



Portrait of Robert Boyle

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ROBERT BOYLE (1627-1691): THE ITALIAN CONNECTIONS

PART 1 - ROBERT BOYLE'S ACQUISITION OF KNOWLEDGE ABOUT ITALY AND ITS SCHOLARSHIP

The paper reviews the Italian connections of Robert Boyle. It is divided into two parts: Part 1 describes means by which Robert Boyle acquired his knowledge of Italy and of its scholars and scholarship. Part 2 (next issue) describes how Italy and other parts of Europe acquired knowledge about Robert Boyle and his works.

Robert Boyle acquired his considerable knowledge about Italy and its scholarship from five sources: (a) making a "Grand Tour" and a later visit to the Netherlands, (b) books and journals of the period, (c) his correspondents in Europe, (d) "Inquiries for Composing of a Good Natural History of a Countrey", made via *Phil. Tran.*, and (e) his visitors from Europe and those in England who had travelled in Europe. This knowledge was demonstrated in his publications and in the unpublished material in the archive of "Boyle Papers" held at the Royal Society in London.

The parallel situation, "How Europe and in particular Italy, learnt of Robert Boyle and his work and writings", will be dealt with in Part 2.

The Grand Tour and his later visit to the Netherlands

The seventeenth century saw the beginning of the practice of continental travel for the education of the young sons of gentlemen, later called

the "Grand Tour". Such tours were made by several early members of the Royal Society and by Bishop Burnet who preached the Sermon at Boyle's funeral [1]. All the sons of the First or Great Earl of Cork were sent on "Grand Tours". The first to go were Rodger and Lewis, 1636-1639, and later, Robert and Francis in 1639 until 1644. All were sent under the supervision of a private tutor, Issac Marcombes. Robert wrote a detailed account of his early life, including his Grand Tour, *An Account of Philaretus during his Minority*. This is given in Birch's *Life of Boyle* [2] published as a single volume and also annexed to Birch's two editions of the *Works of Boyle* [3], it is also given in Maddison's account of the life of Boyle [4(a)], and discussed in detail by Hunter in "Robert Boyle by himself and his friends..." [5] and in his recent excellent and scholarly biography of Boyle [6] which includes a discussion of the impact of Boyle's experiences in Geneva and in Italy. Philaretus was a name frequently used by Robert Boyle to refer to himself in his writings.

The "Grand Tour" was usually confined to the Netherlands, France and

Italy [7]. In Robert's case it included Switzerland but omitted the Netherlands which were the subject of a later visit, February to April 1648. From Robert's autobiographical account we know that his "Grand Tour" took place in four stages. Stage 1, after receiving a Royal licence to travel abroad they went to Rye (20 and 30 Oct. 1639) thence by boat to Dieppe (30 Oct. 1639). On to Rouen (3 Nov. 1639) then Paris (4-12 Nov. 1639), Lyons (22-25 Nov. 1639) and arrived in Geneva 28 Nov. 1639 and stayed until the autumn of 1641. Once at Geneva the boys studied mathematics, history, became perfect in French and received religious instruction. Whilst in Geneva, during a violent thunderstorm, Robert Boyle records his dramatic confirmation of Christian belief, which affected the rest of his life's work. Stage 2, was a short trip to France, the Savoy and Dauphiné organised as recompense for the delay in going to Italy. From Geneva their route took them through Cruseills, Annecy, Rumilly, Aix-le Bains, Chambrey, Isère, Grenoble, Vienne, Lyons and back to Geneva. Stage 3, was the journey to Florence when they visited all the main tourist sights. They left Geneva mid September 1641 and arrived in Florence late October 1641 where they stayed till March 1642. Their route was Lausanne, Zurich, Saleurre, Valtellina, Spülgen Pass, Chiavenna, Bergamo, Brescia, Verona, Vicenza, Padua, Venice, Ferrara, Bologna thence to Florence. Whilst in Florence Robert became fluent in Italian and read the works of Galileo. At the end of March they left for Rome passing through Siena, Viterbo and Montefiascone. Due to the heat they did not stay long in Rome. Stage 4, was the return to Geneva. Their route took them to Pisa, Antibes, Marseilles and Lyon arriving in Geneva in July 1642. At Marseilles they learnt of the Great Earl's financial problems and the planned tour of France was abandoned and they returned direct to Geneva and stayed until the middle of 1644, when they returned to London. In addition to the sights seen and the activities recorded in the autobiography further details are now available from a recently discovered bound volume of documents [8], MS 44, in the Royal Society archive [9(a)], which make up Robert Boyle's student notebook from the second period of his residence in Geneva, 1642-1644. This is an important set of manuscripts for this period of residence in Geneva is the most sparsely documented period of his life. The various items illustrate which subjects the young Boyle studied - modern and ancient history, geography, theology, ethics, Aristotelian natural philosophy, mathematics (Euclid and Clavius) and fortification. Three of the items are directly about Italy, namely "Of Italy", "The Kingdom of Naples" and "Milan". From the end of February to the beginning of April 1648 Boyle was in the Netherlands, he went not only to see the country but to accompany his brother Francis and his sister-in-law back from the The Hague. His stay at The Hague and the return journey provided him with subjects for some of his *Occasional Reflections* [10]. In addition to The Hague he visited Leyden and Amsterdam.

Books of the Period

No full record or catalogue exists of Boyle's library as it was sold piecemeal in 1692 [4(b), 11 and 12(a)]. However, in 1991, Harwood [13] formed the opinion that MS 23 [8(b)], previously known only as a "vol-

ume of seventeenth-century theological notes" contained a partial catalogue of Boyle's library, compiled by John Warr the Younger, not long before (or shortly after) Boyle's death in 1691. Hunter [9(c)] has however since concluded that the books listed were far more likely to be Warr's than Boyle's. Thus to form a picture of what Boyle's library was like it is still necessary to rely on the citations/references in Boyle's published work, in his correspondence and in his unpublished papers. To deduce the original materials Boyle used is not an easy task, as in many cases only partial references were given. However the task has recently been completed by Avramov, Hunter and Yoshimoto and documented in *Boyle's Books* [14] aided by the publication of a new scholarly fourteen volume edition, 1999 and 2000, of *The Works of Robert Boyle* [15] and of the *Correspondence of Robert Boyle* [16]; both of which are annotated with full references to books Boyle cited where these could be derived from the text. Using evidence from Boyle's published writings and from his manuscript reading notes details have been deduced of 125 books that it is likely Boyle owned, thus making a significant contribution to the reconstruction of the contents of Boyle's library. A few examples are given to illustrate Boyle's citations in *Works* [15] of Italian authors on topics of chemical interest. The data for the items in *Sceptical Chemist* [17], *Experiments Touching Colours* [18], *Producibleness of Chymical Principles* [19] shown in Tables 1 (12 items), 2 (14 items) and 3 (5 items) in the Appendix (the Appendix will appear with Part 2). Numerous references to chemical materials from Italy, for example to the "Bolonian Stone" (see Appendix, Tables 4, 12 items, and 5, 4 items) and to Italian authors such as Galileo (see Appendix, Table 6, 28 references) are spread through *Works* and his unpublished material.

The Correspondence of Robert Boyle

The Birch editions of the *Works of Robert Boyle* [3] contain a selection of letters to and from Boyle; a fuller, tentative list including their locations was assembled by Maddison [20]. A more complete set, in six volumes, of the *Correspondence of Robert Boyle* was published in 2001 [16]. These have been searched for reference to Italy and Italian matters (see Table 7, 30 items) and to some of the major cities in Italy, namely Bologna (see Table 8, 12 entries), Florence (see Table 9, 30 items), Padua (see Table 10, 8 items), Rome (see Table 11, 30 items) and Venice (see Table 12, 17 items). Numerous references were found to books by Italian authors such as Galileo (see Table 6, 28 references) and Athanasius Kircher including in one case, the price of Kircher's *Mundus Subterraneus* in London (see Table 13, 19 references).

"Inquiries for Composing of a Good Natural History of a Countrey"

In 1666 the Royal Society of London declared "that for the better attaining the End of their Institution, to study *Nature* rather than *Books*, and from Observations, made of the Phaenomena and Effects she presents, to compose such a History of Her, as may hereafter serve to build a Solid and Useful Philosophy upon; They have from time to time given order to several of their Members to draw up *Inquiries* of things Observ-

able in forrain Countries" [21].

Robert Boyle used sets of "heads" and "inquiries" as a key part of the deductive method he developed on the basis of that of Francis Bacon (1561-1626) as a means of eliciting and structuring data [22]. Boyle used such lists as a means of setting his agenda when studying a topic, for organising data he had acquired and for soliciting related information from others. The format is explicit in two of his experimentally based analytical chemical texts, namely those on *Humane Blood* [23] and *Mineral Waters* [24] and in numerous unpublished studies [25]. The first set of this type of inquiry by Boyle via the *Philosophical Transactions* of the Royal Society was "*General Heads for a Natural History of a Countrey, Great or small*" [26], followed by "*Other Inquiries concerning the Sea*" [27] and a very extensive set, "*Articles of Inquiries touching Mines*" [28]. After Boyle's death these sets of queries were brought together, in 1692, with some additional material to form a small book [29] which was re-published in Latin, by De Tournes in Geneva, in 1696 [30]. Some replies to the Inquiries were made direct to Boyle in correspondence or face to face as recorded in the *Workdiaries of Robert Boyle* [31], others were received from Oldenburg [32].

Boyle's European Visitors and those in England who had travelled in Europe

Biographers previous to Maddison [4, 33-35] paid no attention to Boyle's foreign visitors. This is surprising since from quite an early age Boyle's reputation as a philosopher and devout Christian was well established. His contemporary John Aubrey wrote "He has not only a high renowne in England but abroad; and when foreigners come thither, 'tis one of their curiosities to make him a visit" [36]. At one stage, 30 March 1668, Henry Oldenburg, Secretary to the Royal Society, complained in a letter to Boyle [16(a)] about the numbers of strangers coming to visit the Royal Society. Boyle replied, 3 April 1668, [16(b)] "You are not at all mistaken, in thinking, that I have had my share of troublesome visits from strangers, and that I would not invite my friends at *London*, to procure me any more of them...". Earlier in the same letter he wrote "I am glad you are like to settle a correspondence with *Rome*, that being the chief center of intelligence;...". It seems that Oldenburg had been freely directing visitors to Boyle at Oxford and developed some qualms of conscience on this action.

Most of these visitors left little or no record of the visits [37]; of the thirteen, listed by Maddison [34, 35], seven were or became correspondents of Boyle and two came from Italy, namely Count Lorenzo Magalotti (1637-1712) [34, 37-40] and Cosmo III Grand Duke of Tuscany (1642-1723) whilst he was Hereditary Prince of that state.

In the seventeenth century some Italian scientists appeared to have enjoyed a higher reputation in England than they did in Italy [41], due at least in part to the opposition of some, but not all, Jesuit letterati and scientists to accept the challenge posed by the new atomistic science [42, 43]. For example, Daniello Bartoli (1608-1685) accepted Boyle's experimental data but not always his explanations, for instance Boyle's thesis that ice resulted from water as the atoms slowed their motion,

and eventually stopped, which Bartoli described as "not proven and it does not even seem probable to me" [44]. The regard Italian scientists was such that Henry Oldenburg, Secretary to the Royal Society, London, made contact with Marcello Malpighi (1628-1694) of Bologna to invite him "to a whole-hearted alliance of mind and study, so that, through experimental research into nature, the foundations of philosophy may be laid more solidly, the ancients put to question, and useful novelties may be discovered and made public..." [45-47]. Malpighi works, after 1669, were published in London under the imprint of the Royal Society. Indeed by the end of the seventeenth-century no less than 16 Italians had been elected to the Royal Society, including Malpighi in 1669 and Magalotti in 1707 [41].

Magalotti has a dual importance herein, as a link between the Royal Society of London and the *Accademia del Cimento*, Florence, and for his close friendship with Boyle. The short-lived *Accademia* was important as it was the first Society to employ an organised scientific experimental programme [47-51]. It was founded by Duke Ferdinand II de Medici and his brother Prince Leopold in 1657, five years before the Royal Society of London. The Academy of ten members conducted its affairs in a private and informal manner; its intent was to extend the work of Galileo by making scientific experiments, to demonstrate the folly of opposition to the new science. The sole publication of the *Accademia* was the well illustrated *Saggi di Naturali Esperienze* (1667) [52] prepared by Magalotti its Secretary. The *Saggi* was translated into English by Richard Waller in 1684 [53] and has since been retranslated along with diaries and unpublished experiments and observations [47]. In the *Saggi* are four references to Boyle, "by Boyle for the purpose of his beautiful and noble experiments" [47(a)], "the fine observation, made by Boyle, of the ebullition of luke-warm water in a vacuum" [47(b)], "We have learned of the experiment {dissolution of pearls and coral in the vacuum}" [47(c)] and "...Boyle, who tells us about a lark that lived in the exhausted receiver for ten minutes..." [47(d)]. All refer to experiments in Boyle's *New Experiments Physico-mechanical* (1660) [54]. Connections between the *Accademia del Cimento* and Boyle are well described by Clelia Pighetti [55]; among other aspects, she argues about analogies between researches developed by Florentines and those developed by Boyle. She lightly touches on their reciprocal suspicions of "plagiarism", however her feeling is that likely Florentines felt a certain superiority of the experimental approach used by Boyle and this led to a fruitful scientific emulation. The *Accademia* dissolved in 1667 following the departure of three of its members from Tuscany and the election of Leopold as a Cardinal. The surviving apparatus is among the many treasures of the Museo di Storia della Scienza, Florence. Magalotti made two visits to England [4, 6, 34, 38-40], the first in the company of Paolo Falconieri (1623-1697) in February-March 1668 when he met Oldenburg, attended a meeting of the Royal Society, then visited Boyle in Oxford and spent ten hours with him. During this time Boyle showed him several experiments, some connected with air pressure, others concerning the changes of colour produced by mixing of different liquids. Magalotti was in England again, in 1669, at

the behest of Grand Duke Ferdinand accompanying his son Cosmo and kept a detailed account of this visit [56, 57]. During this second visit he renewed his friendship with Boyle and said of him:

“One could not say so much in praise of this wise and virtuous gentleman that would not merit much more. He is full of religion towards God, of magnanimous charity towards his neighbour, of affability, of courtesy, of gentleness towards all. He is still quite young, but of a constitution so weak it does not promise him all of his days. He speaks French and Italian very well, but has some impediment in his speech, which is often interrupted by a sort of stammering, which seems as if he was constrained by an internal force to swallow his words again and with the words also his breath, so he seems so near to bursting that it excites compassion in the hearer” [57].

During the visit Magalotti was taken ill of a fever and its effects lasted for three and a half months. During this period Boyle visited and sat at his bedside two or three hours daily. Magalotti and Boyle had many interests in common, yet had one point of difference, namely, religion. On his return to Italy Magalotti felt constrained to write to him a long letter (30 folios) ‘*Sopra controversie religiose*’ confuting the theological errors, which he, as a Roman catholic, considered Boyle to hold [9(d), 16(c), 58]. Boyle was not converted, but this point of religious difference did not impair their friendship, which according to Fabroni was life-long. Despite the authorship of the anonymous tract *Protestant and Papist* [59] having frequently been ascribed to Boyle it is clear from his actions in life that he was not a religious bigot and hence and out of character attribution. It has recently been shown that the author of the tract was not Boyle but a former Jesuit, David Abercromby [60].

That we have only one letter extant from Magalotti to Boyle and none of those from Boyle to Magalotti does not mean that they lost contact after Magalotti left London because Magalotti was in contact with Oldenburg, who after Magalotti’s first visit to England acted as an intermediary between Boyle and Magalotti. In a letter to Oldenburg, 15 May 1668, [32(a)], he notes “you make me sigh for England more than ever by advising me of the celebrated Mr. Boyle’s return from Oxford” and “I implore you to assure him of my most reverend humility”. On 1 June 1668 Oldenburg reported that “Mr. Boyle is your servant...” [32(b)]. In Magalotti’s letter to Oldenburg, 11 November 1668 we read “I beg you to salute Mr. Boyle in my name and tell him that I live only for the hour when I can appear before him again to render my humble respects, and whether he be in London or in Oxford at the time of my arrival I shall not cross the sea without seeing him” [32(c)]. On 23 September 1670, Magalotti wrote of that a great friend of his was visiting London, the bearer of the letter, that “I have given him letters for Mr. Boyle, for Mr. Slingsby, and for Sir Samuel Morland” [32(d)]. Oldenburg sent news of Boyle’s chemical activities and publication on the origin and virtues of gems to Magalotti, 13 June 1672, [32(e)].

The first Italian to be elected to the Royal Society was Count Carlo Ubaldini (fl.1665-1667) little is known about him [37, 41, 42]. The Royal Society records reveal very little [61], only he was proposed by Oldenburg, the date of his election (21/11/1667), the date of his admission

(26/11/1667) and his sole contribution (April, 1667) was a medical observation. A small amount more about Ubaldini can be found in, or deduced from, the correspondence between Boyle and Oldenburg. Boyle wrote, 6 August 1665, from Oxford, “There is a Gentleman of Quality in this Towne, who seems to bee a man of parts, and who having been borne, and for ye most part bred in Italy is likely to give a good Acct of ye Roman Affairs...” [32(f)]. Oldenburg replied, 10 August 1665, “The Italian Gentleman now at Oxford, whom you give me hint to me in ye favour of yr last, I am, I think, not unknowne to. I guesse, ‘tis Signr Ubaldini, a Nobleman of Tuscany, a late protestant proselyte, of good naturall and acquired parts, as far as I have been able to discern by the small acquaintance I had wth him, when he was in London...” [32(g)]. Boyle, 24 September 1665, wrote “Here is an Italian Count a man well versd in Civill affairs, and that speaks in divers Languages, who is attempting to translate my History of Cold into Italian; but whether he will have ye skill and ye patience to goe through wth it I cannot yet ghesse” [32(h)]. Boyle, 30 September 1665, “The Intimation you mention about ye Latine Version of ye History of Cold has been already given before I receivd yr Letter. But as yt did not discourage ye Count yt has undertaken ye Italian Translation soe I thought it not fit to urge his desisting from it since it will be ye Printers fault if the Latine Edition be not vended before ye other will be sent over to Italy where consequently it will be bought by few or none save those yt read Italian, not Latine Bookes” [32(i)]. A little later, Ubaldini appears in the correspondence of Wallis to Oldenburg, 12 February 1666/7, “I have with it, adjoined another book, tyed to it, wch I must desire your favour to deliver it to ye Count Ubaldini; it being a manuscript which he is to restore to Sr Robert Moray” [32(j)]. Again, a year later, 1 February 1667/8, “To Count Ubaldini’s last letter, I doubt whether I shall give a very good account from hence; but I shall not be unmindfull of it” [32(k)]. Some of Boyle’s English visitors who had travelled in Europe reported on what they had learnt in correspondence as indicated in paragraph (c) or face to face as noted in his *Workdiaries* [31]. Some of the scientific news received was important to Boyle’s own studies, such as those using thermometers. Description of the Florentine thermometer reached Boyle in 1661 from Robert Southwell, just back from a “Grand Tour” [62]. The Florentine thermometer was invented before the *Accademia* came into being, however it was the subject of the first chapter of *Saggi* [52]. Boyle had a good deal to say about the instrument a year or so later in his *New Experiments and Observation Touching Cold* [63]

Conclusions

The causes behind Boyle’s interest in and high regard for many Italian matters, and the converse, the interest and high regard in which Boyle was held by many of his contemporary Italian intellectuals have been shown to be multifaceted. These interests originated in his “Grand Tour” and to a large extent were sustained, mid to late in life, via contacts and activities which revolved round the Royal Society, its members [1], visitors and its Secretary, Henry Oldenburg.

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