalby, in Roy's words "an able and indefatigable calculator," was recommended by Blagden to examine the paper for errors. After meeting with Dalby, Blagden reported to Banks that "he said there were to his knowledge very many blunders retained by the General, though clearly pointed out to him." Dalby doubted that it would look right if he were the one to point out the errors, but Blagden told him "to put himself in the place of a foreigner, whose object it might be to criticize as severely as possible." Blagden said that they would "take care to present the result to the public in the tenderest manner for the General's reputation, consistent with our duty to the Society," and Dalby then agreed.¹³¹ In an appendix to Roy's posthumous paper, Dalby went through the paper page by page, noting where corrections were in order.¹³² In a second appendix, Blagden gave a brief personal account of Roy in which he offered a partial excuse for his errors. After finishing the triangulation in September 1788, Roy devoted what time his health and his military duties allowed him to preparing his paper. Advised to go to Lisbon in the winter of 1789, he hurriedly finished the paper, and when he returned in April his paper went to press. At the time he died he had corrected the sheets but he had not compared the manuscript with the original observations.¹³³

The errors came about this way. Roy regarded the triangulation operation as relevant to the long-standing problem of the figure of the Earth. He made calculations for a number of assumed hypotheses about the Earth, finding good agreement between theory and observation with Bouguer's hypothesis of a spheroidal Earth. Roy made three kinds of mistakes

¹²⁸"Roy, William," DNB, 1st ed. 17:371–373, on 373. Sven Widmalm (1990, 199).

¹²⁹Charles Blagden to Joseph Banks, draft, 31 Aug. 1790, BL Add Mss 33272.

¹³⁰Roy, "Account of the Mode Proposed," 211.

¹³¹Blagden to Banks, 26 Sep. 1790.

¹³²Charles Blagden, "Appendix," to Roy (1790). Isaac Dalby, "Remarks on Major-General Roy's Account of the Trigonometrical Operation, from Page 111 to Page 270 of This Volume," ibid., 593–614.

¹³³Charles Blagden, "Appendix," to Roy (1790). Blagden's and Dalby's appendices were printed at the end of volume 80 of *Philosophical Transactions*.

in calculating lengths of arc, and these were explained in a footnote to the paper. At this stage all that could be done about the errors was to annex a corrections slip to the paper. The mistakes did not invalidate the general reasoning of the paper, since the only purpose of the computed lengths of arc was to show that Bouguer's hypothesis agreed better than other hypotheses with the actual measurements.¹³⁴ Roy made errors, but he was also wise about errors. Experiments "rarely leave no room for doubt," he wrote on another occasion; different experimenters using different instruments and different methods arrive at different results, and it is "not until things have been viewed in every possible light, that the errors, even of our own experiments, are discovered."¹³⁵ He could have been describing Cavendish's practice.

Errors haunted Roy's publication. In a paper the following year giving measures deduced from Roy's triangulations, Dalby noted yet another error in the 1790 paper. Cavendish's house on Clapham Common had been the corner of one of Roy's secondary triangles, and its bearing from the dome of St. Paul's was printed incorrectly. Dalby wrote to Cavendish about it and corrected it in his appendix.¹³⁶ The error might not seem like much: instead of 26°, 29', and 56.1", it should have been 26°, 29', and 52", but given the instruments, methods, and objectives of the triangulations, it was significant.¹³⁷

In protecting the reputation of the Society, the reputation of Roy was protected as well; for what was valuable in his work was his observations, which were excellent.¹³⁸ In 1784 he laid the foundation for the national survey, and in his papers of 1785, 1787, and 1790, he explained the methods for accurate triangulation. Cavendish headed the list of committee members appointed to examine Roy's apparatus from the triangulation operation, which the king had donated to the Royal Society.¹³⁹

¹³⁷Dalby, "Remarks on Major-General Roy's Account," 614.

¹³⁴Roy (1790, 201).

¹³⁵William Roy (1777, 653-654).

¹³⁶Isaac Dalby to Henry Cavendish, 13 Nov. [1790]; in Jungnickel and McCormmach (1999, 680).

¹³⁸Roy's errors were unimportant relative to his observations, according to John Playfair in his review of William Mudge's collection of memoirs on the triangulation begun by Roy. Playfair (1822, 4:198–201).

¹³⁹11 Nov. 1790, Minutes of Council, Royal Society 7:232–234.