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1667 AND THE ROYAL SOCIETY: A MANIFESTO FOR THE FUTURE

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When Professor Richard Evans generously invited me to give a Gresham lecture on the early Royal Society, I decided to focus on its first official history, which came out in 1667 and was written by a clergyman called Thomas Sprat. Founded only seven years earlier, the Society had not been in existence long enough to have a past, and so I regard this book as setting out a manifesto for the future. At the time, the new Society had no well-defined role, and it was by no means clear that it would survive, let alone that science and technology would come to dominate society.

Looking back from the present, the most significant experiment of that year appears to have been an attempt to transfuse blood from a sheep to a human being, who was paid a pound to undergo the experiment. Rather surprisingly, in this case both the donor and the patient survived, although in France, some subjects died and the doctor was charged with murder.

But that is a retrospective view: for people living at the time, the most remarkable aspect of 1667 was its contrast with 1666, which had felt particularly bad. According to the biblical Book of Revelation (13.xviii), 666 is the Number of the Beast with seven heads and ten horns that emerges from the sea: 'Here is wisdom. Let him that hath understanding, count the number of the beast: for it is the number of a man, and his number is Six hundred threescore and six.' As the fateful year grew nearer, dire prognostications circulated about the doom to be visited on the country. Confirmation of these pessimistic predictions duly arrived. First came the Plague, and then in the year itself, the Great Fire of London was accompanied by some disastrous defeats in naval battles against the Dutch.

In 1667, the poet and playwright John Dryden emerged as the spin doctor who converted this gloomy despondency into a positive message by insisting (in what now seems a somewhat tortured argument) that the nation should be grateful to God for protecting England from even worse devastation. Towards the end of 1666 the English fleet had at last won a glorious victory that enabled Dryden to reconfigure the year in a long and very popular poem, *The Year of Wonders or Annus Mirabilis* (published in 1667). God had, he argued chauvinistically, given Londoners the opportunity to rebuild their city and make it the wealthiest in the world:

Me-thinks already, from this Chymick flame,
I see a city of more precious mold:
Rich as the town which gives the Indies name,
With Silver pav'd, and all divine with Gold.

1667 was also notable for other events. Dryden's phrase *annus mirabilis* is often used to describe the period of 1666-7 when Isaac Newton retreated from plague-ridden Cambridge to his country cottage at Woolthorpe, reputedly performing his crucial experiments in optics and conceiving the theory of gravity when an apple fell from a tree. This was also the year that England's most famous poem was published – John Milton's *Paradise Lost*. And the second edition of Robert Hooke's *Micrographia* appeared, reprinted from plates that had somehow survived both the Plague and the Fire.



Sprat's History of the Royal Society is far less famous than any of those. Its structure reminds me of one of my favourite quotations, originally expressed by the Danish philosopher, Søren Kierkegaard: 'Life can only be understood backwards; but it must be lived forwards.' As a historian, my underlying aim has always been to look at the past in order to understand how we have reached the present – and the whole point of doing that is to improve the future. Sprat's strategy was similar. First, he gave his version of how the Society started, and then he reproduced what he felt to be the Society's most important research reports so far; finally, he boasted about how the Society's activities would benefit the entire country. Writing to impress potential patrons and deflect criticisms, he was more interested in advertising the potential benefits of the Society than in describing its achievements during its short period of existence. In retrospect, the Royal Society seems uniquely important, but acquiring knowledge for its own sake was not presented as its primary purpose.

Dividing up the past into neat periods – Restoration, Glorious Revolution, Enlightenment – makes history deceptively tidy, but personally I incline far more to narratives based on continuity and gradual change. After the disruptions stemming from the Civil War, Charles II landed at Dover in 1660 to reclaim the throne. This is often taken as a momentous event, but many of the policies he implemented had been initiated under the previous regime or borrowed from the Dutch. For historians of science, the German philosopher Jürgen Habermas has had an enormous influence on conceptualising the seventeenth and eighteenth centuries. According to his notion of 'the public sphere', there was a slow and uneven shift away from an older system based on rule by a narrow elite that operated in private and was characterised by a clear distinction between monarch and subjects, between the state and the people. Instead, as government became more democratic, new sites – theatres, newspapers, coffee houses, societies – were established where politics could be discussed, business deals be transacted, support be canvassed, opinions be formed. It was in this context that the Royal Society developed as a public forum where experiments could be witnessed, knowledge exchanged and projects hatched.

The origins of the Royal Society are debated, and its roots can be traced back to pre-Restoration London. Sprat was seeking to curry favour with Charles II, and so he promulgated a story of sudden birth under his influence. Sprat's History portrays the Society as the brainchild of royalist experimenters who had been based in Oxford while the king was abroad – men such as the chemist Robert Boyle, the anatomist Thomas Willis, the inventor Robert Hooke and the astronomer Christopher Wren, who only later became famous as an architect. After Wren was appointed Professor of Astronomy at Gresham College, his friends regularly visited him in London. On 28 November 1660, gathered in his rooms after his weekly lecture, they proposed setting up an experimental society. Two years later, it received its first Royal Charter.

However high their expectations may have been, the group had no way of foreseeing that their enthusiastic speculations at Gresham College would later be viewed as a key turning-point in the history of science and technology. They were laying ambitious plans for the future, but they were also concerned about the immediate problems of earning money, remaining politically safe and persuading sceptics that their style of research would yield dividends – both economic and factual. Monarchs awarded Charters for ventures combining private and public gain, but they needed to be renewed and could be revoked: the British Broadcasting Corporation is one of the few surviving examples. For years, the Royal Society's function remained unclear, its future survival uncertain. Should the Fellows set up a college, regulate inventions, aim to make a profit? Many such possibilities were proposed but abandoned.

Experimental investigations were far from prestigious, and one of the Society's major problems was mockery: Pepys reported that the king laughed at them 'for spending time only in weighing of ayre, and doing nothing else since they sat.' When it became clear that the initial spark of royal interest was fading and that no financial support would be forthcoming, the Fellows decided to generate some publicity and settled on Sprat, a rather stolid clergyman, to produce his History. Recruited for his writing skills rather than his scientific expertise or influential contacts, Sprat produced a narrative that was idiosyncratic and ambitious, but provides a fascinating insight into the Society's early aspirations.



Science and Society

The frontispiece of Sprat's *History* has been extensively analysed because, following Renaissance traditions, it encapsulates many of the book's core themes. In an unsuccessful bid to attract royal funding, the central focus is a bust of Charles II being crowned by the Goddess of Fame. The first President of the Royal Society, the mathematician William Brouncker, is on the king's right, but the more important figure is on the other side – Francis Bacon, who had died in 1626 but is here wearing his regalia as Lord Chancellor and was effectively the new Society's patron saint. Sprat's book was a Baconian exposition. He repeatedly emphasised the revolutionary nature of the new experimental approach, its superiority to the dry logical methods practised in the universities, and its value for improving daily life without detracting from religious commitment. In a verse introduction, the royalist poet Abraham Cowley deployed biblical imagery to celebrate Bacon for leading the Fellows out of an Aristotelian wilderness:

From these and all long Errors of the way,
In which our wandring Prædecessors went...
Bacon, like Moses, led us forth at last...

After his enforced retirement from political power, Bacon planned to write a six-part work called the *Great Instauration*, which would provide a blueprint for revolutionising scholarship. He is particularly famous for the aphorism 'Knowledge is power', although the closest he came to formulating it explicitly is in the epigraph for the preface of the *Great Instauration*: '...a way must be opened for the human understanding entirely different from any hitherto known...in order that the mind may exercise over the nature of things the authority which properly belongs to it.' The only book of the six he managed to finish was the *New Organon* (1620), an attack on the original *Organum* by Aristotle, which was still standard on university syllabuses. Bacon's central argument was that instead of relying on logic and tradition, philosophers should make observations of the natural world and build up theories by induction. His frontispiece showed ships travelling to and from the Americas, leaving behind the mythical Pillars of Hercules, gateway to the security of classical knowledge and the well-charted Mediterranean. This image was reinforced by a tag from the book of Daniel: 'Many will travel and knowledge will be increased.'

As in many early scientific texts, there was a significant religious component to Bacon's arguments. Ever since humanity fell in the Garden of Eden, Bacon explained, our understanding has been clouded by preconceptions and false assumptions. To avoid such Idols of the Theatre, we should rely on what we can see, on what we can be sure is happening. As his great admirer Robert Hooke put it, '...even the forces of our own minds conspire to betray us... remedies can only proceed from the real, the mechanical, the experimental Philosophy...' Professor of Geometry at Gresham College, Hooke became the Curator of Experiments at the Royal Society in 1664, and was responsible for implementing its Baconian programme.

Sprat's frontispiece is packed with instruments stressing the significance of Baconian empiricism. The term 'scientific instruments' only emerged in the nineteenth century. Before that there were three types of instrument – mathematical, optical and philosophical – which were based on traditional divisions among skilled craft-workers. Mathematical instruments measured what could already be seen, and the multiple examples in this picture include a new type of pendulum clock and a glass spiral thermometer. In contrast, optical instruments – microscopes, telescopes – enabled people to perceive things that were previously invisible, while philosophical instruments, such as air pumps or (later) electrical machines, created a new and unnatural state.

As the Society's Curator of Experiments, Hooke worked on every type of instrument, inventing new ones and adapting older ones to provide more precise measurements. In 1667, he was particularly renowned for his optical innovations, especially the extraordinary drawings in *Micrographia*. That book ended by discussing a crater on the moon, but it opened with drawings of a needle, a full stop and a razor, designed to show that whereas human creations are flawed, God's world is perfect. My personal favourite shows an ant, which he complained 'was a creature, more troublesome to be drawn, than any of the rest.' Unable to pin it down by gluing its feet, he finally dropped it in some spirits, so his picture shows a drunken insect. Another of his tiny creatures, more familiar than



than now, was a louse, which he drew holding one of his own hairs to give a sense of scale. Hooke wrote eloquently that 'it is troubled at nothing so much as at a man that scratches his head, as knowing that man is plotting and contriving some mischief against it.' His most virtuoso illustration was of a fly's eyes, showing the multiple reflections of his window reflected in each tiny facet; sadly, he never worked out that fleas were responsible for spreading plague.

The Royal Society was particularly proud of its large philosophical instrument, the air pump developed by Boyle and Hooke. Shown next to the king's head in Sprat's frontispiece, it created an artificial state of nature – or 'twisted the lion's tail', as Bacon had put it. This quintessentially Baconian instrument goes against the Aristotelian dictum that nature abhors a vacuum, and school children can still witness a candle going out, or a bell falling silent. In Joseph Wright's famous painting, *An Experiment on A Bird In The Air Pump* (1768), the travelling lecturer has his hand on the stop cock of an evacuated glass globe, which imprisons a precious white cockatoo. Exemplifying a philosopher's control over nature, he can choose whether the bird will live or die: as a Baconian experimenter, he believes that knowledge is power.

A Global Empire

As well as emphasising that knowledge is power, Bacon also stressed the rewards of travel. Science is often romanticised as the abstract pursuit of pure knowledge, but the development of the early Royal Society was intimately linked with English imperialism, commercial activities and involvement in the international slave trade. In his *History*, Sprat compiled reports that he deemed to be particularly significant examples of the Royal Society's activities. The first that he listed was a questionnaire sent to a merchant in Batavia (Jakarta), who provided financially useful information about diamonds, giant tortoises, poisons, medicines and spices. He also included a paper giving instructions for making gunpowder and saltpetre – and one of the most prominent instruments in his frontispiece is a gun, apparently being pointed out by Bacon. The Society was actively engaged in ballistics research, although this one (probably a Kalthoff repeater) was not an experimental model, but was on sale commercially. At the time, guns were used not only as weapons, but also as diplomatic gifts or tokens of exchange. In Africa, the purchase price was roughly one gun per captive to ship across the Atlantic as a slave. The frontispiece also shows a clock that was designed to measure longitude and for which the Society filed patent rights. To test the clock, the fellows sent it out to West Africa with the king's naval troops who were fighting the Dutch. This was not a scientific expedition, but armed warfare to seize territory and consolidate English trade in gold and enslaved people.

Drawing a flattering comparison between Charles II and King Solomon, Sprat congratulated the restored monarch on improving the nation's financial situation 'with great vigour, by the Foundation of the Royal Company.' He was referring to the Company of Royal Adventurers Trading into Africa, which originated in 1660, the same year as the Royal Society. Rebranded in 1672 as the Royal African Company, it was already reaping huge profits by trading in gold, ivory and people. This company was, Sprat wrote sycophantically, 'the Twin-Sister of the Royal Society' to which 'we have reason as we go along, to wish all Prosperity. In both these Institutions begun together, our King has imitated the two most famous Works of the wisest of antient Kings: who at the same time sent to Ophir for Gold, and compos'd a Natural History, from the Cedar to the Shrub.'

The Company's arms showed the ancient symbol of a war elephant carrying a castle-like howdah on its back, while on either side the two supporters (a heraldic term) conformed to English stereotypes of fierce African chieftains. Most of the Royal Society's members would have been astonished to learn that the region was commercially flourishing, and that some African rulers worked in offices decorated with Dutch tapestries, Indian cloths and silverware made from New World ores. The entire region benefitted as its small independent kingdoms profited by trading with India, Brazil, Portugal and each other. But the economy rapidly deteriorated towards the end of the seventeenth century after Europeans introduced guns as a new form of currency to buy gold and human beings. In 1663, the Company's new Royal Charter gave it exclusive trading rights for people as well as material goods: '...shall for ever hereafter have use and enjoy all mines of gold and silver which are or shall be found in all or any the places above mentioned, and the whole entire and only trade [to those parts] for the buying and selling



bartering and exchanging of for or with any negroes slaves good wares and merchandises whatsoever to be vented or found at or within any of the Cities.’

English maps of West Africa divided the coastal area into regions labelled not by their inhabitants, but by the commodities that traders could acquire: the Gold Coast, the Ivory Coast, and even the Slave Coast. Although large inland tracts remained unexplored by Europeans, the shoreline was littered with strong forts, often within view of each other but belonging to different countries. They were designed to defend the occupiers from European maritime invaders as well as from local Africans. The main British centre on the Gold Coast was called Cape Coast Castle, which had originally been a Swedish trading post. The damp dark dungeons were large enough to hold a thousand Africans before they were despatched through the Door of No Return for their one-way voyage across the Atlantic. Often they were branded with an elephant and castle, the same logo carried by golden guineas and elephant tusks. In 1665, a quarter of the Company’s massive profits came from enslaved people.

There was considerable overlap between the membership of the Royal Society and the Royal Adventurers. In addition, as well as profiting financially, the Royal Society used trading networks to gather information, so that imperial possession, commercial expansion and scientific research were closely linked. For example, in 1667 the wealthy merchant Abraham Hill – who became Treasurer – compiled a questionnaire designed for travellers to Guinea, which reveals not only the curiosity of the Fellows but also their ignorance, the unreliability of information based on hearsay, and their interest in potentially marketable products. Is the rain, he asked, so hot that it rots cloths and generates worms? Is an African’s eyesight far keener than that of a European? Are the people different shades of brown and black? More practically, Hill also wanted to know how to find the best gold, prepare poisoned arrows and distil grain alcohol – no coincidence that he later became a Commissioner for the Board of Trade.

The same year, 1667, a group of angry merchants presented a petition to Parliament, arguing that the monarch’s powers should be reduced still further by removing the monopoly held by the Royal Society’s twin sister, the Company of Royal Adventurers Trading into Africa. They complained that by operating in the king’s name, the Company was squeezing out private dealers in gold and potential slaves, thus adversely affecting English plantation owners in the Americas: ‘That formerly there hath always been a freedom of Trade for all His Majesties Subjects for Negroes on the whole coast of Guiney, by reason whereof the said Plantations have been plentifully supplied with Negroes of the best sort, and at an indifferent rate, to the great encrease of the said Plantations, and the advantage and profit of this Crown and Nation.’ Paradoxically, individual freedom implied the right to trade in human captives, an English entitlement that was confirmed after the Glorious Revolution of 1688 brought greater democracy.

Finally, a quotation from Sprat’s History illustrating what the fledgling Royal Society aimed to bequeath to posterity, to the future...in other words, to us. English gentlemen, he wrote, ‘are to know, that Traffic, and Commerce have given mankind a higher degree than any title of Nobility, even that of Civility, and Humanity itself...in those Coasts, whither the greatest Trade shall constantly flow, the greatest Riches, and Power will be establish’d.’ He was preaching a Baconian sermon.