

Journal of Early Modern Studies, n. 3 (2014), pp. 151-171

<http://www.fupress.com/bsfm-jems>

Scientific Interaction Within Henry Oldenburg's Letter Network

Maurizio Gotti

University of Bergamo (<m.gotti@unibg.it>)

Abstract

The article investigates various functions fulfilled by letters exchanged by European scholars and experimenters in the period 1660-1676. The correspondence network taken into consideration is the one coordinated by Henry Oldenburg, who was responsible for a large exchange of letters in that period, particularly when he became the first Secretary of the Royal Society. The analysis shows that this correspondence greatly stimulated the growth of a real community of adepts, as it provided an excellent means for the exchange of views, the conducting of controversies, the corroboration of individual observations and the official recognition of one's own findings. Communal correspondence also fulfilled other important goals linked to socialization purposes, favouring the creation of a new specialized community sharing innovative intellectual interests and professional practices, as well as the adoption of a spirit of solidarity among its members.

Keywords: Communal Correspondence, Controversy, Experimentation, Henry Oldenburg, Royal Society

1. *Introduction*

This article examines the exchange of letters that took place between several European scholars and experimenters in the period 1660-1676. The aim of the article is to investigate the various functions fulfilled by these letters and highlight the contribution that this exchange made to the development of science. The correspondence network taken into consideration here is the one coordinated by Henry Oldenburg, who was responsible for a large exchange of letters in that period, particularly when he became the first Secretary of the Royal Society.

In the seventeenth century communal correspondence was widespread and was used for the attainment of several aims. Indeed, the exchange of letters was not always intended for merely personal purposes, but often had a wider scope and a more official function, offering recipients greater opportunities of keeping abreast of the times. Letters often conveyed information about the research work carried out not only by individuals but also by groups, and were frequently addressed not merely to single experimenters but also

to teams of researchers working elsewhere. The development of communal correspondence – favoured by the introduction of postal services, which, particularly in the seventeenth century, became quite regular and reliable – greatly stimulated the growth of a real community of adepts, as it provided an excellent means for the exchange of views, the conducting of controversies, the corroboration of individual observations and the official recognition of one's own findings. Letters were often distributed through clearing houses for scientific correspondence, such as the salon of Father Marin Mersenne in Paris or the office of Henry Oldenburg in London. Samuel Hartlib, too, engaged in a great deal of correspondence; by means of his 'office of address' he maintained very useful relations both at home and abroad. In these clearing houses, letters were copied and sent to several new recipients, who usually read them aloud at their local meetings with colleagues and friends, thus helping the formation of 'hidden' or 'invisible' colleges (Mantel 1980). The development of communal correspondence greatly stimulated the growth of a real community of adepts. Ultee (1987, 100) estimates that in 1690 there were at least 1,200 active corresponding members of the Republic of Letters in northern Europe. Particularly in France and England, scientists commonly published announcements of discoveries, reported on experiments or expressed their views on some subject of controversy in the form of a letter to a friend. These letters were reproduced and distributed to several readers.

In 1662 the Royal Society was founded, after a period in which its members had met in an informal manner (Hartley 1960; Valle 2006). The efficacy of this corresponding activity was greatly enhanced by the Royal Charter which gave the Society 'full power and authority, by letters or epistles [of the Royal Society in matters or things philosophical, mathematical, or mechanical...] to enjoy mutual intelligence and knowledge with all and all manner of strangers and foreigners, whether private or collegiate, corporate or politic, without any molestation, interruption, or disturbance whatsoever' (quoted in Boas Hall 1991, 55). This privilege to correspond freely with citizens of other countries was particularly helpful in a period of great domestic turbulence and international conflicts. Many letters were read aloud at meetings of the Royal Society, particularly before the *Philosophical Transactions* started publication (Johns 2003).

The circulation of these letters did not only imply a direct relationship between the writer and the main addressee, but also with several other recipients, as copies of the original letter were often made by the main addressee and then circulated through the network. As Banks (2012, 87) rightly remarks, 'Such correspondence was not private in the contemporary sense: it was generally understood that these letters were to be copied, sent on, read at meetings, or otherwise disseminated'. A confirmation of this practice comes from the following direct testimony, which points out that these letters were commonly conceived to be public rather than private, as they were not only read out aloud

at meetings and circulated among colleagues, but also frequently printed. The writer was supposed to be aware of this, as is clearly pointed out by Auzout:

I am very sorry that you are displeas'd at my having printed (at the request of my friends) the letter you kindly wrote to me setting forth the opinions of Mr Hooke. I did not regard this letter as being altogether your own work as much as the reply of Mr Hooke and since both of us had already begun by printing this material I saw no inconvenience in printing the rest if our friends wish'd to see the sequel of the dispute. For I see little difference between printing scientific matters contained in letters and showing these same letters to those learn'd in these matters who can copy them out when they have them on loan, and everyone knows perfectly well that when one exchanges ideas by letter one does not look for eloquent and polished but plain and simple language and that there is a great difference between an eloquent discourse and some treatise which has been written on some occasion for oneself alone which one would never print without the author's permission or a letter which one writes well aware of the fact that it will be shown to many learn'd men... (Auzout to Oldenburg, 23 September 1665, in Oldenburg 1965-1986, II, 518, original in French, translated by the editors)

As it was commonly understood that the knowledge shared by the network through these quasi-public letters would be made visible in the public discourse of the community, some – or parts – of them were read at the meetings of the Royal Society or were published in journals such as the *Philosophical Transactions*. Indeed, Oldenburg often read the contents of the letters that he received at the meetings of the Royal Society, thus transforming his private correspondence into public communication. Here is a direct confirmation of this policy:

When your most welcome letter of 4 January last was lately handed to me by your distinguished relative, I judg'd it altogether proper to exhibit it as soon as possible to our Royal Society so honorably mention'd therein by you and to call the Fellows' attention to your singular goodwill towards them. They received your remarks on their purposes with great pleasure and congratulate themselves particularly on recruiting for their cause a man of so great fame, who promises to enhance the honour and further the business of their Society. (Oldenburg to Hevelius, 11 May 1664, in Oldenburg 1965-1986, II, 186, original in Latin, translated by the editors)

This explains why these letters look like hybrid texts, combining both private and public news: the former (such as personal or family news), commonly placed at the beginning or end of the letter so as to be easily omitted in the copying and sharing phase; the latter (usually located in the central part of the letter) containing the public information to be passed on to other members of the network. As Daston (1991, 371) states, 'The scholarly letter of this period was a peculiar hybrid of the personal and the public, composed with both a particular reader and a general readership in mind'. This is the reason

why communal correspondence has often been referred to as an example of 'semi-public' writing (Chartier *et al.* 1997). As pointed out by Constable (1976), there has been a great change as regards the standards that apply to Early Modern letters compared to contemporary private correspondence: the latter are characterized by spontaneity and privacy, while the former – even when they were considered private correspondence – had a more public status as in the Early Modern period letter writers were aware that their letters were often meant to be read by more than one person. This greater publicity determined closer attention to formal features rather than to spontaneity and intimacy, which implied the adoption of an appropriate style to convey the right level of courtesy and civility. Indeed, the opening of these letters was commonly very obsequious, highly praising the addressee and placing the writer in a humble position. They often continued with a sign of solidarity (such as an enquiry about the addressee's health and stating one's good health or the memory of a previous meeting) thus expressing Positive Politeness (in Brown and Levinson's [1987] terms) and only then formulating the request (a Negative Face-Threatening Act). For example, in the following quotation, Lister's request to Oldenburg to help him defend his credibility and fair behaviour is preceded by praises of the interlocutor and memories of their first meeting:

Sr. I presume from your Civilitie (wch I did well understand yt moment I had ye hap-
pinesse to kisse your hands wth Mr Skippon at your house in London) & prudence,
yt if such Note be printed... noe unhandsome reflection will be made upon me or
anything detracting from my credit in suffering my notes to be published. (Lister to
Oldenburg, 9 August 1670, in Oldenburg 1965-1986, VII, 105)

This sequence would be followed by further forms of solidarity or some act of self-deprecation demonstrating Negative Politeness – e.g. a self-deprecating formula such as *your servant* or *your slave* – meant as an act of redress. For instance, the quotation above is completed by the offer to continue correspondence on a regular basis – mitigated by the use of several modalising elements such as *venture, may, happen, not altogether* – and a final formula expressing humility:

This Letter I venture to send to you by Mr Martin your printer at ye Bell: but if you
please to send me how I may direct a Letter to you & to entertain a correspondence
wth me, I happen upon something now & than wch may not be unwelcome to you
& I am at present not altogether unfurnished of such matters I am

Your humble servant

Martin Lister. (Lister to Oldenburg, 9 August 1670, in Oldenburg 1965-1986, VII, 105)

First and second person pronouns were often used to refer to the writer and the addressee. The tone was polite and the style in line with the 'civil' style used also in the other types of contributions. In this, the letter was facilitated

by the fact that this text type was the one that most resembled conversation in highlighting politeness values (Klein 1994).

The role of people such as Oldenburg and Mersenne was not merely passive but also active, as they did not limit themselves to receiving correspondence but also requested news and views from their correspondents. Moreover, in many cases Oldenburg started corresponding with important foreign scientists – such as Hevelius from Danzig and Malpighi from Bologna – even without being instructed to do so by the Society's Council. The important role played by Oldenburg in stimulating the start of epistolary communication with an innovative experimenter is well highlighted by Boas Hall in the case of Newton:

It must be remembered that without Oldenburg, Newton would never have published his early optical papers, which Oldenburg extracted from him by skilful praise, report of the Royal Society's appreciation (first of his reflecting telescope, then of his first paper on light and colours of 1672) and communication of others' reactions. All this was cleverly done and elicited from Newton valuable clarifications of his ideas. (Boas Hall 1975, 181)

The vastness of Oldenburg's exchange of letters is confirmed by his contemporaries. According to Martin Lister, a biologist who belonged to the Royal Society network:

[Oldenburg] held Correspondence with seventy odd persons in all parts of the World, and those be sure with others; I ask'd him what Method he used to answer so great a variety of subjects, and such a quantity of Letters as he must receive weekly; for I know he never failed, because I had the honour of his Correspondence for Ten or Twelve Years. He told me he made one Letter answer another, and that to be always fresh, he never read a Letter before he had Pen, Ink and Paper ready to answer it forthwith; so that the multitude of his Letters cloy'd him not, or ever lay upon his hands. (Quoted in Oldenburg 1965-1986, I, xvii-xviii)

Oldenburg's role was not limited to providing foreign scientists with news, but also to act as an intermediary between foreign scientists and English ones, informing them of one another's activities and opinions. Sometimes foreigners contacted Oldenburg directly to learn more about the current work of an English scientist and would then receive some news from him. The reverse also occurred with English fellows contacting Oldenburg with enquiries, requiring him to write letters to experts abroad. The vastness of these intermediary activities is confirmed by Oldenburg himself in his account of 'The Business of the Secretary of y^e R. Soc.'. Referring to himself in the third person, he writes:

He... writes all Letters abroad and answers the returns made to ym entertaining a corresp. wth at least 50. persons; employes a great deal of time, and takes much pains in inquiring after and satisfying forrain demands about philosophicall matters, disperseth farr and near store of directions and inquiries for the society's purpose, and sees them well recommended etc. (Quoted in Boas Hall 1965, 290)

As Secretary of the Royal Society, Oldenburg often read the contents of his 'official' correspondence, particularly about new theories and experiments, at the Society's meetings. These were considered of great interest by the Fellows, who debated them by adding their own considerations and experimental accounts. Oldenburg's role as the centre of this correspondence network was not at all neutral. At times he either mediated between contrasting views or did the reverse, stimulating debate and even arousing conflict, as in the case of the prolonged controversy over comet observation and theory, involving exchanges between both Auzout and Hooke and Auzout and Hevelius (Boas Hall 1991, 58). Moreover, his role in promoting a wide *commerce de lettres* brought him a certain status, as he was the kingpin in the correspondence network. As Goldgar (1995) aptly remarks: 'The wider the *commerce* of a scholar, the greater his status, both because he clearly had the respect of many colleagues, and because his extensive network of contacts allowed him to procure assistance for many 'subordinates' in the community' (1995, 30).

2. *Sharing Information*

The main function of these letters was to convey or require information about one's own or other people's work. Letters were circulated in order to make known some new idea or discovery to other members of the learned community or to present some personal observations concerning interesting or unusual events worthy of notice. This sharing of opinions and experience confirms the high degree of cooperativeness existing in the community, which derives from the Baconian principles aiming at the construction of a strong base of empirical knowledge from which generalizations could then be drawn. Every scientist tried to have a correspondent in the major scientific centres of Europe so as to be able to exchange news and opinions with them. They often initiated the correspondence as they were eager to learn more and possibly share in the work of the foreign group or because they were interested in a particular subject or needed some specific information. Although keeping a large correspondence was time-consuming, they preferred to do so as it was often the best way to know what was happening elsewhere in the world. Books recorded only completed results and therefore took years to appear; moreover, it was often difficult to find out what books had been published on a specific topic. The use of correspondence offered several advantages to researchers:

Unlike weekly meetings of the Society, correspondence allowed geographically remote individuals to engage in, and with, the new sciences. While publication and distribution of the *Philosophical Transactions* certainly contributed to the diffusion of knowledge, it did not provide for the flexibility, openness, manoeuvrability and relative rapidity of interaction that correspondence did. In short, the Society's correspondence encouraged a more participatory science. (Rusnock 1999, 156)

The main topic dealt with was 'natural philosophy', or science and technology in our terms (the word *science* had not yet acquired its contemporary meaning; cf. Banks 2004). Some of the news were mere observations of strange facts or unusual events that the author considered interesting in order to arouse some considerations and explanations from his correspondent(s). Very often such descriptions concerned monstrous creatures, as can be seen in the following letter:

I shall scruple to dispatch to you the Account I have now receiv'd of a Monster, yt was lately brought forth, & may probably be yet alive at Salisbury... On Tuesday night last, there was borne in Fisherton adionying to our Town of Salisbury a Monstrous Issue in part, the Woman has three Children Grles, ye one very well formed & fatt, the other two as you may call them hath but one Body, continued handsomely to their shoulders, from whence growth foure Armes compleatly made, two Necks & two heads very well featur'd, wth all ye parts, but they are contrary posited, one at one end of ye Body & ye other at ye other, out of ye side there is a Belly, Navell, a Woman's part, & one Fundament, & two compleat Leggs, & thighs, feet & Nayles... (Boyle to Oldenburg, [?] 30 October 1664, in Oldenburg 1965-1986, II, 277)

As can be seen from the passage quoted above, although the facts reported denoted exceptionality and unnaturalness, their descriptions tended to be sober and neutral, as they were reported not simply to arouse interest, but mainly for epistemological and cultural reasons (Daston 1998). For this reason, these monstrous accounts were often made more reliable by the mentioning of the names of direct witnesses and of their professional qualifications. Indeed, in the letter above, Boyle specifies that the account had been reported to him by 'Dr Turbervill, a person deservedly famous in those parts for being an excellent Oculist'. Moreover, many of these accounts reflected the specialized nature of the writer as they frequently made use of highly precise terminology and often followed a well-organized structure, resembling that of an experimental account (cf. Gotti 2003, chapter 9). The objectivity of the account was also guaranteed by the faithful and neutral attitude of the correspondent transmitting the news. Indeed, in introducing his report Boyle states: 'But not having been an Eye wnesse my Selfe, all yt I can doe is faithfully to transcribe ye Relation sent me from ye Place where ye Monster was borne, in ye very words of ye Relators' ([?] 30 October 1664; in Oldenburg 1965-1986, II, 277).

On receiving a letter with some news about recent experiments, Oldenburg would soon reply providing the correspondent with further news about similar research taking place elsewhere, thus serving as an important kingpin in the dissemination of scientific information. For example, on receiving a letter from Hevelius about his astronomical observations by means of a telescope, he answers in this way:

We are in great hopes of seeing major advances in astronomy as the way of making telescopes is being perfected day by day. No doubt you have already heard of what is

being done at Rome, where such instruments are said to be made solely by means of a lathe, without any form... A new way of polishing lenses exactly is being worked upon by a certain famous Englishman, a fellow of the Royal Society, which is soon to be examined and tested. It consists in this... (Oldenburg to Hevelius, 13 November 1664, in Oldenburg 1965-1986, II, 306, original in Latin, translated by the editors)

Oldenburg used his letter network to stimulate his correspondents to send him news about their work. He often did so in a very insistent way, putting pressure on his interlocutors:

I cannot conclude this letter without urging on you again and again the publication of those matters which you have yourself ruminated upon. I shall never cease to urge you until you grant my request. Meanwhile, if you were only willing to disclose to me certain chapters of their contents, oh! how I should love you, and how closely bound to you I should consider myself. (Oldenburg to Spinoza, 31 July 1663, in Oldenburg 1965-1986, II, 100, original in Latin, translated by the editors)

The distribution of letters stimulated the establishment of valuable cooperation among experts, as is explicitly recognized by Halley himself in the following passage concerning his first personal acquaintance with Wallis:

I delivered the letter you entrusted me with to Dr. Wallis, who entertained me very kindly, and I had a great deal of discourse of an astronomical nature with him; and he, at my departure, told me he would gladly see me some other time; wherefore I reckon myself much engaged to you, for giving me [the] opportunity to come to the knowledge of a man I so much esteem. (Halley to Oldenburg, rec. 10 July 1676, in Rigaud 1965, I, 230)

This sharing of information enabled correspondents to compare their views and findings to those of distant colleagues, and integrate them with their own in the interpretation of complex phenomena, which often led to innovative theoretical conclusions. To highlight the great importance of epistolary communication in the elaboration of a new scientific theory or the creation of specific technical equipment, Boas Hall provides the following account of the development in the field of pneumatics:

The initial impulse for the first water barometer came from the reading of Galileo's *Discorsi* by members of a group in Rome, who wished to test the statement that suction pumps would not lift water more than thirty feet because that was the length of a column of water which could hold together (or, alternatively, be supported by air); but the plans for the experiment, the dissemination of its success, the suggestion for the substitution of mercury for water which led to Torricelli's experiment, the transmission of his results, and of Pascal's subsequent Puy-de-Dôme experiment – all these depended upon a network of epistolary communication quite wonderful in its achievement, for within a very few years, without the publication of a single printed

book, this important development in physics was known from Rome (where it began) eastwards to Warsaw and northwards to Sweden, and had been extensively discussed in France and England. (1975, 176)

Letters were also used as a means for gathering facts and observations on a systematic basis from correspondents based in various parts of the world. For this function, Oldenburg – acting on behalf of the Royal Society – played an important role. Here are two extracts from the letters he sent to Richard Norwood in the Bermudas and to John Winthrop in Connecticut to stimulate their contributions regarding some specific astronomical observations:

The R. Society, persuaded, Sir, of yr ability and willingness to make such Observations, not doubting you to be furnisht wth instruments necessary for it, have commanded me to desire you, to observe wth all, possible exactness ye mentioned Conjunction, and to acquaint ym with yr performances therein. If yr generosity invite you to adde hereunto, what in and about yriland occurs considerable for ye enriching of ye History of Nature (whose composure is one of ye maine things, they have in their Eye) it will be a very good service to ye Commonwealth of Learning, and a thing most acceptable to ye R. Society, and particularly obliging to

Sir

yr very humble and affect. servt

H. Old.

(Oldenburg to Norwood, 6 March 1663/4, in Oldenburg 1965-1986, II, 146)

The sd Society being persuaded both of yr ability and willingness to make such Observations, and not doubting, you to be furnisht wth instruments necessary for it, have commanded me to desire you, to observe wth all possible exactnesse ye mention'd Conjunction, and to acquaint ym with yr performances therein. (Oldenburg 26 March 1664, in Oldenburg 1965-1986, II, 149)

In this way, the great potential of letters to link people from very distant parts of the world was fully exploited. The advantages of the use of correspondence as a scientific method soon became evident and were at the basis of the creation of several international projects mainly in the field of meteorological observation (Frisinger 1977).

3. Promoting Experimental Practices

Seventeenth-century experimenters were fully convinced of their innovative approach and were willing to convince the rest of the world of its validity. There was a general wish to spread the great epistemological and methodological innovations of that period (Vickers 1987; Hunter 1989; Jardine 1999; Shapiro 2000) and to socialize the discoveries made and the new ideas developed, also thanks to a collaborative spirit which inspired seventeenth-century scientists, in

contrast to the individualism that characterized philosophers in the Renaissance period. Scientists therefore wrote to colleagues around the world explaining their aims and pointing out the advantages of their research methodology. An example is the following extract from a letter written by Oldenburg to Van Dam:

It is our business, in the first place, to scrutinize the whole of Nature and to investigate its activity and powers by means of observations and experiments; and then in course of time to hammer out a more solid philosophy and more ample amenities of civilization. I set the whole matter before you briefly, for your information. Indeed I seriously urge all who perceive its importance to unite in aiding and perfecting it as best they can, and to work towards it assiduously so that at last, abandoning fictions and shadows, we may attain to knowledge of things as they are. (23 January 1662/3, in Oldenburg 1965-1986, II, 14, original in Latin, translated by the editors)

Letters were thus used for a proselytizing purpose, particularly by those people who found their proper identification in the newly-founded Royal Society. The members of this select group often took advantage of the writing activity to inform others of the new principles they shared and to gain their consensus. Indeed, many of Oldenburg's letters were written to people active in research and experimentation in order to present the purposes of the Royal Society and stimulate their contribution and feedback. Here is the beginning of a letter to Richard Norwood:

Sir,

I am apt to believe, you may have heard, yt his Majty hath not long since founded a Corporation of a number of Ingenious and knowing persons, by ye Name of ye *Royall Society of London for improving Naturall knowledge*, whose dessein it is, by Observations and Experiments to advance ye Contemplations of Nature to Use and Practise, and to render ym more serviceable for ye necessities and accommodations of ye Life of Man. Such a Foundation being laid, ye persons thus incorporated Judge it very conducive to their purpose, to bespeake and engage all sorts of intelligent and publick-spirited men, to contribute, what they can, to so Noble and Usefull a Work. (Oldenburg to Norwood, 6 March 1663/4, in Oldenburg 1965-1986, II, 146)

Communal correspondence had an important socializing function. Letters were written not only to exchange information, but also to promote new professional relationships and to strengthen existing links, thus favouring the formation of a new scientific community. Scholars belonging to the Royal Society considered themselves to be part of a select group of people, separating themselves from the less learned group of non-scientific practitioners. Some of the features characterizing the members of the new scientific community can be found in the following extract from a letter sent by Gascoines to Oldenburg, in which the qualities of Isaac Newton and Francis Line – although presented as adversaries from a theoretical point of view – are extolled:

Therefore in this let us suppose them equal; that they were both great scholars in their kind; great lovers of truth and haters of contest for itself; that both trusted to nothing but to their eyes and experience, nor delivered any thing but what they thought they had truly found. (15 December 1675, in Rigaud 1965, I, 223)

An important aspect of this proselytizing activity concerned the methodology to be adopted in research and experimentation, which emphasized direct experience and personal observation. Communal correspondence was often meant to encourage the readers to perform the experiments themselves. Apart from this emphasis on experimental activity, another important aspect of the new scientific approach consisted in the need for both the procedures and the results of these experiments to be made known to the entire learned world. The publicity given to the work of the members of the Royal Society would further distinguish them from the group of alchemists, who considered secrecy one of the main characteristics of their research method. This explains the wish, often expressed very strongly, that researchers should publish the results of their enquiries:

We therefore suggest that we have often heard that the worthy and learned Mr. Barrow hath divers treatises in a good forwardness for the press, and some of us have lately seen his Treatise of Optics, which he prepared to deliver in to the former Vice-Chancellor, as his anniversary lectures, according to the laudable constitution or injunction laid upon your mathematic professor; but we fear the author's modesty is such that he will not promote the publication thereof, unless excited thereunto... We are induced to believe that length of time, and the persuasion of friends, may hereafter prevail with the said Mr. Barrow to publish some other good books by him intended, as his Comment on Archimedes, on the Spherics, his own Perspective, Projections, Elements of Plane Geometry... (Oldenburg to Baldroe, in Rigaud 1965, I, 137-138)

These new researchers were convinced that many natural philosophers in the past had been anxious to provide explanations and theories before having enough evidence to base them on, and emphasized therefore the need for an experimental approach, so as to collect abundant data from which correct generalizations could be derived. This new approach was often pointed out in the letters exchanged between natural philosophers, who frequently emphasized the basic criteria this approach was based on and invited their colleagues to pass on their ideas to other people working in specialized fields:

Our motto being *Nullius in verba*, we intend to examine these propositions by making tryals ourselves of the matters asserted therein; and ye Author of ym [i.e. Huygens] is to be urged to explicate, how he infers his universall measure from what he affirms here. (Oldenburg to Boyle, 20 October 1664, in Oldenburg 1965-1986, II, 264-265)

The sense of belonging to this community often stimulated the writer not only to comment on the methodology and instruments employed by others,

but also to describe his own so as to suggest practical and concrete ways in which the experiments commented on could be improved:

And in particular I have wished that those sextants, at least, he makes use of for measuring the distances of stars, were furnished with telescopical sights, which is no small advantage for regulating and assisting the sights, which if he desires it, I shall be most ready to gratify him with any information, that the small experience I have in those things will furnish me with. The largest glass I have several times made use of, is a spherical lens, convex on both sides, of a sphere whose radius is 60 feet, and the focus or length of the glass is near about the same length... The tube I make use of is about 66 or 68 feet in length, and consists... I have inquired the lowest rate any such object-glass will be sold for, and find it will not be afforded for less than twenty-five pounds sterling, and the eyeglasses will cost forty or fifty shillings more. If Mr. Hevelius desire any, upon his signifying his mind to me, I shall endeavour to get him the best that can be made here, and at the lowest rate. (Hooke to Hevelius no date, in Rigaud 1965, I, 180-182)

4. *Joining and Widening the Community*

Joining a letter network was often considered the first step to be admitted into a select group or an exclusive circle. The scholar, especially if young and inexperienced, would approach the correspondent in a humble way. For example, this is how Leibniz addresses his first letter to Oldenburg:

Pardon the fact that I, an unknown person, write to one who is not unknown; for to what man who has heard of the Royal Society can you be unknown? And who has not heard of the Society, if he is in any way drawn to an interest in true learning? (13 July 1670, in Oldenburg 1965-1986, VII, 64)

The writer would then introduce his work and interest and subsequently ask specific questions on a particular aspect relating to his research. When approaching a famous scholar for the first time, the person aspiring to be included in his elite circle would write a very elegant and flattering letter, lavishing great compliments on his interlocutor. This high degree of esteem was reflected in the frequent use of positive adjectives referring to personal qualities such as *celebrated*, *expert*, *great*, *industrious*, *ingenious*, *learned*, *worthy*. The use of titles and honorific adjectives was not only a way of expressing deference but also of claiming in-group membership by using terms of endearment (Raumolin-Brunberg 1996, 175):

Noble and famous Sir, my greatly-honored Patron, while my bold vessel, its anchor weighed, ventures upon the ocean waves it trusts itself to the lucky stars, that the glowing Oebalian brothers, Pollux and lucky Castor, may shine in their twin splendor. You, dear Oldenburg, are the star in the Illustrious Experimental Society's serene

firmament, to which my little bark looks as a protector. It was you, along with Mr Haak, who beamed benignly upon my fellow-countryman Ms Jacobi when he was in London last year and, at the behest of our renowned senator, Mr Hofmann of Hofmanswaldau, enquired about the genesis of the Illustrious Society. In so doing you shed some rays on me, absent though I was... You promised, renowned Sir, munificence in the communication of experiments... I beg for it most earnestly... (Sachs to Oldenburg, 12 January 1664/5, in Oldenburg 1965-1986, II, 345, original in Latin, translated by the editors)

Scientists were very eager to be accepted within the community, particularly in those circles, like the Royal Society, that had attained a high reputation. As can be seen in the following letter, in order to be admitted they would write to Oldenburg and present their case in a very humble tone:

And therefore this is my best season, & best agreeing with the integrity & candor of my hearte, to offer my selfe by yr Mouth a Supplicant, That as yr Honble Society of their kindnesse & without my suite is pleas'd to admit mee a Member, soe at my requeste they wilbe further pleas'd to bestowe on mee the priviledges of the same fellowship. In wch I have noe other ayme then wth freedome, & under their Countenance to offer to their Teste the various kinds of thirtee years studies in practicall philosophy, wth chiefe endevors for generall accommodations... Sir, I must noe further trouble you with this requeste. That yu present mee to my most obliging friends, as most ready to serve them & all Mankind in every capacity. (Beale to Oldenburg, 15 January 1662/3, in Oldenburg 1965-1986, II, 6-7)

Also the practice of sending letters with travellers, instead of through the post, favoured the enlargement of the community, as it enabled the bearer of the letter to meet the recipient and thus give him the possibility of introducing himself and of informing his addressee of his activities and interests. As Goldgar rightly asserts:

This means of establishing scholarly relations was a common one in the learned world. One service a scholar could do for another was to write letters of introduction for him to take on his travels. The recipient of such a letter would be enjoined to show hospitality to the bearer, including introducing him to other savants; thus one or two people in each location might serve as nodes for an ever-expanding network of acquaintance. (1995, 24)

The direct delivery of letters stimulated the establishment of valuable cooperation among experts, as is explicitly recognized by Halley himself in the following quotation concerning his first personal acquaintance with Wallis:

I delivered the letter you entrusted me with to Dr. Wallis, who entertained me very kindly, and I had a great deal of discourse of an astronomical nature with him; and he, at my departure, told me he would gladly see me some other time; wherefore I reckon myself much engaged to you, for giving me [the] opportunity to come to the

knowledge of a man I so much esteem. (Halley to Oldenburg, rec. 10 July 1676, in Rigaud 1965, I, 230)

Besides, providing the chance of initiating a new relationship between the traveller and the receiving scholar, this type of letter would also strengthen the bonds of cooperation and friendship between the writer and the addressee. The important role played by communal correspondence in enlarging the scientific community was often highlighted by Oldenburg himself. For example, in writing to Leibniz' patron, Baron von Boineburg, he expressed his wish:

That those who excel in... the sciences in our Germany would... imitate the example of England, France and Italy herself in turning to experiments. What we are about is no task for one nation or another singly. It is needful that the resources, labours, and zeal of all regions, princes and philosophers be united, so that this task of comprehending nature may be pressed forward by their care and industry. (10 August 1670, in Oldenburg 1965-1986 VII, 107)

This zealous spirit of information sharing was considered a fundamental step for the improvement of knowledge:

For it is our business, having already established under royal favor this form of assembly of philosophers who cultivate the world of arts and sciences by means of observations and experiment and who advance them in order to safeguard human life and make it more pleasant, to attract to the same purposes men from all parts of the world who are famous for their learning, and to exhort those already engaged upon them to unwearied efforts. Indeed, friendship among learned men is a great aid to the investigation and elucidation of the truth; if such friendship should be spread through the whole world of learning, and established among those whose minds are unfettered and above partisan zeal, because of their devotion to truth and human welfare, philosophy would be raised to its greatest heights. (Oldenburg to Hevelius, 18 February 1662/3, in Oldenburg 1965-1986, II, 27, original in Latin, translated by the editors)

Correspondence was also seen as a stimulus to other people's sharing views and experiences. As Hall and Boas Hall aptly point out:

Most scientists believed... that the best way to persuade a reluctant scientist to state his views publicly was to let him know what others were doing. Often it was thought expedient not only to let X know Y's scientific ideas, but also to let X know what Y thought of X's ideas. This was a sure way to persuade X to speak out, and to develop his own theories more fully and carefully. (1965, xxii)

Scholars were pleased to cooperate with and do favours for people that were part of their community. Services and their return formed an ethic for polite society in that period (Goldgar 1995). People were asked for favours not only as scholars but also as gentlemen.

5. *Defending Oneself from False Accusations*

The writing of a letter to be made public was sometimes prompted by the author's need to defend himself against accusations from adversaries or possible attacks from public authorities. This is the case, for example, of the letter written by Denis to Oldenburg (and then published in the *Philosophical Transactions*) describing a case of blood transfusion in a period in which such procedure was considered very risky. In this letter, Denis provided a lengthy and detailed account of the transfusion of calf's blood to a mentally ill patient, who subsequently died. The letter was thus meant to defend the author's personal and professional reputation. This is the reason why at the beginning of the letter, the writer clearly stated that the practice of transfusion was not prohibited by the Magistrates of London and that this operation had been carried out successfully in many cases:

Sir, you have sensibly obliged me to have assured me by your Letter of April 29, that the Magistrates of London had not at all concern'd themselves to prohibit the Practice of the Transfusion of Blood, and that that operation had been hitherto practiced with good success on Brutes, and without any ill consequence on man. (*Philosophical Transactions* 1668 III, 710-723)

Letters could also serve in case of controversy. The author would reject criticisms in a firm but polite way. This is shown by the frequent use of hedging expressions, as highlighted in the following extract:

Sir,

Together with my most hearty thanks for the favour you were pleased to do to me, in sending me an Epitome of what had been by the ingenious Monsieur Auzout animadverted on a description, I had made of an engine for grinding spherical Glasses, *I thought my self obliged*, both for your satisfaction, and my own Vindication, to return you my present thoughts upon those Objections. The chief of which *seems to be* against the very Proposition itself: For *it appears*, that the Objector is *somewhat* unsatisfied, that I should propound a thing in Theory, without having first tried the Practicableness of it. But first, *I could wish* that this worthy Person had rectified my mistakes, not by speculation, but by experiments. (Hooke to Oldenburg, [?] May 1665, in Oldenburg 1965-1986, II, 383, my emphasis)

Also the reply to this self-justification – which expresses further perplexity and disagreement – is formulated in a highly polite and cooperative tone:

He will please forgive me then if I continue to doubt the worth of his machine in spite of his reply and if I wait until he has made it work before retracting what I said in my comments... But *I feel myself obliged* for the sake of the truth and in order to explain some places which Mr Hooke has not interpreted according to my meaning to make some comments on his reply, in approximately the same order, *which I shall try to do*

as briefly as possible. (Auzout to Oldenburg, 22 June 1665, in Oldenburg, 1965-1986, II, 419, original in French, translated by the editors, my emphasis)

The role played by Oldenburg in these controversies was that of the intermediary, who however was not totally passive but acted as a sort of referee highlighting the rules of polite conversation that should be followed by gentlemen when they disagreed in their views or argued over experimental results:

Mr Hooke salutes you, and affirms that he is very particularly obliged to you for your conduct towards him, in the letter you addressed to me. Surely, Sir, it is indeed the right way to manage a correspondence between two worthy men and fine minds, when each expresses to the other his thoughts and discoveries in a frank and polite way, without offence given or taken, so that their minds may reciprocally stimulate each other and learn from each other, to the further progress of knowledge. If you please to continue in such conduct towards the author of *Micrographia* (who is certainly very learned in mathematics and mechanics) I can promise you that you will find him free and generous in acknowledging your civilities, and capable of recompensing you for the discoveries you may please to communicate to him. If you wish, I will be the go-between, since you do not know enough English to write to him nor he enough French to reply. (Oldenburg to Auzout, 23 July 1665, in Oldenburg 1965-1986, II, 441-442, original in French, translated by the editors)

In their correspondence seventeenth-century scientists were very keen to point out that *ad hominem* accusations should be avoided and that respect should always be paid even to those with whom one disagreed. What distinguished a gentleman's behaviour, therefore, was his respect for the person whose views he was criticising and his limiting his objections to the points he saw as incorrect without any unfair recourse to excessive aggressiveness. According to this view, *ad hominem* argument was deemed unacceptable, as criticism should be directed towards the debated matter rather than the opponents:

My dessein in all, I write, being none else but ye search the Truth, without prepossessing myselfe either for my owne conceptions, or against those of others, (as I think every Philosopher ought to doe) me thinks, yt ye true means of succeeding therein, is, to explain as cleerly as we can our thoughts; and when we are obliged to combat with those of others, to doe it without ay offensive expressions. (Auzout to Oldenburg, 12 August 1665, in Oldenburg 1965-1986, II, 468, original in French, translated by Oldenburg)

The civility of a scientist's behaviour could also be seen from the way in which, even when objecting to a certain methodological supposition, he was grateful to the person who expressed it. Indeed, in the course of the discussion the contestants kept repeating that the purpose of their objections was to clarify their own positions and not simply to quarrel. To soften the tone of the divergence of opinions, the writer frequently made use of hedging expressions, as can be seen in the use of *it appears* and *he seems* in the following passages:

For it appears, that the Objector is somewhat unsatisfied, that I should propound a thing in theory, without having first tried the Practicableness of it. (Hooke to Oldenburg, [?] May 1665, in Oldenburg 1965-1986, II, 383)

I have Mr Branker's (accompanied with sheet X) wherein he seems not fully to understand my meaning, which, that it may not be mistaken, I shall here more fully enlarge. (Collins to Pell, 9 April 1667, in Rigaud 1965, I, 125)

The civility that scientists adopted in their discussions is also shown by their natural way of presenting opinions and evaluating objections in a cooperative and respectful atmosphere. Indeed, the 'challenged' author usually showed his cooperative attitude by trying to make his points clearer:

Next, I have this to answer, that (though I did not tell the Reader so much, to the end that he might have the more freedom to examine and judge of the contrivance, yet) it was not meer Theory I propounded, but somewhat of History and matter of fact: For, I had made trials, as many as my leisure would permit, not without some good success. (Hooke to Oldenburg, [?] May 1665, in Oldenburg 1965-1986, II, 383)

If necessary, the 'challenged' author would provide further testimony to support his argumentation:

Thus I hope I have cleared those doubts, which may be thought considerable, in that little treatise I gave you. In it I affected brevity as much as possible, as knowing that it most respected the learned in astronomy; and to all such I doubt not, but what I here send you will be a sufficient demonstration. (Halley to Oldenburg, rec. 10 July 1676, in Rigaud 1965, I, 235)

The adoption of a 'civil' style thus implied that the scientist should always be open to criticism and willing to reconsider his conclusions once it had been proved to him that other theories were more convincing than his. The correct behaviour of the parties involved in a controversy is clearly underlined in their correspondence, where they emphasized that in this way they were contributing to the growth of scientific knowledge:

You will judge my sincerity, Sir, by this discussion, and will oblige me by testifying to it with Mr. Hooke whom I hold in high esteem, and if I have written that he wanted to discover animals in the moon, I did not think I was putting words in his mouth after what he had written in his preface and repeated in his reply and which you repeated again in your letter. However this may be, I assure you that everything has been done in the interest of discovering truth, without any thought of profit from my ideas or his replies. (Auzout to Oldenburg, 25 September 1665, in Oldenburg 1965-1986, II, 518, original in French, translated by the editors)

The polite tone, however, would not prevent the writer from expressing his criticism with frankness. This too was considered to be part of a sincere relationship and honest behaviour:

For I judged that I would be ill-advised to keep absolute silence on these points when replying to you. Yet to praise those things which pleased me little would be nothing but sheer flattery, which I consider most dangerous and pernicious in friendship. I therefore decided to open my mind to you very frankly; and I thought that nothing would be more welcome to philosophers than this. (Oldenburg to Spinoza, 31 July 1663, in Oldenburg 1965-1986, II, 96, original in Latin, translated by the editors)

Sometimes criticism was expressed in an indirect way, with the critic conveying his negative evaluation to others but not wishing the object of criticism to be aware of the source of criticism. This is the case in the following letter:

My mention of Mr. Mercator puts me in mind of a thing, which may be acceptable to you, that is, that... in his example of Cassini's and his own method, whereby he would shew the insufficiency of Dr. Ward's theory, he hath mistaken in his calculus, and neglected to account for the motion of the aphelion... If you shall think fit, you may let Mr. Mercator know as much; but I desire that, if you do, you would please to conceal my name. (Halley to Oldenburg, rec. 10 July 1676, in Rigaud 1965, I, 227)

6. *Claiming Precedence*

Letters were also used to solve conflicts and disputes over priority. Indeed, many of Oldenburg's correspondents made use of his letter network as they considered it an excellent system for making an official claim to experimental precedent. See, for example, the exchange of letters in the period 1669/1671 between Lister, Ray, Hulse and Oldenburg over who first reported the way in which spiders cast their threads, examined in detail by Valle (2003). Ray and Lister had been corresponding about the results of their observations of spiders, but only Ray had been able to report such results to the Royal Society. Lister therefore decided to write to Oldenburg, the Secretary of the Royal Society, to claim the same right as Ray to be held responsible for these discoveries:

This Sr, is ye truth of ye business; wch Mr Wray will not deny & his letters will sufficiently evidence: yt ye observation is as well mine, as his, from whom Me Wray had first notice of it & yt I was not in ye least beholden to him for it: but yt I writ it to Mr Wray, not as a thing altogether unknown to him, but to confirme & enlarge it by ye addition of my owne observations. (Lister to Oldenburg, 9 August 1670, in Oldenburg 1965-1986, VII, 105)

For the fulfilment of this important function of publicising innovative results and thus attributing official recognition and granting a patent of originality to their authors, Oldenburg openly proposed himself as a public certifier:

I acknowledge, yt yt yealousy, about the first Authors of Experiments, wch you speak off, is not groundlesse: And therefore offer my selfe, to register all those, you or any

person shall please to communicate, as new, wth yt fidelity, wch both of ye honor of my relation to the R. Society (wch is highly concernd in such experiments) an my owne inclinations doe strongly oblige me to. (Oldenburg to Boyle, 29 August 1665, in Oldenburg 1965-1986, II, 486)

The detailed and accurate description of a personal scientific experience was considered one of the requisites for transforming a personal account into an official protocol to be submitted to the broad community of men of science. Indeed, the establishment of priority in discoveries often led to acrimonious disputes and made the assertion of one's priority a face-threatening act, particularly in those cases in which an unfair attempt to attribution had been deliberately made. In such cases, the careful and objective narration of one's experiments could instead provide the materials for proper scrutiny and reliable judgement, and thus permit the transformation of personal results into facts widely accepted by the scientific world. Having obtained in this way the consensus of a wider public, experimental data could then become 'matters of fact' and part of scientists' shared culture.

7. Conclusion

The analysis carried out in this article has shown the great variety and importance of the functions performed by scientific communal correspondence in seventeenth-century England. Indeed, in the early phases of the dissemination of specialized discourse, the letter was the predominant form of scientific communication. However, the communicative role of this writing activity was not merely limited to the informative aspect. Scientific communal correspondence also fulfilled other important goals linked to socialization purposes, favouring the creation of a spirit of solidarity among the members of a new social group sharing innovative intellectual interests and professional practices. By providing a relatively inexpensive channel of communication, scientific communal letters helped scholarship and encouraged scientists to publicize their work, thus favouring the growth of the sciences themselves.

In the following decades, scientific communal correspondence was almost totally substituted by the scientific journal, which evolved as a means of dissemination of specialized news. However, although greater emphasis was given to news items and experimental accounts, letters continued to thrive and be published in specialized journals. In particular, correspondence with Oldenburg continued also after the foundation of the *Philosophical Transactions* as the writers hoped their letters and reports would be published in the journal. They often adopted a curious fiction, continuing to write letters to him but with an eye to publication, although not overtly mentioning this possibility in their correspondence. In this way, the popularisation of epistolary communication greatly favoured the advancement of science by disseminat-

ing those new patterns of scientific communication that were required by the specialized community that had formed in England in the seventeenth century.

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