

Chapter Five - Public Participation and Representative Science

Taking over the *Pennsylvania Gazette* from Samuel Keimer in October of 1729, Benjamin Franklin informed the public of an impending change in the format of the paper. He intended to eliminate the weekly installment from *Chamber's Cyclopedie*:

The *Pennsylvania Gazette* being now to be carry'd on by other Hands, the Reader may expect some Account of the Method we desire to proceed in. Upon a View of Chamber's great Dictionaries, from whence were taken the Materials of the Universal Instructor in all Arts and Sciences, which usually made the First Part of this Paper, we find that besides their containing many Things abstract or insignificant to us, it will probably be fifty Years before the Whole can be gone thro' in this Manner of Publication.¹⁴⁸

Excerpts from Chamber's great dictionaries had been the front-page article for the past year. Keimer had taken seriously his promise to adhere to the promise of the paper's original title, *The Pennsylvania Gazette or Universal Instructor*. In the October 1, 1728 broadsheet advertising the newspaper, Keimer had vowed to capture and deliver essentially the whole of enlightenment thought, especially those of the arts and sciences, and principally through *Chamber's Cyclopedie*. Keimer wrote that the imminently published weekly subscription newspaper would:

. . . contain at Times, the Theory of all Arts, both Liberal and Mechanical, and the several Sciences both humane and divine, with the Figures, Kinds, Properties, Productions, Preparations of Things natural and artificial; also the Rise, Progress and State of Things Ecclesiastical, Civil, Military and Commercial, with the several Systems, Sects, Opinions among Philosophers, Divines, Mathematicians, Antiquaries, &c. after an Alphabetical Order, the whole being the most compleat body of History and Philosophy ever yet publish'd since the Creation, containing among many Thousand other Things, such as the following;

Agriculture, or the Tillage and Improvement of Soil, Clay, Sand, Earth, &c.
Algebra, or the Doctrine of Aequations, Simple, Quadratick, Cubic, &a.
Analyticks, or the Resolutions of Problems, by Spicies, or Symbolical Expressions.
Anatomy, or a Description of animal Bodies and their Parts.
Architecture, including the Construction of Building.
Astronomy, or the Doctrine of the Heavens.
Chronology, or the Doctrine of Time.

¹⁴⁸ *Pennsylvania Gazette*, Oct 2, 1729. For the remainder of the dissertation I will use the original spelling and grammar of the colonial American newspaper articles.

Chymistry, including the Use of Fire, Water, Baths, Menstruums, Furnaces, Retorts, &c.

Commerce, or the Affairs of Merchandise.

Dialling, including the Furniture, and Projection of Dials, Horizontal, Declining, Reclining, &c.

Ethicks, or the Consideration of Natural Inclinations, Passions, Tastes, &c.

Gardening, including the Culture of Herbs, Flowers, Fruits, &c.

Geography, including the Doctrines of the Earth or Globe, its Circles, Parallel, Tropick, *Horizon*, Axis, Poles, &c.

Geometry, or the Doctrine of extended or continous Quantity.

Hydrology, or History of Water.

Hydrostaticks, or the Consideration of Fluids.

Law, or the Rules and Measures of Society.

Logick, or the Consideration of Ideas or Notions, whether Simple, Complex, or adequate.

Manage, including the Consideration of Horses.

Mechanicks, including the Structure of Machines, &c.

Medicine, including the consideration and Preservatives of Life and Health.

Metaphysicks, or the Doctrine of Essence, Existence, Power, Act, Understanding, &c.

Meteorology, or the History of Air and Atmosphere.

Minerology, or the History of Earth.

Navigation.

Opticks, including the Laws and Consideration of Vision and visible Objects.

Perspective, or the Projection of Points, Lines, Planes.

Pharmacy, or the Preparation and Composition of Remedies.

Phonicks, or the Doctrine of Sounds.

Physicks, or the Doctrine of Causes, Nature, Law, &c.

Pneumaticks, or the Consideration of the Air, its Weight, Density, Pressure, Elasticity, &c.

Policy, or the Consideratoin of Society and Commonweal.

PhytoLOGY, or the History of Plants.

Rhetorick, or the Art of Persuasion.

Theology.

Zoology, or the History of Animals.¹⁴⁹

However, Keimer's intent "to publish a Paper of Intelligence" lasted only a year. He had begun by noting in the same advertisement that "the late *Mercury* has been so wretchedly perform'd, that is has been not only a Reproach to the Province, but such a Scandal to the very Name of Printing, that it may, for its unparallel'd Blunders and Incorrectness, be truly titled *Non-sense in Folio*, instead of a Serviceable News-Paper." During the following year, Benjamin Franklin and Joseph Breintnall wrote thirty-two BUSY BODY letters in the *Mercury* criticizing Keimer's style. Faced with this

constant detraction, a small subscription base, and Franklin's financial backers in the Meredith family, Keimer finally relented, selling his printing business and newspaper to Franklin.

Franklin, taking his lessons from Bradford, felt that for a newspaper to succeed, it could not rely on an intellectually elitist appeal. The colony would not yet support such a publication, a lesson he re-taught himself when he attempted a more literary magazine years later. The colonists did not want a "Universal Instructor", he reasoned, but something with broader appeal. In the process of Franklin creating that appeal, the colonists lost the steady access to the theory and practice of natural philosophy through the newspaper with Keimer and gained sensationalism, consumerism, and a more arbitrary and commercialized access to the arts and sciences.

Despite Franklin's later recognition as America's premier scientist of his day, his newspaper did not generally act as a primary communication device for his or any other individual's philosophical inquiries. Many alternatives, principally letter writing networks, satisfied that need. With some interesting exceptions, science in the *Pennsylvania Gazette*, and the other newspapers in our study, even the more literary *Virginia Gazette*, rarely offered detailed descriptive, instructional, or theoretical articles of philosophical interest¹⁵⁰. They rarely offered direct access to the process of science. Those papers reflected an orientation towards representative democracy, meritocratic ideals, and a consumer economy more than a direct democracy. The newspaper could play a role in the promotion of those values. For individuals, groups, and organizations, the distribution of printed material became a potential route to power. Control over printing and the post allowed for the movement of information relating to commodities and thus for the accumulation of wealth. The eighteenth century saw the negotiation of this reality. Individuals from the mercantile class, such as Franklin, gambled on the promise of printed material, empiricist and populist philosophy, and the potential for the accumulation of wealth. In order to succeed in science, politics, and commerce, an editor like Franklin needed to consider the sensibilities of the powers that be -- such as the Royal Society and the local colonial government. He also needed to consider the sensibilities of the populace.

¹⁴⁹ Advertisement for the *Pennsylvania Gazette, the Universal Instructor*, Oct 1, 1728.

¹⁵⁰ See Elizabeth Cook.

In this chapter I follow Franklin and others as they establish the portrayal of natural philosophy and the right of public access within the pages of the press. The chapter begins by showing the numerous avenues for both communicating and publishing science that existed. It continues by exploring the role of the scientific society and overviews the American members of the Royal Society. It leads to detailing the few calls for public participation and ends by arguing how the public space of the newspaper creates a science of representation where, despite the potential for a ‘lay’ science, an insider’s clique persists. Rather than detract from science, this state probably furthers its claims to authority.

The Modes of Science Communication

Science in the eighteenth century was communicated through a public/private-spectrum of spaces, written and unwritten. Whether spaces or instruments were expressly designed to communicate science (like formal and informal scientific societies or philosophical transactions) or were ostensibly less single purposed (like the public coffeehouses of Philadelphia and the private salons of Paris), they all played a part in dissemination, communication, legitimation of scientific knowledge. This section addresses the technical means and social instruments that allowed the communication of science to take place.

Artifacts

A huge assortment of non-direct, or non-published, artifacts exist which might tell us about the flow of information. If we can find them, tickets or notices of passage, letters, unpublished collections, notes during society proceedings, dissertations, written articles, chronologies in diaries, advertisements, the quick hand-written note, or personal notes, un-catalogued library collections, unpublished education curricula, police records¹⁵¹, and bills of lading might be very useful among others. At the 1993 National Association of Science and Technology Studies (NASTS) conference in Washington D.C., Darlene Richardson of Indiana University of Pennsylvania even spoke of the

¹⁵¹ Robert Darnton makes creative use of Police Records in *The Great Cat Massacre*.

possible communication between Darwin and Lyelle through the correspondence of their wives. Unfortunately, a number of means of communication are not well documented in the secondary literature -- for example the colonial networks of letters or who published in general periodicals -- and may never be addressed due to the loss of the originals. However, there is a lot we can glean from the information we do have.

Little explored is the notion that knowledge can be communicated in the technological or scientific artifacts themselves. To give two chronologically extreme examples, a pre-historic man or woman might have learned skills by coming upon the technological artifact of another - an arrow for instance. Its creation could be taught, but it also could be 'reverse engineered' in a manner no differently from that engineer in Tracy Kidder's *The Soul of a New Machine*, who walked across the street from his office in Data General to see what Digital's new circuit board looked like.

Colonial Americans received the telescopes, microscopes, astrolabes, electrical apparatus, and other instruments from Europe that contributed to the pursuit of natural history and philosophy. It was a two-way street. Europeans were eager to receive the flora, fauna, and descriptions of the New World as well. Later in the century, colonists such as David Rittenhouse became recognized for creating the finely crafted, formerly imported instruments of natural philosophy.

The meanings of such artifacts were contextualized, reflecting the political, market, or personal expediencies of those involved locally. But, just like the meanings of texts, the meanings of artifacts were negotiated (even internationally) as well. As knowledge moved it changed with the movement.¹⁵²

Lectures and Shows

With the rise of public acceptance of natural philosophy during the 17th and 18th centuries, where it became "a respectable leisure time occupation for country gentlemen and townsmen of substance",

¹⁵² Michel Callon uses the word 'translation' to describe the transfer of technology being a negotiation with various forms of enrollment in "Sociology of Translation".

an increase occurred in middle or upper class sponsored traveling lecturers in France and Great Britain.¹⁵³ Benjamin Martin traveled in England giving lectures mostly to the gentry for years.¹⁵⁴ In the Feb 4, 1735 issue of the *Pennsylvania Gazette*, there is a long poem thanking a Mr. Greenwood in Boston for his lectures on math and astronomy¹⁵⁵. They were popular in the colonies as well. Ebenezer Kinnersley spent many years lecturing on his and Franklin's theories of electricity. These lectures connected Kinnersley and electrical theory in the public's imagination to the point where many people felt that Franklin was unduly taking credit for Kinnersley's work.¹⁵⁶ Electricity excited a wide audience in Europe and the colonies. Stearns notes over twenty public lecturers in the eighteenth century who either concentrated or touched on electrical phenomenon.¹⁵⁷

It is arguable that these lectures were merely popularizing natural philosophy¹⁵⁸, and had little to do with communication between those actually doing natural philosophy. However, I cannot discount the effect the lectures might have had on those unfamiliar with certain areas of natural philosophy - budding scientists as it were. Franklin himself was initiated into electric exploration by attending a lecture. In addition, some of Kinnersley's original work may have seen public exposure before written to Franklin or others as well.¹⁵⁹ Once again, from many perspectives, the differences between the lay philosopher and those established by, say, society membership for instance, were not as great as they are today. Kronick feels that, to some extent, an established specialized audience of scientists had not come into existence yet. This may be one reason why the amount of original material presented in these lectures is difficult to establish.

Indoor and outdoor lectures large and small were a staple of the times in the colonies. The spectacular turnouts for the Philadelphia electrical demonstrations were equaled by the crowds brought out by evangelist George Whitefield. That the city of Philadelphia constructed a

¹⁵³ Kronick, p. 38. He quotes Eric Ashby, *Technology and the Academies; an Essay on Universities and the Scientific Revolution*, 1958, p. 5. Ashby notes that in England many of these travelers were sponsored by the middle class, whereas in France it was more for the intelligentsia than the common people.

¹⁵⁴ See John Millburn.

¹⁵⁵ A poem praises a lecture by a Mr. Greenwood in the Feb 4, 1735 *Pennsylvania Gazette*.

¹⁵⁶ Lemay, p.578, 581.

¹⁵⁷ Stearns, p.510-511. Stearns notes the secondary sources that cite experimental lectures. They include Bridenbaugh, Rebels and Cities in Revolt; Cohen (ed), Benjamin Franklin's Experiments; Lemay, Ebenezer Kinnersley; L.H.Gipson, Lewis Evans; and Morse, "Lectures on Electricity in Colonial Times".

¹⁵⁸ To a great extent, how various forms of communication are used as popularization rather than the exchange of some original scientific inquiry is the point of this exercise but I will unpack 'popularization' in a later chapter.

¹⁵⁹ Lemay seems to suggest that this was not the case however.

meetinghouse for itinerant lecturers shows the importance of such occurrences.¹⁶⁰ A single speaker could reach thousands of listeners in a narrow timeframe. By measuring the distance where Whitefield was still audible one afternoon in Philadelphia, Franklin established that up to thirty thousand could be preached to easily.¹⁶¹

Oral Discourse

Places surrounding or loosely linked to organizations such as the Royal Society in London or the Universities of Oxford, Cambridge, or Harvard College were conduits of some scientific information. Affiliated lectures, lecture halls, hallways, salons, coffeehouses, and corner pubs heard the latest in natural philosophy. These are the places that may have no published material (although some did).

The coffeehouses of London¹⁶² and, likely, Philadelphia, provided newspapers to their customers and thus encouraged discursive exchange around public information.¹⁶³ Public Houses filled a role similar to coffeehouses. By 1752 there were 120 licensed taverns in Philadelphia. "There was a public house to suit every purse and every taste from innumerable sailors' groggeries down by the wharves to Daniel Smith's famous City Tavern"¹⁶⁴

A number of places - churches, inns, town halls - also served similar public functions, especially outside of the city. In many instances these were the places where textual information, such as that of newspapers, were converted into oral exchanges. John B. McMaster quotes a colonist living in a typical out-of-the-way town. The writer notes that on post day,

¹⁶⁰ Schwartz, p.129. According to Schwartz the building became a point of contention as Whitefieldians and Moravians moved toward vocal opposition. Whitefield attempted to dissuade Moravians from using the nondenominational "New Building" in Philadelphia by writing a letter to their minister.

¹⁶¹ Franklin, Autobiography, p.133. Franklin notes the reports that Whitefield had addressed twenty-five thousand in London. It is doubtful that any lecture in Philadelphia was that big in the 18th century.

¹⁶² I cannot find direct information on the coffee houses of Philadelphia but I will assume some similarity. Information pertaining to public and private oral spaces can be found in a number of sources. Richard Sennett, The Fall of Public Man: On the Social Psychology of Capitalism, Jürgen Habermas, The Structural Transformation of the Public Sphere, and an unpublished paper (quoted in Goodman) by Daniel Gordon, "The Art of Conversation, or The Concept of Society in the British Enlightenment," are a few.

¹⁶³ Goodman, p.123.

¹⁶⁴ Bridenbaugh, p.21.

"half the village assembled to be present at the distribution of the mail, which in good and bad weather alike, took place at the inn. The package for the whole village was generally made up of a roll of newspapers a week old and a few bundles of drugs for the doctor. It was a great day whereon, in addition to the usual post, a half-dozen letters were given out. Then, as the townsmen press around the inn door to make arrangement for borrowing the 'newsprint' or to hear the contents of it read aloud by the minister or landlord, the postman was carried home."¹⁶⁵

Percentage wise, small numbers of subscriptions to newspapers served many people. Papers available in taverns and other public houses had multiple readers. Often, community leaders - ministers, lawyers, merchants, and others - related what they read to a broader audience.

Dena Goodman suggests that coffeehouses and salons, although both used for an oral exchange of information, served different clientele. The salons of Paris were the private locations where letters as well as published material were discussed.¹⁶⁶ Private clubs and dinners may have served the same functions in Philadelphia as the salons did in Paris. Richard Brown examines diaries to reconstruct dinner conversations in colonial America to show the range of topics discussed there.¹⁶⁷

Another venue, the club, was popular. A large number of private clubs with particular to general purposes incorporated in Philadelphia in the 18th century. In the years proceeding the revolution there existed some fifty clubs officially registered (consisting mostly of men), and probably far greater numbers unregistered.¹⁶⁸ Franklin created perhaps the most important club for addressing issues of the arts and sciences when he formed the Junto (corrupt for the Spanish 'Junta') for Common Improvement with nine others in 1727. This organization - sometimes called the Leather Apron Club since it consisted mostly of tradesmen - met in the local tavern every Friday night for thirty years.¹⁶⁹ The club was not explicitly shy of metaphysics, morals, and politics like the Royal society.¹⁷⁰ In his autobiography Franklin mentions the Junto's rules: "required that every member, in his turn, should produce one or more queries on any point of Morals, Politics, or Natural

¹⁶⁵ Kielbowicz p.27, 51.

¹⁶⁶ To some extent this separation of private and public spheres is artificial, but it may be useful to highlight where the elite gathered.

¹⁶⁷ Brown, p.51, 57, more.

¹⁶⁸ Bridenbough, Rebels and Gentlemen

¹⁶⁹ Seegar, p. 20.

¹⁷⁰ See section on Societies in this chapter.

Philosophy".¹⁷¹ This organization was important to the development of science, however, for it was to inspire and to some extent evolve into the American Philosophical Society (APS) in 1743.¹⁷²

Libraries, Zoos, and Museums

The importance of libraries and other locals where information can be stored and retrieved cannot be underestimated. Libraries in the colonies were private in the first part of the 18th century. The first subscription (or semi-private) library was established by Franklin in 1730. He states in his autobiography that "so few were the readers at that time in Philadelphia, and the majority of us so poor, that I was not able, with great industry, to find more than fifty persons, mostly young tradesmen, willing to pay down for this purpose forty shillings each."¹⁷³ For a time, the printers in Philadelphia were stationers and did not supply books (except almanacs, ballads, and common schoolbooks). Those interested in reading borrowed books from others. Those interested in purchasing literature, sent for it from England.¹⁷⁴ The Library Company made bulk purchases of books and lent them to subscribers. Franklin, as a stationer, also began to import books to be sold.

Repositories of curiosities, proceeding the modern museum began to appear in Philadelphia in the 18th century. The Library Company collected, along with learned books, scientific apparatus and natural history curios. Often, these objects were gifts from travelers or members. One gift was a collection of Eskimo artifacts, which the library received in 1754 by the North-West Company. Another source of pride was the collection of fossils.

The APS in 1769 also began a collection of fossils, inventions, and the Fothergill collection of anatomical preparations and drawings; all viewable for one dollar. Archibald McCall started a zoo

¹⁷¹ Franklin, Autobiography, p.74.

¹⁷² American Philosophical Society online history (<http://www.amphilsoc.org/about/>). The society states that it gained international fame by 1769. That was the first year of the publication of its *Transactions*.

¹⁷³ Franklin, p.97. Franklin goes on to state: "reading became fashionable; and our people, having no publick amusements to divert thier attention from study, became better acquainted with books, and in a few years were observ'd by strangers to be better instructed and more intelligent than people of the same rank generally are in other countries."

¹⁷⁴ Franklin, p.96.

of sorts in 1763. As a merchant, McCall instructed all his supercargoes to purchase strange animals for him in foreign ports.¹⁷⁵

Schools

Since ministers and schoolmasters were often involved in pursuing natural philosophy, it seems reasonable to postulate that information about natural history passed through their teachings to their pupils. There is evidence that it did. Especially in Pennsylvania, many people encouraged the study of natural history.¹⁷⁶ However, independent study was a colonial custom, and most schooling was directed primarily through textbooks. While this situation might intuitively seem detrimental to teaching natural history in primary school, textbooks were primarily domestically produced. Since a great number of people developing textbooks were interested in natural knowledge, natural history became a part of education.¹⁷⁷

The institutions of higher education were initially started by religious organizations. American colleges diverged from their English models in developing a system of external ownership and control. Instead of being autonomous corporate bodies of scholars and masters, they were governed by outside groups of nonresident laymen or trustees. This more closely linked them to their local surroundings and economies. In addition to Harvard (1636) there were:

William and Mary, VA (Anglican Church in Virginia, 1693)
Yale, CN (Counter to Harvard unorthodoxy, 1701)
Princeton, NJ (Presbyterian, 1746)
Brown, RI (Baptist, 1764)
Rutgers, NJ (Dutch Reformed, 1766)
Dartmouth, NH (Congregational, 1769)
King's College, NY (became Columbia, Interdenominational, 1754)

These colleges resembled Oxford and Cambridge in consisting of mostly classics and theology. However, logic, mathematics, and natural sciences became more prevalent during the pre-

¹⁷⁵ Bridenbaugh, Rebels and Gentlemen, p.353.

¹⁷⁶ Schwartz, p.150. Pennsylvanians looked at education with some agnosticism as well. A teacher's devotion to a particular creed was considered less important skill in teaching.

¹⁷⁷ Mary T. Luins Small, The Printed Textbook in Colonial America, (Dissertation, Boston College).

Revolutionary period. Alan Koller indicates that among puritans the promotion of natural philosophy in institutions of higher learning was restricted by religious concerns but assisted by the utilitarian needs of the colonies and the strong personalities of the professors, tutors, and presidents involved.¹⁷⁸

Within Philadelphia, a long negotiation over the style of pedagogy - aristocratic, classical, and Anglican versus democratic and utilitarian - played itself out among the schools. By the time of the revolution the Anglicans held a slight edge in available institutions but schools for mechanics and tradesmen, underprivileged, and special groups existed.

The education requirements of the population were mixed as well. Quakers ran most of the primary schools in mid century. These schools were tolerant and practical, and so many Anglicans sent their children there as well. However, some Quakers began to desire a classical education for their children and so enrolled them with such aligned tutors and also converted some schools to be Latin and classically oriented. A number of residents found this situation exasperating¹⁷⁹ and so set up a 'university' system to accommodate enlightenment and utilitarian pedagogy.¹⁸⁰

Because of the orientation of the college, many later successful citizens interested in advance education looked outside of Pennsylvania's boarders for schooling. Most found themselves abroad, avoiding the strong denominational affiliation of the other colony's institutions. This situation persisted until the college of New Jersey opened in 1746. Medical students stayed home in greater numbers when the Philadelphia medical school opened in 1765. The opening of Rhode Island College in 1764 (which has been attributed to Philadelphia scholar's searches for institutions free from sectarian bias) created another domestic venue for a more secular higher education.¹⁸¹

¹⁷⁸ Koller, Alan M., "Mathematics Education and Puritanism in Colonial America: The Colleges of Harvard and Yale". (1990 Dissertation, Columbia University).

¹⁷⁹ Bridenbaugh states that the course of study stressed at the Academy led Benjamin Rush to rejoice in retrospect that his friend David Rittenhouse had escaped the pernicious influences of an educational system designed for fifteenth-century Europe and in no way adapted to circumstances in the New World on p.45 of Rebels. On page 35 he notes that John Bartram complained to Collinson that he had no wish to see his son Willaim, then 16, become a gentleman but wanted him to have some business or calling to make a reasonable living.

¹⁸⁰ Proposed by Franklin and Francis Alison, the school set up in 1755 had a college with three Philosophical Schools and the Latin and Greek Schools and containing about a hundred student; the Academy, made up of the English and Mathematical Schools and caring for some ninety students; and the 120 scholars of the Boys' and Girls' Charity Schools. (From Bridenbaugh, Rebels, p.59).

¹⁸¹ Bridenbaugh, Rebels, p.63.

For primary and secondary education, parents and students interested in modern education found private tutors. Over 125 tutors advertised their services in the newspapers between 1740 and 1776. Instructors taught practical subjects, covering mathematics, surveying, navigation, accounting, bookkeeping, the various branches of science and English and contemporary foreign languages.¹⁸² The few public schools also taught the modern topics.

Practical education with some natural philosophy intermittently existed for adults as well. The Literary Republic opened at the George Reinholt bookbindery in 1764 for the education of men and useful members of the commonwealth.¹⁸³ There were at least eleven "Evening Schools" that jointly advertised on October 12, 1767 for instruction in writing, arithmetic, bookkeeping and practical mathematics.¹⁸⁴

The Scientific Journal

Concurrent with the rise of the general periodical was the rise in the published transactions of society proceedings. Two authors perhaps even overstate the inheritance society proceedings owe to newspapers. Fielding H. Garrison argues that the scientific periodical came out by way of the scientific society and the newspaper: "The scientific society, as a part of this pedigree, came out of the medieval guilds; the newspaper, derived, by way of the newsletter, from the so-called intelligence offices."¹⁸⁵ Kronick argues that since the audiences of the early newspaper and scientific periodical did not differ to the degree to which they differed later, the newspaper may have been the prototype for scientific communication.¹⁸⁶

While there may have been some similarity in content between the general and scientific journal - and part of the answer to that question is the point of this exercise - with increased production and

¹⁸² Bridenbaugh, Rebels and Gentlemen, p.36.

¹⁸³ Bridenbaugh, Rebels, p.64.

¹⁸⁴ Bridenbaugh, Rebels, p.40.

¹⁸⁵ Fielding H. Garrison, "The Medical and Scientific Periodicals of the 17th and 18th Centuries," Bulletin of the Institute for the History of Medicine, II (1934), p. 287.

¹⁸⁶ Kronick, p. 71.

specialization the general and scientific periodical likely grew far apart. Authors like McClellan have argued that the society was the most important organ for furthering science, and one might suppose by extension that the transactions and journals connected to those societies were extremely important as an effective means of written communication.¹⁸⁷

As stated earlier, however, there were many other channels of communication, many of which were far more timely in publication or communication. Both Kronick and McClellan note that Society journals were infamously slow in publication, with possible delays of up to a decade or more.¹⁸⁸ This may have been especially the case for the colonists so far from Europe and since the first effective domestic journal concerned with natural philosophy was not established until 1769 with the creation of the American Philosophical Society's *Transactions*. Kronick theorizes that, "use of the general periodical press for scientific communication may have been more necessary in the colonies where outlets were even more limited than they were in England."¹⁸⁹

According to Kronick, the rise in experimental science using the single observation or experiment created value in short communications distributed quickly. This led to a publication formula of one experiment or observation equaling one essay or article. The book (and the pamphlet to a lesser extent) was less efficient because the author had to accumulate numerous results to justify publication and its attendant cost. The change in emphasis from constructing comprehensive world views and all-embracing philosophical edifices, to an emphasis on collecting the results of observations and experiments (the inductive method which requires the stating of particulars before generalizations can be drawn) impacted the mode of written communication, which in turn impacted science. A new egalitarian view of examining nature that was confident of an eventual perfect understanding through the accumulation of facts from many quarters.¹⁹⁰ From this potentially idealized version of the enlightenment comes the implication that the inductive method might have contributed to the rise in the number of periodicals. The important point is, however,

¹⁸⁷ McClellan states, "The publications of the scientific societies were the major forums for the presentation of new research in science in the eighteenth century.", p. 188.

¹⁸⁸ See Kronick, pp. 143, 153; and McClellan, p.189. McClellan quotes Saint Petersburg academician Paul Henri Fuss, who said "It is very discouraging for an author to see his productions remaining buried thus in the storerooms", from the Imperial Academy, Protokoli, vol. 3, August 22, 1782.

¹⁸⁹ Kronick, p. 252.

¹⁹⁰ Kronick, p. 45.

that moving information expeditiously demanded alternatives to journal publication. This most definitely occurred through letters – often later published in journals – and, potentially, newspapers.

Kronick continues by arguing that periodicity was not a strong characteristic of the early journals, although there was some attempt at appearing at regular intervals like newspapers. The characteristic of sporadic periodicity adopted by the scientific periodical determined, to a large extent, the early role it was to play. It made many early journals predominately depositories of scientific knowledge rather than vehicles for the expeditious communication of scientific information.¹⁹¹

However, Kronick notes that a large proportion of the scientific journals of the 18th century must be regarded as the media of choice for the dissemination of established ideas rather than as mere repositories of contributions to science.¹⁹² Journals such as *Observations sur la Physique, sur l'Histoire Naturelle et sur les Arts* started by Abbe' Rozier in Paris in 1773, were the exceptions in publishing largely original contributions. In the case of *Observations* the contributions were sent in by members of provincial academies and Parisian scientists, as well as other leading European countries. Another of the first natural science periodicals to contain a significant proportion of original contributions and to limit itself to pure science was *Der Naturforscher*, which was not begun until 1774.¹⁹³

That there was an 18th century audience in America to support scientific periodicals separate from the organs of the societies, as well as separate from the general periodical, seems unlikely from the evidence available.¹⁹⁴ However, books concerning health and husbandry for the laymen such as *The Englishman's Treasure*, 1585; *The House of Health*, 1636; and the *Book of Husbandry*, 1523, were popular much earlier.¹⁹⁵ With the establishment of the periodical came the specialized journal for such matters and the writing of scholars in the popular press as well. These publications can be regarded as a manifestation of a growing concern on the part of scholars for bringing some of the

¹⁹¹ Kronick, p. 71.

¹⁹² Kronick, p. 111.

¹⁹³ Kronick, p. 104.

¹⁹⁴ See Kronick on p. 106.

¹⁹⁵ Kronick, p. 38.

results of their work into the practical affairs of society, or a growing need to have popular support for a variety of reasons.

Interestingly, a subject content analysis of the first fifteen volumes of the *Acta Eruditorum* covering 1683 to 1700 was carried out by Martha Ornstein in the 1938 *The Role of Scientific Societies in the Seventeenth Century*. It showed that the coverage of science defined by medicine, physics, mathematics, and astronomy declined steadily from 39 percent to 23 in that time period. Similar declines occurred in *Journal des Scavans* and *Acta Eruditorum* in the same time period according to H.J. Reisink in the 1931 *L'Angleterre et la Litterature Anglais dans Trois plus Anciens Periodiques Francais de Hollande de 1684 a 1709*.¹⁹⁶

One answer to this decline may be the increasing specialization of natural philosophy and the responding publications. The number of journal titles increased proportionately. Natural philosophy reflected the nascent complex specialization occurring in many areas of society. It is not surprising to find specialization in the fields where there was already an audience. I have already mentioned a specialized audience for health and husbandry.

But overall the 18th century was still primarily an age of generalism in which every educated person felt responsible for the whole range of art, natural and moral philosophy, in fact, the entire literature. The *Journal des Scavans* and the *Acta Eruditorum* are important in the communication of natural science. However, even these journals varied in content - with editorial direction among other factors. One point in this dissertation is to show that the less scholarly general periodical of Colonial America also served the purpose of communicating natural science, although to a lesser extent and potentially different audience.

Generalism only begins to show some strain after the American Revolution. The date of the appearance of the third edition of the *Encyclopedie Britannica* in 1788 has been cited as marking one significant point in the history of the fragmentation of knowledge. About this time an increase in subject specialists wrote sections of the encyclopedia instead of general editors.¹⁹⁷

¹⁹⁶ Kronick, p. 247.

¹⁹⁷ Kronick, p. 95.

The deciding factors in the venue that a particular communication might be found are complex. There is no doubt that many scientists were drawn by the prominence and the prestige of the Royal Society and sent their communication to the editor of the *Philosophical Transactions*, but many others do not seem as interested in the international exposure. The Italians Tommaso Alghisi and Antonio Vallisnieri both published in general journals in the early 18th century. As I will show, Americans did likewise. There is also the matter of publicity. A scientist's cause was not hurt by wide publicity, whereas it could be hurt by the lack of it. Kronick cites the case of Mendel's classical paper on genetics that was buried in the publications of the local scientific society for forty years, noting that there were many such cases, and probably many more still unknown.¹⁹⁸

The question is, then, was the general periodical used for communication among those doing science, between the colonies and the continent, or between the colonists themselves. More specifically, was the general periodical seen as a place to communicate original observations and/or theories given the depository nature of scientific journals and the frequency of newspapers? Even more elusive is the question of the type of any science communicated in the colonies through the general periodical. For instance, would the science communicated in the general periodical only fall under certain categories, such as health or husbandry? A good way to start is to examine those who were doing science at the time.

Societies

The scientific societies significantly set the boundaries of the scientific endeavor. In the case of England and British colonies the Royal Society determined the periphery of science. The charter drawn up in 1663 proclaims the society is set out to "examine all systems, Theories, principles, Hypotheses, Elements, Histories & Experiments of things Natural, Mathematicall & Mechanicall." The society refused to meddle with "Divinity, Metaphysics, Morals, Politicks, Grammar, Rhetorick or Logick."¹⁹⁹ A look at the Society records shows the interests of the Royal Society. Of the 9876

¹⁹⁸ Kronick, p. 254.

¹⁹⁹ Stearns, p.91.

papers, 2174 concerned natural history, 2171, medicine, 2694 concerned physics or astronomy, and the one fifth remainder concerned meteorology, antiquities, and other curiosities.²⁰⁰

Individuals could gain international recognition through encouragement, literature, and instrumentation received through an informal network of correspondences, the *Respublica Literaria*, or Republic of Letters. According to McClellan, the scientific society largely replaced this informal network of systematic correspondence replaced in the eighteenth century.²⁰¹ However, as we shall see below, many letters were initially not published, and the Republic of Letters remained a critical part of the movement of scientific information in the 18th century.²⁰² Informal networks moved many interesting philosophical communications. Additionally, many were written with the expectation that they would be read by more than the person to whom they were addressed: they were often copied and circulated.²⁰³ In the science of the American colonies, at least, "everyone knew each other".²⁰⁴ Novice natural historians were introduced by more established philosophers to others with similar interests for example, and a great deal of Franklin's correspondence with Americans about electricity was outside the framework of the Royal Society.²⁰⁵

²⁰⁰ Stearns, p.99.

²⁰¹ McClellan, p.195.

²⁰² M. Feingold believes that this actually held true up through the first quarter of the twentieth century. There is a great deal written on the *Respublica Literaria*, although not on the network within the colonies as a whole. Secondary literature tends to focus on discussions between (or about) great minds, Franklin and Kinnersley, Franklin and Edwards, etc. It is an area that deserves work. Hunter Dupree addresses this to some extent.

²⁰³ Joseph Pitt, private correspondence. Pitt notes some of the more famous examples of this in the previous century, such as Mersenne in France, or how Galileo intended his letter to the Grand Duchess to be a public document.

²⁰⁴ Stearns quoting Benjamin West, p.468.

²⁰⁵ I must temper this interconnection of American scientists to some extent. Simon Baatz seems to suggest that prior to the Civil War "the American scientific community, as a national community, was inchoate: the primary loyalty of most scientists was to local institutions." Three cities - Philadelphia, Boston, and New York - dominated cultural, intellectual, political, and economic affairs in colonial America. That dominance hindered the creation of a national community of scientists.

Philadelphia, Boston, and New York were geographically far apart, so the growth of science occurred within isolated and distinct contexts that were determined by idiosyncratic economic and political factors. The scientific community in the United States was by no means unified or even cohesive. It consisted of a series of local communities varying greatly in size and strength and often at odds with each other.

For all three cities, one of the most fundamental concerns of science during the period was the search for patronage. At a time when the support for science from government and industry was minimal, it was imperative that savants locate and extract patronage - usually from private individuals - to support their scientific activities. The structure of disparate localized communities forced scientists to appeal to their local patrons in highly idiosyncratic terms. Since each community was internally heterogenous and because scientists in a community were competing with each other

According to McClellan, the scientific society encouraged, recognized and legitimized science. The society became the dominant scientific institution of the period which, when linked with others, lent a structure and coherence to the organization of science, coordinating the goals and processes of science on local, national, and international levels.²⁰⁶ The scientific societies were not wholly independent entities. Rather, through complex interaction, individual institutions transcended their purely local roles and separate existences and collectively forged a larger institutional network.²⁰⁷ This coordination occurred through membership, contests, and projects, and the exchange of literature, instruments, and society transactions.

The first society is generally accorded to the Academia Secretorum Naturae, established at Naples in 1560. In the 17th century the scientific society movement took off. There was the Accademia dei Linci at Rome in 1603, the Academia Naturae Curiosum at Leipzig in 1651, the Accademia del Cimento at Florence in 1657, the Royal Society of London (RS) in 1662²⁰⁸, the Academie des Sciences at Paris in 1666, the Accademia delle Scienze at Bolgna in 1690, and the Societas Regia Scientiarum at Berlin in 1700. The 18th century saw the establishment of societies in Edinburgh, Dublin, Brussels, Bordeaux, Lyons, Orleans, Marseilles, Lisbon, Prague, Munich, Gottingen, Danzig, St. Petersburg, and more.²⁰⁹

In the American colonies, the first scientific society was probably the Boston Philosophical Society, "A Philosophical Society of Agreeable Gentlemen who met once a Fortnight for a Conference upon Improvements in Philosophy and Additions to the stores of Natural History."²¹⁰ Although it collected instruments and literature and published material as well, the society soon died out and it was not until 1727 when Benjamin Franklin started the Junta, a secret literary and scientific society called a "club of mutual improvement"²¹¹, that there was another with similar interests in the

for limited resources, factional disputes between scientific cliques were endemic into the early decades of the nineteenth century.

²⁰⁶ McClellan, p.188.

²⁰⁷ McClellan, p.153.

²⁰⁸ The Royal Society of London states as its official date November 28, 1660. The name Royal Society first appears in print in 1661 and, in its second charter of 1663 appears as the Royal Society of London for Improving Natural Knowledge. See <http://www.royalsoc.ac.uk/royalsoc/index.html>. Bates, p.1, argues for 1662.

²⁰⁹ Bates, p.1.

²¹⁰ In Bates p.3., quoted from Cotton Mather Memoirs of Dr. Increase Mather. Membership is in Stearns, p.485 with footnote 210.

²¹¹ Franklin, Autobiography, p.74.

colonies. As mentioned before however, this club was not expressly for the study of nature and philosophy and it did not publish proceedings or other materials. John Bartram of Philadelphia proposed a more open and specifically philosophical society in 1739 but that met with limited success. In 1743, the American Philosophical Society (APS), proposed by Franklin, came into existence in Philadelphia.²¹² The society intermittently languished until 1767. In 1769 it merged with the American Society for Promoting and Propagating Useful Knowledge (which the Junto had evolved into by 1766) to become the APS (American Philosophical Society Held at Philadelphia for Promoting Useful Knowledge), the organization which still exists today. Because there was no central organized steady clearinghouse of scientific information in America, many authors claim that prior to 1769, the Royal Society remained the primary organization for colonial American naturalism.²¹³

Internationally, those interested in natural philosophy often held dual or more memberships, which facilitated communication. Of the two premier institutions of the 18th century, the Royal Society of London had 29 members who were members of the Paris Academy and Paris had 63 members in the RS out of joint total of 174 members.²¹⁴ By the late 1750s, Benjamin Franklin was a member in the Paris Academy and Royal Society, plus the American Philosophical Society.

Systematic investigations were another area of societal interaction. The 1723 Royal Society plan for the 'joint observations of the weather'²¹⁵ involved many institutions. To facilitate comparable observations, instruments (mostly barometers and thermometers) were sent to eighteen of the other societies. In addition to those instruments used in attempting to forecast the weather, the Royal Society sent instruments such as sextants, clocks, and telescopes to individuals, libraries, universities, and, principally, other societies.

²¹² Membership found in Bates, p.7. Membership was Dr. Thomas Bond, physician, John Bartram, botanist, Thomas Godfrey, mathematician, Samuel Rhodes, mechanician, William Parsons, geographer, and Dr. Phineas Bond, general natural philosopher, with Thomas Hopkinson, president, William Coleman, treasurer, and Benjamin Franklin, secretary.

²¹³ Stearns, p.681. Ironically, Bates notes that there was the possibility of the Royal Society starting in Connecticut if the Civil Wars had not ended, p.2.

²¹⁴ McClellan, p.180.

²¹⁵ McClellan, p.161.

The societies were heavily involved in publishing and dispersing published materials as well as occasionally underwriting the expense of publishing works.²¹⁶ The Royal Society's Philosophical Transactions, which the Society formally took over in 1752 (although it had been in existence since 1665), was dispensed regularly to all the major naturalists centers²¹⁷. The larger societies also received a great deal of societal publications. The Royal Society and the Paris Academy each regularly received publications from over 30 societies. St. Petersburg received over 20. The American Philosophical Society and Berlin were around twelve.²¹⁸ The society secretary became an important individual who directed, to a large extent, the success of societies becoming central to scientific exchange.²¹⁹

To further understand the place of colonial newspapers in explicating science we need to examine those colonials involved in science and the venues they selected or found available for communicating.

Colonial "Scientists"

The Royal Society in the eighteenth-century accepted a handful of the colonial Americans involved in natural philosophical inquiries. The fellows were (followed by life span, date elected fellow, and respective colony)²²⁰:

Name	Birth/Death	Year elected	Colony
John Winthrop Jr.	(1616 - 1676)	1663	CN
Roger Williams	(1604 - 1683)	1664?	RI?
William Brattle	(1658 - 1717)	1714	MA
Thomas Brattle	(1658 - 1713)	?	MA

²¹⁶ A list of books appears in Stearns, p.105-106.

²¹⁷ Partial lists in Stearns, p.105, and McClellan, p.170.

²¹⁸ McClellan, p.174.

²¹⁹ A great deal has been written about the Royal Society's Henry Oldenburg, the first secretary in the 17th century, and Peter Collinson, secretary during the time which I am examining.

²²⁰ This list was compiled from several sources which conflict, chiefly Baltzel and Brasche. There seems some debate as to whether Thomas Robie was elected a fellow (Baltzel - yes, Brasche - no), Count Rumford (Baltzel - yes, Brasche - no), Thomas Brattle (Balzel - no, Brasche - yes), and Roger Williams (Baltzel - no, Brasche - yes). I've added them all. Brasche may not have included Count Rumford since he was elected after he moved to England. Brasche, p. 338; Baltzel, p.167.

William Byrd II	(1674 - 1744)	1696	VA
John Leverett	(1662 - 1724)	1714	MA
Cotton Mather	(1663 - 1728)	1713?	MA
Paul Dudley	(? - 1751)	1721	MA
Thomas Robie	(1689 - 1729)	1725	MA
Zabdiel Boylston	(1679 - 1766)	1726	MA
John Winthrop	(1681 - 1747)	1734	CN
John Mitchel	(? - 1768)	1743	VA
Benjamin Franklin	(1706 - 1790)	1756	PA
John Winthrop IV	(1714 - 1779)	1766	MA
John Morgan	(1735 - 1789)	1765	PA
John Tennent	(? - c.1770)	1765	VA
Alexander Garden	(1728 - 1792)	1773	SC
James Bowdoin	(1726 - 1790)	1788	MA
David Rittenhouse	(1732 - 1796)	1795	PA
Benjamin Thompson (known as Count Rumford)	(1753 - 1814)	1779	MA

While a majority of those recognized by the Royal Society contributed original discoveries to science, either in articles in the Royal Society's *Transactions* or *Proceedings*, or through letters or lectures to the members of the Royal Society, written contributions were not a requisite for membership. There appears to have been no record of Roger Williams having had any contribution to science at all, although Brasch notes that it may have been for his rationalist views in orthodox puritan New England that he was given cognizance.²²¹ William Brattle also does not have any scholarly work of his own (except for the reissue of some of the work of Descartes) but may have been recognized for his presidency of Harvard College from 1704 to 1724, and founding a Cartesian philosophic school of thought at Harvard in 1690. Another president of Harvard College, John Leverett, also appears to have made no particular contribution to science in the colonies, although his liberal views in the 17th century earned him high regard.²²² The evidence suggests that the Royal Society recognized scholars not only for direct contributions to science but those involved in promoting rationalism in the Colonies as well.

Most of the colonial members of the Royal Society, however, contributed to science by corresponding with Royal Society members in some capacity. John Winthrop Jr., son of

²²¹ Brasche, p. 343. Many of the subsequent short bios below of American members of the Royal Society are taken from Brasche.

²²² Brasche, p. 347.

Massachusetts' first governor, though never published by the Royal Society, sent many specimens of nature, such as minerals and plants, to a list of contacts - including Isaac Newton, Robert Hooke, Sir Robert Boyle, and others - he had built up on his visits to England. Winthrop also sent an account (although the veracity of his observation is contested) of discovering a 'fifth satellite of Jupiter' to Sir Robert Morey. His grandson, John Winthrop, also was a diligent collector of specimens, mostly of geological remains such as fossils, shells, and stones with interesting conglomerations.²²³ Winthrop had over 600 specimens catalogued and sent to the Royal Society. Records indicate that the fellows of the Society analyzed them all, although Winthrop's catalog was not published until 1844 in the *American Journal of Science*.²²⁴

Another American who contributed numerous specimens to the Royal Society is John Mitchell, who sailed for England in 1746 with over 1000 species of plants.²²⁵ Mitchell, using Linnaeus' system of plant classification, had two pamphlets published in 1738 and 1741 through Peter Collinson of London. He presented papers and was published several more times through the Royal Society. He also presented Franklin's paper "Sameness of Lightning and Electricity" to the society, rather infamously, for that paper was derided by a number of English experts of the time.²²⁶

The scientific elite sought Thomas Brattle's work. His sightings are mentioned in Newton's Principia for his precise observations of the comet of 1680-81 (although not named exactly but labeled "the observer in New England"). He met with Boyle and John Flamsteed during his years in England 1682-1689 and continued corresponding with them and others until his death. Although he had nothing published in England, his papers were sought by the Royal Society for archiving.²²⁷

Benjamin Franklin eventually would publish eleven papers in the *Transactions*. James Bowdoin's letters to Franklin concerning the nature of electricity eventually were published by the Society as well. John Winthrop IV (descendent of the above noted Winthrop) published eleven papers in the

²²³ Brasche, p. 354.

²²⁴ Brasche, p.38. The original catalogue is still preserved in the Royal Society archives. John Winthrop continued to add to this catalogue until his death in London in 1747.

²²⁵ Kennedy, p.586. Unfortunately many were actually destroyed when his ship was taken by the Spanish and subsequently retaken by the British. His continued correspondence with John Bartram in America, however, allowed for almost full replenishment.

²²⁶ Brasche, p. 36.

Transactions, and six pamphlets published by the Society, mostly concerning astronomy. Winthrop made the first observations of sunspots in America, and the first accurate transit of *Mercury* across the sun, thereby offering partial confirmation of Newton's laws and contributing to the effort for finding the exact longitudinal distance between Cambridge and London.

Cotton Mather, Paul Dudley, and Alexander Garden published letters in either the *Transactions* and other less well known English philosophical journals such as the Edinburgh Philosophical Society's *Essays and Observations*. Mather had most of 37 letters addressed to the Society published in the *Transactions* in abstract form. Dudley had a large proportion of 25 papers addressed to the society published in abstract form as well. Most concerned weather and earthquakes. Garden had several papers concerning zoology (mostly fish and reptiles) read before the Society. He sent many species to England; the most famous of which is an electric eel. Linnaeus's admiration for Garden's work prompted him to give the name 'Gardenia' to a new genus.²²⁸

Zabdiel Boylston and William Byrd II both had one paper attributed to them published in the *Transactions*. Boylston's paper was entitled "Ambergris found in Whales" but it is mostly for his work in the inoculation of small pox in New England for which he is remembered. Byrd is also less known for his only Society published paper "An Account of a Negro-Boy that is dappel'd in several Places of his Body with White Spots", than for importing scientific instruments and books to the colonies, and for forwarding roots and seeds to Sir Hans Sloane.

The advent of the American Philosophical Society in the 18th century opened a new channel for original American scientific publication. However, as stated earlier, although founded in 1743, it was not until 1769 that the *Transactions of the American Philosophical Society* was first published. It is also difficult to determine whether the American *Transactions* became the first choice of those scientists looking to publish (although there is the possibility that the Revolutionary War altered the publishing status of the American *Transactions*, at least politically). At least three of colonial Society members made use, although not exclusive use, of the American Transactions. Benjamin Franklin published eight articles there, although his most famous pamphlet on lightning was

²²⁷ Kennedy, p. 584. According to Kennedy, few personal papers, unfortunately, survive. Although there is no mention as to why by Kennedy, I would guess that they may have been destroyed during the World War II blitz.

²²⁸ Brasche, p. 460. The subsequent information about John Morgan and David Rittenhouse is also from Brasche.

published in England. John Morgan of Philadelphia, who was the founder of America's first medical school, published three papers in the American *Transactions*. However, he also spent a lot of time in England, was a licentiate of the Royal College of Physicians and the College of Physicians of Edinburgh, read several papers before the Royal Academy of Surgery and was published there, and continued to correspond with peers in England until the Revolution.

David Rittenhouse, also of Pennsylvania, contributed nineteen papers to the American *Transactions* and between 1790 and 1796 was its second president. He is said to have mastered Newton's "Principia" as well as instrument making. In the transit of Venus study of 1761 he created the altitude instrument, transit telescope, and timepiece which were required for the measurement. With the data from Greenwich he calculated the distance to the sun within 40,000 miles and also observed a Venusian atmosphere, which eluded the royal astronomers. Rittenhouse may have been unique for there appears to be no evidence of correspondence between him and the continent - or even outside of Philadelphia for that matter. His work was passed on by others and recognized in Europe and within the colonies.

Little is known of 18th American made a Society member, John Tennent. Apparently, he arrived in America in 1725 but the dates of his birth and death are unknown. It appears that he never published in England or with the American Philosophical Society. He did print a pamphlet, "An Essay on Pleurisy" through William Parks in Williamsburg, Virginia in 1736. In 1738 and 1742 he published, also in Williamsburg, a Seneca Indian snake-bite remedy in "An Epistle to Dr. Richard Mead Concerning the Epidemical Diseases of Virginia, Particularly a Pleurisy and Peripneumony wherein is Shown the Surprising Efficacy of the Seneca Rattlesnake Root . . . Demonstrating the Highest Probability That This Root Will Be of More Extensive Use Than Any Medicine in the Whole Materia Medica". Tennent tends to be the exception to the rule of mid-eighteenth century colonial naturalists. His work is hard to trace. However, he becomes an interesting figure in newspaper publication as we shall see in the next chapter.

In addition to the 18 colonists listed above who became members of the Royal Society in the eighteenth century, many more individuals, or virtuosi, toiled in the Enlightenment project, many

recognized by the Royal Society without ever becoming fellows.²²⁹ John Clayton (1693-1773) of Virginia in botany, John Bartram (1699-1777) of Philadelphia in botany, Cadwallader Colden (1688-1776) of New York in electricity, and Thomas Robie (1689-1729) of Harvard in astronomy and math. They made recognized contributions known through the Republic of Letters and other means.²³⁰

Within the Philadelphia environs alone there seems to be at least 48 men who engaged in natural pursuits to some degree. A list might include in no particular order: Thomas Godfrey, Nicholas Scall, William Parsons, William Maugridge, James Logan, George Fox, Joshua Fisher, Joeseph Breintnall, Christopher Witt, Jon Kearsley, Thomas Bond, Phineas Bond, John Bartram, James Alexander, Thomas Lees, Humphry Marshall, William Young, Jared Eliot, John Clayton, Isaac Breenwood, Anthony Lamb, James Ham, Philip Syng, Samuel Rhoads, Thomas Moffatt, William Claggett, Thomas Hopkinson, Ebenezer Kinnersley, Charles Thompson, Francis Alison, William Smith, David James Dove, Lewis Evans, Thomas Hutchinson, Alexander Wedderburn, Charles Thomson, William Franklin, Edmund Physick, Samuel Powel, Cadwallader Evans, Lewis Nicola, Owen Biddle, Isaac Bartram, Moses Bartram, Benjamin West, William Alexander, Archibald McCall.²³¹

Evidence suggests that these individuals also corresponded with others, whether recognized by the Royal Society or not, interested in natural philosophy. For example, Franklin wrote to John Bartram in January 11, 1770 about planting Rhubarb seeds in America. He wrote letters to Cadwallader Colden about possibilities in electrical experiments in 1751 and 1752. Kinnersley and Franklin exchanged numerous letters about electrical experiments and presentations. Bartram had a great deal of correspondence with Peter Collinson, acting secretary of the Royal Society.²³²

²²⁹ See Daryll Maclean Anderson for an explication on "virtuosi". Essentially, Collectors, experimenters, and catalogers in natural history or natural philosophy all could fall under this category. As a group, many (mostly in Britain) became objects of satire in the journals of Addison and Steele, and in the writings of Jonathan Swift.

²³⁰ Compiled from Sterns.

²³¹ Compiled from Bridenbaugh, Stearns, Hindle.

²³² Examples of this correspondence can be found in Goodman, *The Franklin Reader*.

Primacy in Publication

It would appear that most of the colonial members of the Royal Society and other philosophers contributed to science by correspondence with Royal Society members in England and among themselves. Although some colonial scientists did not publish extensively, it seems likely that most sought to have their scientific works published through the established and prestigious organs of the Society, through letters to members of observations or even physical contributions of a botanical or geological nature. If it is not obvious that the colonists were interested in writing for an exclusive publication, it is obvious at least that a great deal of cross-Atlantic communication of natural philosophy and history took place. The Royal Society in London appears to be the center of natural philosophy in colonial America. Brattle's characterization of the colonies as a scientific backwater in the late 17th, early 18th century was probably fairly accurate.²³³

Colonists did not publish in England solely to be under the auspices of the Royal Society however. While centralist snob appeal and status might have factored into any colonist's publishing venue, naturalist oriented or not, there were other factors. The pragmatic aspect of reaching a broader audience in the more populous mother country played a part. There may have been another economic consideration. The British intended to keep the colonists in a position of providing raw materials for the empire. A number of letters to the newspaper actively discouraged colonial manufactured goods. English publishers and customers protected their domestic industry as well. In general, colonial American publications sold poorly in England, but not necessarily colonial American authors.²³⁴

Given the economic and social considerations, publishing in England was a viable option for colonial men of science. However, given slow transatlantic communication, transaction publishing speed, increasing domestic orientation of colonial journals, and local considerations it seems reasonable, to assume that domestic publication took place.

²³³ Brasche, p.42.

²³⁴ Robert D. Harlan in a letter to Papers of the Bibliographic Society of America, 59, 1965.

Indeed, some colonial Royal Society members made use of local presses, through the *Transactions of the American Philosophical Society* (David Rittenhouse, Benjamin Franklin, John Morgan) or, prior to the American *Transactions'* inception, through locally published pamphlets and letters (John Winthrop IV, Cotton Mather, and Paul Dudley).

American scientists published in the general periodical as well. Zabdiel Boylston published a report on the inoculation of smallpox in the *Boston Gazette* of July 15, 1721²³⁵ and again in the *New England Weekly Journal* on April 20, 1730.²³⁶ John Winthrop wrote a report on earthquakes to calm the recently shook up inhabitants of Boston in the *Boston Gazette* of January 26, 1756.²³⁷ Kinnersley (working with Franklin) published a lecture on electricity in the *Gentlemen's Magazine* of January, 1750.²³⁸ John Tennent published articles on Pleurisy in the *Pennsylvania Gazette*, reprints from the *Maryland Gazette* (July 19, 1739). As we shall soon see, many articles by those recognized as natural philosophers found their way into the popular press.

The local periodical press could also act to recognize the achievements and affiliation of natural philosophers with philosophical societies and academic institutions. The *Maryland Gazette* of 3/21/54 noted that Royal Society cited Franklin for his work on electricity. The 8/16/53 issue of the *Maryland Gazette* recognized Franklin again:

Boston, July 30, On Monday last, the Corporation of Harvard College met at Cambridge, and taking into Consideration of the great Genius of BENJAMIN FRANKLIN, of Philadelphia, Esq.; for Learning, the high Advances he has made in Natural Philosophy, more especially in the doctrine and Experiments of ELECTRICITY whereby he has rendered himself justly famous in the Learned World, unanimously voted him a Degree of Master of Arts, which Vote was the Day following as fully confirmed by the Overseers of that Society, and on Friday the President presented him a DIPLOMA therefor.

²³⁵ Stearns, p.436.

²³⁶ Kronick, p. 252.

²³⁷ Stearns p.650.

²³⁸ Stearns p.509 (from Lemay, p.62).

The achievement that Harvard College recognized Franklin for, however, had been published in Great Britain and did not get a domestic printing until the 19th century.²³⁹ Franklin also wrote many letters and notes of scientific merit during the mid-century. A partial list could include:

- Letters concerning electricity to Peter Collinson on 4/23/47, 7/29/47, 10/19/52, and September 1753.
- Letters to Cadwallader Colden in 1751 and 4/23/52 about electricity and conduction.
- A letter to James Bowdoin on the nature of lightning on 1/24/52.
- A letter about making lightning rods to David Hume on 1/24/62.
- His Journal of the voyage from London to Philadelphia in 1726.
- A letter with a diagram on waterspouts and whirlwinds to John Perkins in 2/4/53.
- A letter about cooling by evaporation to John Lining on 4/14/57 and 6/17/58.
- A letter about salt deposits to Peter Franklin 5/7/60.
- A letter on the origin of Northeast storms on 5/12/60 to Alexander Small.
- A letter about Tides and Rivers on 9/13/60, distillation of salt water on 8/10/61 and a letter about the influence of color on heat absorption on 9/20/61 to Mary Stevenson.
- A letter on sound to Oliver Neave on 7/20/62.
- A letter to Jon Pringle on 12/1/62 about the behavior of oil on water.
- Notes on an improved fireplace in 1744.
- Farming techniques in a letter to Jared Eliot in 1749.
- The mechanism of the armonica in a letter to Giambatista Beccaria on 7/13/62.
- The rules of health and long life as an article in Poor Richard's Almanack of 1742.
- A letter to Jane Mecom on 6/19/31 about smallpox and cancer.
- A catheter design in a letter to John Franklin on 12/8/52.
- A letter to John Pringle on 12/21/57 about an electrical treatment for paralysis.

Of all the above letters and notes, only the 10/19/52 letter to Peter Collinson saw immediate publication in the *Pennsylvania Gazette*. From what I can tell, none of the other letters and notes ever saw publication in the *Pennsylvania Gazette* or any other general periodical.

Was the general periodical an archival device, a place for original work, a means of popularization, or some combination? The newspaper did include information valuable to those interested in or doing science. But, how much of that might be considered original? What role did the newspaper play?

²³⁹ Cohen, forward in Benjamin Franklin's Experiments, A New Edition of Franklin's "Experiments and

Original Science in the Press

One hundred and twenty articles in the *Pennsylvania Gazette* address technology, earthquakes, husbandry, health, navigation, plants, animals, astronomy and other phenomena of the sky, and other natural philosophy. Without accounting for the substantial number of references to medicines, there are also more than 70 advertisements referencing these categories through books, instruments and instruction.²⁴⁰

Few of these articles run to any length, give explicit instructions, or delve into any theory. Of these, far fewer still appear original to the newspaper. Most articles run only a paragraph and describe social interactions more than the details of the process or technology. They frequently begin "We are informed that..." such as this notice in the 2/6/52 *Maryland Gazette*:

London, Oct, 31. We are informed that a Scheme for finding out the Longitude from the different Variations of the Needs in different Parts of the Globe has been laid before the Lords in the Admiralty by Mr. Zachary Williams, an old and experienced Mathematician; and their Lordships have referred it to the Consideration of Dr. Bradley, Regius Professor of Astronomy at Greenwich.

All the extensive articles in the *Pennsylvania Gazette* for 1728 and 1729 come directly from Chamber's Cyclopaedia. A number of subsequent articles in the *Gazette* also came from the Cyclopaedia; for example, the 5/28/30 through 6/23/30 serial article on smallpox and the 1/6/37 article on aurora borealis. Although not necessarily labeled with their source at the time, subsequent scholarship has demonstrated the literary lineage of many more of these extensive articles. For example, the 10/9/29 article on the uses of hemp and flax and the 12/15/37 through 12/22/37 articles on earthquakes came from Chambers.²⁴¹ Five weeks later, William Parks of the *Virginia Gazette*

Observations on Electricity."

²⁴⁰ Because of the way the data for the *Pennsylvania Gazette* was collected, this subjective collection of extensive articles does not include, except for select articles, most of the scientific articles originating in Europe. It also does not include medical advertisements or weather observations. It is a list intended to show only the small proportion of in-depth articles to all those of science.

²⁴¹ Aldridge (1950), p.163. Aldridge states that the earthquake essay, previously pointed to as one of Franklin's first scientific writings, is actually a "word by word transcript from the article 'Earthquakes'" in Ephraim Chambers' *Cyclopaedia: or, an Universal Dictionary of Arts and Sciences*, although in an inverted order, starting in the middle and publishing the beginning in the subsequent issue.

reprinted the Franklin article, itself the reprint from Chambers, also without indicating the source.²⁴²

Other extensive articles came from other sources as well such as *Gentleman's magazine* or the *Philosophical Transactions* of the Royal Society. The June 21, 1739 essay on using olive oil for snakebites was from the Royal Society *Transactions* from a previous year. The September 6, 1739 detailed description on making a drink for curing gallstones was taken from a month-old *London Gazette* (which may itself have been a reprint). The September 11, 1735 articles on lice and saltwater were extracts from a book, although the name of the book was not given. The articles of August 2 and 23 of 1744 on the camera obscura were labeled as reprints from the New York papers, which were themselves probably reprints of some kind of notice since the camera obscura had already toured in Europe the year before. Dr. Tennent's essays of July and August of 1739 on pleurisy, the attraction of matter, and rattlesnake root were also reprints from a pamphlet.

The following table gives an overview of all the extensive articles in the *Pennsylvania Gazette* (excepting Keimer's year of encyclopedia excerpts). It distinguishes between original articles and those articles known or likely to be reprints. It also distinguishes between articles of a *practical* nature (instructions on how to cure a disease for example), articles that strictly make *observations* of phenomena, articles that posit *theory* for phenomena, and the lone article, Franklin's kite experiment, that actually *instructs* the user as to how to do the experiment.

²⁴² Aldridge, p.163, "We know that Parks took his material from Franklin instead of directly from Chambers because he followed Franklin's inverted order instead of the order of the original."

Date(s)	Article	Reprints	Orientation
5/28/30, 6/26/60	Small Pox	Yes	Practical
7/13/38, 8//10/38	snake bites - Tennent	Yes	Practical
9/6/39	gall stones	Yes	Practical
5/14/30	Buggs	Yes	Practical
9/11/35	Lice	Yes	Practical
7/19/39, 7/26/39, 8/2/39	Pleurisy - Tennent	Yes	Theory/Practical
11/21/51	Cancer	Yes	Practical
9/4/55	Goal fever	Maybe not	Practical
10/9/29	Hemp and Flax	Yes	Practical
5/25/32	River navigation	Probably not	Practical
5/9/65	Grapes	Maybe not	Practical
12/6/45	Navigation - longitude	Maybe not	Practical
1/6/37	Aurora Borealis	Yes	Theory
12/15/37	Earthquakes	Yes	Theory
7/26/39	Matter	Yes	Theory
4/19/59	Comet	Yes	Observational
8/27/52	French electrical exp.	Yes	Observational/Theory
10/19/52	Kite electrical exp.	Recent letter to Collinson	Instructional/Theory

Table 5.1 - Extensive original and reprinted science articles in the *Pennsylvania Gazette*.

It appears that all but a few of the in-depth articles in the above table were reprints. The largest of these is the four-part river navigation article that began May 18, 1732. The *Pennsylvania Gazette* labels this article as the product of an author (not named) who is "some old experienc'd engineer," who had not yet put pen to paper. The article contains detailed descriptions of devices such as flood gates and latching mechanisms. I saw no references to this article in any secondary literature.

While it cannot be discounted that this article is a reprint from another journal or pamphlet, it seems that it could be an original publication of interest. Granted it would not count as 'high science' in that it is not physics or mathematics, rather a 'technique' that might be published in an English husbandry journal of the day. Since Philadelphia (if indeed this article is from a local source) did not have such a journal at the time however, then the article may not have been able to find an outlet anywhere else. I also found no advertisement for it as a pamphlet. It is difficult to determine since we do not even know the author. We also do not know the authors for two more, less detailed but still substantive, articles: the May 14, 1730 article on "buggs" and the December 6, 1745 article on a new method of determining longitude.

As just noted, the *Virginia Gazette* had a number of the same extensive articles as the *Pennsylvania Gazette*. The two part series on the causes of earthquakes on 1/27/38 had come from that paper. So did the 5/9/51 article on the exploration of the falls of Niagara and 10/27/52 article describing the French electrical experiment. Interestingly, I did not find a reprint of Franklin's experiments. A number of articles written by Tennent appeared in the *Virginia Gazette*. A few of these appear in the *Pennsylvania Gazette* and must either have been reprinted from Virginia or been submitted directly by Tennent to the *Pennsylvania Gazette*. The Tennent articles appear to be excerpts from his pamphlets already published and often advertised in the same issues that the articles appear.

The *Virginia Gazette* had extensive articles from other sources as well. An extensive article on Artifacts discovered in Naples from the *Philosophical Transactions* appeared on 3/14/51. A 12/27/51 article on observations on a dwarf, a 3/17/38 article on curing a dogs bite, and a 3/27/52 article on the eruption of Mt. Vesuvius all appear from publications abroad. An article on Tar water in 8/11/38 comes from the *Gazette* in South Carolina and another on 4/9/45 is listed as from Dr. Berkeley of Ireland.²⁴³ Out of 245 articles on science, the only extensive article that I currently cannot trace is the 2/12/62 article on how to make wine.²⁴⁴

²⁴³ It is unclear if Dr. Berkeley was still in Ireland or in Rhode Island when he wrote the letter.

²⁴⁴ I am able to include the articles from overseas for the *Virginia Gazette*, *American Weekly Mercury*, and *Maryland Gazette* which should account for the greater number of articles. This count does not include reports on weather and earthquakes. It does not include advertisements either.

From 180 articles, the *Maryland Gazette* presents a number of extensive reprints: the 7/9/52 on the natural history of salts, the 8/27/52 Paris electrical experiments, 11/16/52 Franklin kite experiment, 8/16/53 repeat of the kite experiment in Charleston, a 8/18/57 letter from Boston starts by wondering how anyone alive could not know to not stand under a tree in a lightning storm, a 12/10/45 on how to make sassafras water and Indian salve, a 4/5/49 on tar water from Mr. Prior (interesting that this article appears about the same time as the one in the *Virginia Gazette* for Dr. Berkeley's tar water. Both told of the beneficial effects of tar water and both represented products sold in stores). More reprints: a short note on retrieving a feather quill from a man's stomach on 11/8/49, a 2/6/52 cure for a mad dog bite, a 3/26/52 small pox inoculation from the Gentleman's magazine, a 2/1/53 on reviving an unconscious individual by artificial respiration, a 4/11/54 essay on comets, the transit of Venus by John Winthrop on 4/30/61 from Boston, and two, two-part essays on flax from Dublin on 7/5/45, 7/26/45 and 3/9/48, 3/29/48. One article of 12/21/58 may originate locally. It concerns destroying the small moth along with a call to the general public for a cure for the corn beetle. Both pests had been destroying the colonial crop of corn.

In the *American Weekly Mercury*, a count of 265 articles gives us potentially 13 extensive articles. From other sources: the 11/28/28 on astronomy and the 1/5/31 detail of an operation from a London source, the 8/8/45 on making flax from the Dublin society (also found in the *Maryland Gazette* a month earlier), the 8/2/33 destruction of buggs, a 9/6/39 on the cure of stones from the London Gazette, a 7/28/43 on exploring the North West passage from the London Magazine. A 2/24/31 on Small pox from Dr. Sydrhem actually dates from the year 1669. A 12/15/37 article had a short yet descriptive essay on fixing a leak in a ship's hull from the *Gentleman's Magazine*. A 6/8/32 article gave details for a technology for determining longitude but appears likely is a repeat.

Unlike the few substantial scientific articles of obvious local and original origin printed in the *Virginia* and *Maryland Gazettes*, the *Mercury* does appear to have several. A 9/20/39 article noted a locally conducted experiment of curing a dog of a rattlesnake bite with salad oil. A local merchant, Thelonius Grew, modified Flamsteed's tables to give fairly complex set of measurements to use when viewing the upcoming lunar eclipse.²⁴⁵ An article on 2/3/37 ran only 17 lines but gave a

²⁴⁵ American Weekly Mercury, 3/9/36:31

detailed and quantified description of a comet. Another similar comet appeared on 1/18/44. All these articles not only appear locally produced but locally oriented.

The *Mercury* also made at least three separate calls to its readership for their thoughts on observed phenomena. The 4/14/37 issue had an account of an eclipse and asked for people to speculate. A report of a fireball in Connecticut in the 1/4/43 issue asks for "conjecture from the public", and a strange atmospheric apparition ended the 2/12/41 with a call to philosophers to explain.

Interestingly, I never saw any published responses from the public following these articles.

The public obviously could act as observers in the field. The 4/5/53 *Pennsylvania Gazette* had a call from the Royal Society asking for observers of the upcoming transit of Mercury. A month later, on 5/3/53, the newspaper published an article on how to calculate the transit. Two categories, which I've purposely and largely left out of our discussion so far, earthquake and weather reports, give even more ample evidence of the participation of the public.

For our period, the *Maryland Gazette*, *Virginia Gazette*, and *American Weekly Mercury* had a combined total of at least 139 reports of earthquakes and 477 reports of weather. The majority of these consist of excerpts from other newspapers, a large proportion from overseas. However, reports from ship captains, locals, and letter writers also added to the total. Individuals gave the details of duration and magnitude for local earth tremors. Sailors reported of storms at sea. Farmers wrote of lightening strikes. In 6/21/53 Franklin even placed an advertisement in his own paper asking specifically for any observations of lightning strikes. These submissions might later find publication in the *Pennsylvania Gazette*.

Public and Private Electricity

In England, an unknown author introduced his or her unsigned pamphlet with the following:

A Letter to Benjamin Franklin, LL.D. FRS In which his Pretensions to the title of Natural Philosopher are considered. . . . You no doubt perceive already that the style of this Letter will be very different from the compliments you have been accustomed to I am sorry to say it, I found in them [Franklin's writings on

electricity] what sufficiently convinced me that you are ignorant both of Philosophical Reasoning and Philosophical Principles, I mean those which have been most successfully applied to explain the appearances of nature; which grieves me the more, because, from the great reputation you and others of your stamp have acquired, it is to be apprehended we are in danger of losing every idea of true philosophy. . . . I think they contain more ridiculous absurdities, under the notion of Philosophical Reasonings, than any book I know, at least that is so generally read; and that from the swarms of Philosophers we meet with every where, of the same reach and qualifications, your works may be used with great propriety as a barometer for discovering the state of Philosophy at this present time.

Apparently, Franklin did not enjoy universal support from the sages of natural philosophy. According to this letter, Franklin, even after election as a Fellow of the Royal Society (FRS), could be critiqued on the scientific methodology of his electrical studies. The writer of the letter continued by decrying the public attention given Franklin, his mistaken experimental method, and the public verification that allowed for the existence of such 'flawed' systems while threatening 'true' systems such as Newton's. The writer inferred that Franklin's methodology had been given attention because of popular appeal:

If people could be prevailed upon to examine one or two philosophical questions, so minutely as to be able to form a clear notion of Newton's method of reasoning, and then compare it with yours; this would be a very probable means of removing some of those numberless corruptions which are daily creeping into natural Philosophy: and that to such a degree as to be in danger of verifying a remark, which I used to think proceeded from the ignorance of those who made it; namely, that the Newtonian Philosophy is one of those fashionable systems which depend upon the humour of the people, and as that changes, give place to some new scheme.²⁴⁶

Just as Tory John Freke and Behmist John Law opposed the English itinerant lecturer on electricity Benjamin Martin²⁴⁷ along religious, class, and philosophical lines, so did our anonymous critic of Franklin argue against Franklin. If this letter is representative of the sentiments of numerous philosophers, then in their opinion, Franklin's worldwide fame had more to do with gaining popular support through appearing homespun than having knowledge or being subjected to philosophical peer (or superior) review. The letter continues:

²⁴⁶ Cohen (1941), Franklin's Experiments, Appendix II, 422. No date for the pamphlet is given.

²⁴⁷ Schaffer (1993), p.506.

But an author, whose reputation has been acquired by some discussion in science, and who has beside the merit of being illiterate, is in some respects out of the reach of criticism; because, in this case, things not very consistent with each other are sure to be advanced and defended. For, if he be convicted of blundering in points of learning, or should be proved ignorant of every thing done by others, in the very science to which he chooses to refer his own discoveries, his deficiencies, instead of turning to his discredit, will be considered as so many vouchers for his great abilities.

Interestingly, Franklin probably intended to appear less popular. Likely aware of his audience, and aware of the potential reception in the Royal Society, he might have tried to utilize the appropriate means for communicating with the appropriate audiences. His paper, *Observations and Experiments on Electricity* attempts clarity, circumspection, attention to detail and method, and humility in the face of nature. As we shall see, this can easily be contrasted with the flashy language of the public electrical experiments conducted by Kinnersley.

Originally, Franklin's letters to Collinson and others were received by the Royal Society with mixed reactions. Meanwhile, several French philosophers, possibly for their own political purposes as well as philosophical, seized on Franklin's writings and gleefully announced the success of the experiment. The British then gave more attention to the fledgling colonial scientist, who benefited from the Franco-British political rivalry and gained British recognition.

It would appear that despite such critical reaction to the contrary, Franklin's writings on electricity were not intended for public consumption, and his general strategy appeared to insist on a forced separation between philosophical circles and the public at large. The editors' notes of all the editions of *Observations* suggest this.²⁴⁸ Nor were the devices described intended for a broader audience. The equipment would require an outlay of money for materials and building expertise that would put it firmly in the range of the gentleman natural philosopher. In fact, Franklin himself never built the "sentry box" for experimenting with lightning detailed in the *Observations*. In addition, he delayed publication of the experiments in the *Gazette* until after the French experiment. The *Observations* did not get published in the colonies until the nineteenth century.

²⁴⁸ Cohen (1941), *Franklin's Experiments*, p.398.

Further proof of Franklin's scientific strategy comes from Ebenezer Kinnersley's work in publicizing electricity. His early lectures, although designed by Franklin and beginning before the 10/19/52 article on the kite experiment, never mentioned Franklin or call the system Franklinian. For a long time in the early part of the 1750s, the public credited Kinnersley with the lightning and electricity hypothesis. Only with the news of Dalibard's work in France in August of 1752 did Franklin's name get publicly linked to the theory.²⁴⁹ Kinnersley wrote a letter to defend Franklin's expertise in the November 30, 1758 *Gazette*, so the debate continued even till then. From letters with Franklin, Kinnersley obviously contributed experiments, theories, and proofs to the inquiry. However, Franklin and Kinnersley (as well as other lecturers in Kinnersley's style -- some trained by Franklin) divided the world between them. Franklin, the savant, addressed the elite, while Kinnersley, the country showman, spoke to the populace. Only with the unsigned kite article did Franklin make a more popular connection. Otherwise, Kinnersley created and was identified with the popular representations of experiments on lightning - and these representations, true to our anonymous reviewer's words, did eventually hinge on "the humour of the people."

In a June 21, 1753 letter to Hall, Franklin asked for reports from people seeing a lightning strike:

Those of our Readers in this and neighboring Provinces, who may have an Opportunity of observing, during the present Summer, any of the Effects of Lightning on Houses, Ships, Trees, &c. are requested to take particular Notice of its Course, and Deviation from a strait Line, in the Walls or other Matter affected by it, its different Operations or Effects on Wood, Stone, Bricks, Glass, Metals, Animal Bodies, &c. and every other Circumstance that may tend to discover the Nature, and compleat the History of that terrible Meteor. Such Observations being put in Writing, and communicated to BENJAMIN FRANKLIN, in PHILADELPHIA, will be very thankfully accepted and acknowledged.

Long before this call for observations however, the *Gazette* had started printing substantially more stories about lightning strikes than it had earlier. Table 5.2 shows how, concurrent with Kinnersley's advertisements (starting on 7/25/51 and shown highlighted and underlined), the *Pennsylvania Gazette* had a proportional rise in articles about lightning. It seems likely that Franklin began to both increasingly publish letters from friends invited informally to contribute observations and to pique the public's interest in lightning in anticipation of his findings regarding

²⁴⁹ Lemay (1961), p.82.

electricity and lightning. The *Maryland Gazette* shows a similar correspondence between an increase in articles about lightning strikes and advertisements and articles about electricity in Table 5.3 (although tailing off in the later period).

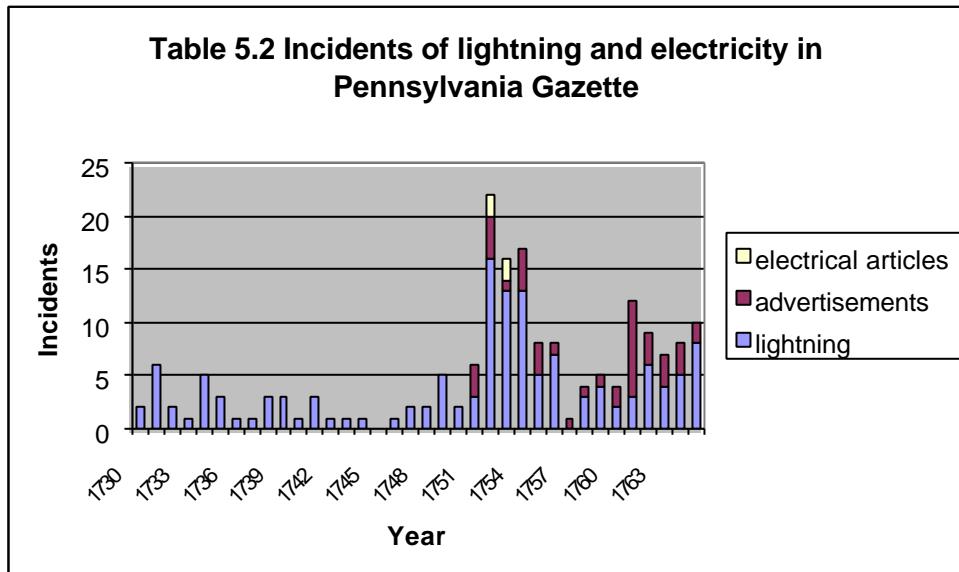


Table 5.2 The advertisements are from Ebenezer Kinnersley performing experiments starting with April 11, 1751. Of the four articles, two are articles of Franklin's famous lightning experiment performed in Carolina (7/26/53, 9/13/53). One is Franklin's kite experiment done in Philadelphia by himself (10/19/52) and the other the 8/27/52 article on the French experiment. The chart shows a substantial rise in reported lightning strikes as Kinnersley begins to lecture, a sharp rise during the initial 'experimental years' starting in 1752, and an average yearly increased amount after 1750. Interestingly, however, a lull does occur starting in 1757.

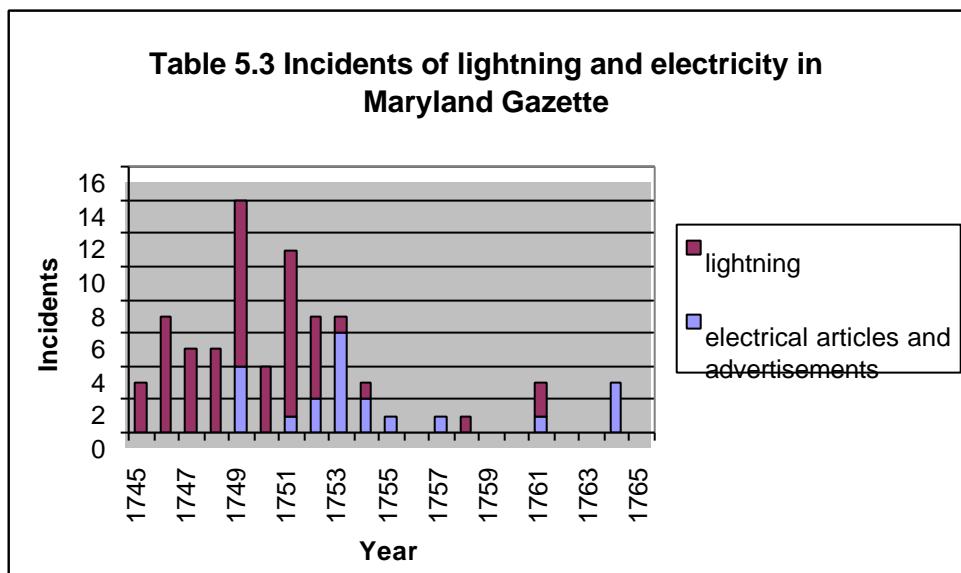


Table 5.3 The Maryland Gazette shows just as much activity during the initial electrical years although tailing off in later years. This includes the French and kite experiments.

The *Virginia Gazette*, however, does not show this lightning/electricity correspondence despite printing a number of articles about electricity (although not the Kite experiment). Nor do I find any advertisements for Kinnersley's lectures there.

The character of lightning strike articles also changes later in the period. A 6/15/38 article in the *Pennsylvania Gazette* was the first that mentioned that the person killed had been standing under a tree. A 4/29/42 article noted that the person had been under a shed on the top of a hill when hit. There seemed to have been an acknowledgment in the *Pennsylvania Gazette* before 1749 of the danger of standing near tall objects during a lightning storm. However, the articles of pre-mid-century were, on the whole, different than those later. The later articles observed the path and effect of lightning with the understanding of charges, conductors, and ground, even if not stated explicitly.

The numerous articles on lightning that appeared after 1750 not only advertised the lectures of Kinnersley and the 'sameness of lightning and electricity.' Most were letters and archived the witnessed events occurring throughout the colonies. They show an awareness of electrical nature of lightning. The separation between witnesses and experimenters could still exist. A 6/27/65 *Pennsylvania Gazette* letter from Boston contained the observation that no adequate conductor existed for an iron topped house tragically struck by lightning and so "the event showed the validity of those experimenters involved in electricity." Yet the existence and printing of such letters and Franklin's call for them validated the public accessibility to experiment.

Franklin added to this accessibility by printing in the *Pennsylvania Gazette* the directions for how to construct the kite experiment. Here is the letter from Franklin as it appeared in the October 19, 1752 issue:

PHILADELPHIA, October 19.

As frequent Mention is made in the News Papers from *Europe*, of the Success of the *Philadelphia* Experiment for drawing the Electric Fire from Clouds by Means of pointed Rods of Iron erected on high Buildings, So it may be agreeable to the Curious to be inform'd that the same Experiment has succeeded in *Philadelphia*, tho' made in a different and more easy Manner, which any one may try, as follows.

Make a small Cross of two light Strips of Ceder, the Arms so long as to reach to the four Corners of a large thin Silk Handkerchief when extended; tie the

Corners of the Handkerchief to the Extremities of the Cross, so you have the Body of a Kite; which being properly accommodated with a Tail, Loop and String, will rise in the Air, like that made of paper; but this being of Silk is better to bear the Wet and Wind of a Thunder Gust without tearing. To the Top of the upright Stick of the Cross is to be fitted a very sharp pointed Wire, rising a Foot or more above the Wood. To the End of the Twine, next the Head, is to be tied a silk Ribbon, and where the Twine and the silk join, a Key may be fastened. This kite is to be raised when a Thunder Gust appears to be coming on, and the Person who holds the String must stand within a Door, or Window, or under some Cover, so that the Silk Ribbon may not be wet; and Care must be taken that the Twine does not touch the Frame of the Door or Window. As soon as any of the Thunder Clouds come over the Kite, the pointed Wire will draw the Electric Fire from them, and the Kite, with all the Twine, will be electrified, and the loose filaments of the Twine will stand out every Way, and be attracted by an approaching Finger. And when the Rain has wet the Kite and Twine, so that it can conduct the Electric Fire freely, you will find it stream out plentifully from the Key of the Approach of your Knoucke. At this Key the Phial may be charg'd; and the Electric Fire thus obtain'd, Spirits may be kindled, and all the other Electric Experiments be perform'd which are usually done by the Help of a rubbed Glass Globe or Tube; and thereby the *Sameness* of the Electric Matter with that of Lightning completely demonstrated.

At least one individual (unnamed) from South Carolina repeated the experiment. A July 26, 1753 article in the *Gazette* archived this achievement, "I HAVE several Times this Season, when there was an Appearance of a Thunder storm, succeeded in making Mr. Franklin's Experiment with a Kite, for drawing the Lightning from Cloud's, and last Monday I repeated the same with remarkable Success before many Spectators." This report included a detailed description of the effect not included in Franklin's letter:

The Flow of the Electrical Fluid, or the Matter of Lightning, was so rapid and copious down the Line near 700 Feet long, to the Key appended at the lower End of the Line, that from thence I obtained Sparks of Lightning as thick and long as the first two Joints of a Man's little Finger, and these as quick one after another as I could bring the Loop of a Wire, within about two Inches of the Key: And the Snappings from the Key were so smart and loud, that they were heard at the Distance of at least 200 Yards.²⁵⁰

²⁵⁰ Interestingly, the letter implied an understanding of electricity not described in any of the newspaper articles up to this point. So the experimenter must have had other sources of information than the *Pennsylvania Gazette*. Franklin believed that a conductor robbed the clouds of electricity. That comes across in the final part of the report (or some kind of parallel, self-generated philosophy):

I received such a Shock up to my Shoulder, that I failed in the Attempt; and before I could be furnished with a longer Wire to discharge the Phial, without receiving a Shock, all the Electrical Fluid or Lightning in the Cloud was drawn from thence and discharged in the Air, with a hissing Noise, from the Extremity of the Phial's Hook. A greater Degree of Serenity soon succeeded, and

Another letter from St. John's, in Antigua, dated July 17, verified the account: "By a Letter from Charles Town, in South Carolina, we learn that a curious Gentleman there, in the Presence of many People, has lately met with extraordinary Success in the Experiment of the Electric Kite, which extracted very large Quantities of Electric Fire from the Thunder Clouds." The letter reiterated the advantages in protecting property against the ravages of lightning and the success the experiment has had in convincing others:

. . . as their Climate is frequently subject to very tremendous Thunder Storms which often do considerable and irreparable Damage, and as the Carolinians are so fully convinced of the Reasonableness of the Method proposed by the Electricors, for preventing, in a great Measure, the dreadful Effects of that destructive Element; they are now fixing sharp pointed Iron Rods on their Churches, Houses, Granaries, &c. for that laudable Purpose.²⁵¹

It should be noted that both newspapers had some affiliation with Franklin through his publishing network.

Kinnersley moved from testing theory to creating a showpiece in very short order. The electrical pony race came from Kinnersley's questioning an aspect of Franklin's system. Kinnersley wrote to Franklin in London on March 12, 1761 of testing whether the amount of electricity in the air is the same two to three hundred feet as it is at ground level, finding that it was denser above. Using the same testing apparatus, he immediately rigged up horses and riders, an electrical horse race with electrified points instead of spurs.²⁵²

The quick turn-around between experiment and presentation certainly gives the impression of public participation in at least observing the experiments of the forefront of natural philosophy. Kinnersley performed the important link between the private discussions between himself and Franklin regarding theory. In some cases, he created new presentations before Franklin yet became aware of them. Public participation needed more than the witnessing of pre-arranged experiments.

no more of the awful Noise of Thunder, before expected, was heard. I am, Sir, Yours, &c. Charles Town, May 15, 1753.

²⁵¹ *Gazette*, September 13, 1753.

²⁵² Lemay (1961), p.99.

Potentially, the audience even could have contributed to theory derivation. Kinnersley's demonstrations proved an important element in moving natural philosophy into the consciousness and interests of the public. Participation included the image of accessibility: that the experimenter's actions were within reach of ordinary people. The articles on lightning, Franklin's call for individual's observations, directions on how to perform the kite experiment, and the individual in Charleston, S.C. who repeated the experiment served this function. However, to succeed as a scientist, Franklin also appears to have needed to work in a more private arena.

Observing Earth and Sky

The newspapers welcomed and frequently published the observations of the public concerning earth and atmospheric phenomenon. The great number of articles regarding earthquakes and weather, as noted above, points to how frequent public contributions could occur. The newspaper could serve as a long-running commentary on the state of the world. Given a rudimentary schema, colonists were invited to observe the experiment of God having set his universe in motion. The resulting letters still show some fantastical fascination for the emissions of the earth and sky, yet use detailed description, common metaphors, and attempt a purely observational stance. In July 26, 1764, a meteor was described thus:

I saw a Ball of Fire near the Northeast, about 50 Degrees above the Horizon; it took its Course near Northwest, its Diameter at times considerably bigger than that of the Sun, especially at one time it opened so as, seemingly, it would have separated itself. It appeared like large flaming Sheets of Fire, inclining together, like that of a new blown Rose; its Sound as it went (which was very swift) was like that of a great Fire, urged by a strong Wind; it kept near of one Height all the Way, till it had crossed the Meridian to the North, about 20 Degrees, where was a small Cloud, which seemed as if it attracted it; it mounted higher, and just as it seemingly touched the outward Edge of the Cloud, it broke into Thousands of Pieces, like that of springing a Mine, where the Pieces and Particles would all be in a Flame, when, as near as could be guessed, in about 30 Seconds of Time came the Report, which was like the Firing of a large Cannon, the Sound of it believed to last one full Minute. It had something exceedingly remarkable in its Center, like a Bar of Iron, which appeared to be very hot, out of which there came Sparks of Fire as it went. T. T.

In the next two chapters we will see many more of these dramatic representations of nature in descriptions of earthquakes, volcanoes, weather, and medical anomalies. Sometimes the author would make strict, detached and measured observations as well. On the other hand, rarely would an author speculate on causes.

Second, the Chambers article, and another article on matter from 7/26/39, are the last two in the *Gazette* to display theoretical systems rather than an experimental approach to natural philosophy. After the article on matter, the *Gazette* excludes theoretical systems as a rhetorical strategy within articles of science. The articles continue to be authoritative but require the reader to go beyond the text of the *Gazette* to discover the theoretical framework, perhaps to the publications sold in bookstores like Franklin's.

Franklin - Printer/Popularizer

It should come as no surprise that Franklin wanted to be remembered as a printer. It was through that skill that he helped create an “enlightened” world. In the 1730s he possessed the advantage of the smallest print face in the colonies,²⁵³ and through superior technology, industriousness,²⁵⁴ and political savvy, he expanded the readership of the *Gazette*, issued the successful Poor Richard's Almanac in 1732, secured most government printing jobs when he became clerk of the Pennsylvania general assembly in 1736, and gained control of distribution after becoming a colonial postmaster in 1737.²⁵⁵ In his autobiography Franklin wrote of his decision to begin a newspaper:

My hopes of success . . . were founded on this, that the then only newspaper, printed by Bradford, was a paltry thing, wretchedly manag'd, no way entertaining, and yet profitable to him; I therefore thought that a good paper would scarcely fail of good encouragement.²⁵⁶

This followed on the heels of his description of the Junto -- a private reading, writing, and discussion group -- and its members:

²⁵³ Richardson (1931), p.24. Small type face meant that newsprint (an expensive item) could be conserved.

²⁵⁴ Hard work is part of Franklin's self-story. See Franklin (1955), pp.77, 83, *et passim*.

²⁵⁵ Among others, Richardson (1931), p.18.

²⁵⁶ Franklin (1955), p.77.

Our friendship [with William Coleman] continued without interruption to his death, upward of forty years; and the club continued almost as long, and was the best school of philosophy, morality, and politics that then existed in the province.²⁵⁷

In this way, Franklin showed us the means with which he addressed the world and made a profit. In the inner circles of the leather apron club businessmen debated matters of philosophy and politics, which then sold them to the public as both entertaining and revenue producing.²⁵⁸

Public service also was linked inextricably to the market by creating a market for the books he imported and work for his friends. He described the beginnings of the Library Company of Philadelphia:

And now I set on foot my first project of a public nature, that for a subscription library. I drew up the proposals, got them put into form by our great scrivener, Brockden, and by help of my friends in the Junto, procured fifty subscribers of forty shillings each to begin with, and ten shillings a year for fifty years.²⁵⁹

And the type of public service also reflected this link. In a passage written seven years after the last one, Franklin re-wrote his history:

So few were the readers at that time in Philadelphia, and the majority of us so poor, that I was not able, with great industry, to find more than fifty persons, mostly young tradesman, willing to pay down for this purpose. . . reading became fashionable; and our people, having no publick amusements to divert their attention from study, became better acquainted with books, and in a few years were observ'd by strangers to be better instructed and more intelligent than people of the same rank generally are in other countries.²⁶⁰

Yet, many historians downplay the extent of increasing literacy during the eighteenth century.²⁶¹ This was a public accustomed to reading the Bible, as Franklin did in his youth. So readers are not just people able to read, they are those reading the works of the Enlightenment -- Locke and Newton and less so the works of John and Luke.²⁶² The pages of the *Pennsylvania Gazette* list the books for

²⁵⁷ Franklin (1955), p.76.

²⁵⁸ I use this term from the work of Latour (1987).

²⁵⁹ Franklin (1955), p.87.

²⁶⁰ Franklin autobiography, p.96.

²⁶¹ See Chartier (1987) and his "The practical impact of writing" in *A History of Private Life III*.

²⁶² See Zall (1989) and Wright (¹⁹⁸⁶) for perspectives on Franklin's *Autobiography*.

sale at Franklin's stationary store. While bibles and religious treatises are listed first, other works outnumber them. This differs from Bradford's *Mercury*, which listed many more religious works.

In choosing their literature, the people of eighteenth-century colonial America voted for a new society with dollars, shillings, and pence. Franklin's characterizations of the readers as 'so poor' only added to the dramatic turn that took place. Those readers became the successful leaders of that new society, a society in which natural philosophy, natural history, and technique played a crucial role. Some of those same readers became the success stories played out in the *Pennsylvania Gazette*: entertaining models for behavior. Many times in his autobiography Franklin mentioned his humble origins, highlighting not only his own rise but also the rise of a culture in which print played a critical role:

I look'd round me and made overtures of acquaintance in other places; but soon found that, the business of a printer being generally thought a poor one, I was not to expect money with a wife.²⁶³

To what extent did those stories allow for the direct participation of the populace in the creation of facts, versus the creation of wealth and/or power for those marketing those facts and the means of creating them? Few articles posited hypotheses, usually established matters of fact. The readers rarely got articles on the theoretical frontier and few were original. Many times the articles had been published years, even decades, before. The bulk of the writing related to natural philosophy, natural history, or techniques resided in short notices. As we shall see in the next chapters, the number of advertisements outnumbered the articles related to science. In addition, the proportion of those advertisements to articles also increased over time. A participant public nature of natural inquiry remained mostly sporadic and elusive in the general periodical.

However, while the newspaper did not usually act as a timely avenue for the latest scientific advances, the colonists did require information of a timely nature. Reprinted substantive articles of technical merit reflected the political and market needs of the colonies. For example, the newspaper printed articles on making shot during the war against the French and Indians, irrigation and pest

²⁶³ Franklin (1955), p.86.

control during drought and infestation, inoculation for the smallpox during epidemics and growing grapes and raising silk worms for trade.

These extensive articles appear largely utilitarian. Of universal philosophical interest were the two articles on electricity published in 1752. The first detailed the successful experiment in France and made the utility of the information obvious. The second brought the experiment within the price range of the general public so that the colonists could prove to themselves its potential utility. However, in the newspaper, utility really had been positioned as an elemental part of the electrical experiments all along. The original letter of the French experiment, printed a month earlier than Franklin's, clearly endeavors to make the work of the philosophers more than idle experimentation:

Extract of a Letter from Paris, dated May 26.

From several electrical Experiments performed by our most consummate Naturalists, in Pursuance of those by Mr. Franklin, in Philadelphia, to find whether the tonitruous and electrical Matter be not analogous; it appears, that to fix on the highest Part of Buildings, or Ships, sharp-pointed Iron-bars of 10 or 12 Feet, and gilt to prevent Rust, with a Wire hanging down on the Outside to the Ground, or about one of the Ships Shrouds is a Preservative against Thunder. The Sieur Dalibard having placed in a Garden at Marley, an Iron-bar on an electrical Body, at the Height of 40 Feet, was informed, that on the 120th of May, about 20 Minutes after Two, a Tempest passing over that Spot, the Parish Priest and other Persons drew from the Bar such Sparks and Agitations as are seen in the common electrical Performances. . . Both these Experiments have been reported to the Royal Academy of Sciences, and both evince that Thunder Clouds may be deprived of their Fire, by Iron Bars fashioned and fixed as above.²⁶⁴

Some public access to make observations and experiments of science did exist. However, it appears that the majority of scientific information exchange occurred outside of the newspaper. Letter writing and verbal communication was more efficient for a rapid exchange of information. Print - especially the newspaper - worked to preserve, to archive, and to distribute to a large audience. We must also assume that the editors of these publications knew their audience to some extent. All four papers published for several decades, surely a sign of marketing skill. In his first issue of the *Pennsylvania Gazette* of October 16, 1729, Franklin asked his readers to send "every remarkable Accident, Occurrence, &c. fit for public notice". Many in the audience may not have had the time, interest, or felt particularly convinced of the benefit of either actively participating in or even

²⁶⁴ *Virginia Gazette*, 10/27/52.

hearing of the latest scientific advances. In any event, the negotiation between audience and editorship would mitigate the role the public would play in the enterprise of science. As we have inferred, and shall see further evidence of in the coming chapters, the newspaper played a role in legitimizing science to a broader audience more than communicating between those doing science.

The small amount of science done in the colonies, the limited number of venues for publicizing that science and the desire to convince a broad audience of its value still made the newspaper instrumental. A number of original or fairly recent publications did appear in the newspaper. Along with oral and letter networks, books and pamphlets, technological artifacts, and public lectures, the general periodical served as transmitter and archive: a philosophical marketplace, and a direct and indirect recorder of the movement of information and the creation of wealth and power. Originally, the development of print and science had moved hand in hand.²⁶⁵ In the eighteenth century, that development continued but expanded the audience for print. The general periodical became a space through which many practices and interests -- religious, economic, political, and philosophical -- were negotiated, promoted, or castigated by many more people.

In the next chapters we shall see how the promotion of science fits within the various negotiations displayed in the pages of the newspaper. In Chapter Six we see the rhetoric of writers working to defend the practices of natural knowledge. In Chapter Seven, we see more of the rhetorical strategies to make science a valuable part of everyday colonial lives. In the new world of print, advertisements served as conduits for products of natural philosophy to a broader public. Sometimes hard to differentiate from the articles, these advertisements created reverberations in the marketplace and helped to establish a commodification, from subject selection to rhetorical strategy, of natural inquiry. Advertisements listed the titles or contents of books and pamphlets -- from the mundane to the esoteric -- for a literate society. The patent medicine industry established itself. Courses in mathematics and navigation called for an audience in a land that gained most of its wealth through shipboard trade. More than that, the world of advertising affected the articles of science themselves.

²⁶⁵ This theme is explored throughout Rivers (1982).