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Science and Society

Scientific Societies in Victorian England[1]

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ABSTRACT: The article analyzes the development of scientific thinking and production in England from the early to the late Victorian period. 19th century England saw a thorough change in every sphere of society including that of science. This was a time when the very idea of science – as understood in the 20th century – started to emerge. The article compares the *modus operandi* of three scientific bodies of utmost importance: the Royal Society, the British Association for the Advancement of Science, and the so-called X-Club. The first one represented an old-fashioned scientific body with a narrow, aristocratic social basis, whereas the BAAS, a reformist, much newer society was founded with the manifest idea of science as a universal, all-encompassing and neutral field, free of political and religious influences. The article shows that despite this official standing, the BAAS still represented a narrow range of scientific, political, cultural and social interests. In contrast to both of these bodies, the X-Club, an informal but highly influential set of nine scientists, introduced the idea of a modernized science. Largely due to their influence and shrewd strategic action, by the end of the century the scientific sphere had become far more independent of extra-scientific influences than ever before. The article concludes, however, that this independence meant a greater need to disguise the social and cultural embeddedness of science with a new set of criteria for scientific legitimacy, rather than actual, full autonomy.

Keywords: Victorian England, history of science, science and society, Royal Society, British Association for the Advancement of Science, X-Club

Science in Victorian England

"Don't accept any scientific place, if you can avoid it, and tell no one that I gave you this advice, as they would all cry out against me as the preacher of anti-patriotic principles. I fought against the calamity of being President[2] as long as I could. All has gone on smoothly, and it has not cost me more time than I anticipated; but my question is whether the time annihilated by learned bodies ('par les affaires administratives') is balanced by any good they do. (...) At least, work as I did, exclusively for yourself and for science for many years and do not prematurely incur the honour or penalty of official dignities. There are people who may be profitably

1 I would like to express my gratitude to the Hungarian Academy of Sciences for the grant I received under the János Bolyai Postdoctoral Scholarship programme while conducting the research that serves as the basis for this article.

2 Lyell was the president of the Geological Society in 1835-36 (and later in 1849-50).

employed in such duties, because they would not work if not so engaged." (Charles Lyell to Charles Darwin, 26 December, 1836)[3]

These words were written by Charles Lyell, the excellent geologist and one of the pioneers of evolutionary theories, to the young Darwin. Although Darwin went on to become a member of numerous scientific bodies, and received many official honors and awards (among others the Copley Medal, the most prestigious recognition of the Royal Society), he seems to have taken his older friend's advice to heart, or perhaps just followed his own inclinations, and chose to witness most of the intensive scientific life of the decades to come from his peaceful country home.

Other outstanding figures of Victorian English[4] scientific life, however, were characterized by having a rather different attitude. One of the most important processes taking place during the era was a thoroughgoing reform of scientific bodies – an aspiration toward which many well-positioned scientists invested a great amount of energy.

English scientific life went through a radical transformation from around the middle of the century. To the extent that it is valid to use a term that would only be meaningful in relation to a professionalized science that emerged later, we can say that the first half of the century was characterized by an 'amateurish' science. The scientific field was almost fully dependent on aristocratic control and funding and received very minimal state support. There were practically no scientific jobs, and practicing science was mainly only possible as a leisure time activity. Compared to the traditionally accepted fields of study – such as theology, philosophy and classics – natural science played a marginal role in the curricula of universities and other schools.

The old elite universities changed very slowly. Unlike in the United States or France at the time, the higher education system in England did not go through a radical reform, and the rigid university structure and the resistance of the establishment towards change was a major hindrance to the emergence of new subjects like sociology and even new approaches within traditional subjects. However, natural science was in a favorable situation as economic and social changes created an increased need for scientific instruction. This was represented by changes such as the introduction of the Natural Science Tripos at Cambridge, or the fact that the social background of students started to gradually change with an increasing intake of middle-class students. (MacLeod–Moseley 1980) These changes, however, did not mean a radical transformation: the influence of the establishment remained unquestioned both with regards to social background and the contents of the curriculum. Despite the appearance of new, more open and tolerant institutions of higher education such as the University College of London, throughout the whole Victorian period, the main

3 Source: http://www.darwinproject.ac.uk/entry-335

4 The present article focuses on England alone, since Ireland, Scotland, and Wales were all quite different from the point of view of the analysis. However, when appropriate, I make some references to Britain as a whole.

loci of scientific life and especially of transformations within it were the formal and informal scientific societies.

There are numerous studies about the scientific life of Victorian England. One of the approaches considers professionalization to be the most significant factor, and describes different conflicts and often sharp public debates as a result of this process (e.g. Turner 1978). This dimension is obviously of no little importance. Members of the so-called X-Club and others indeed did a lot to promote the more professional working of scientific institutions, clearer regulation of scientific methods, financing of laboratories and modernizing the curricula of universities and other schools. However, this was in fact more a consequence of the struggles often only pursued for influence and positions than the originally intended goal. Furthermore, the professional/amateur dichotomy cannot be really plausibly applied to this time. Many of the leading figures of the scientific movement[5] were amateurs in today's understanding of the word, and most of them made an at least acceptable living from means other than practicing science. It is still clear, on the other hand, that a major aspect of the 'boundary work'[6] of the time was to remove the 'amateurishness' from science, to define the criteria for a pure science conducted in specific ways, and to establish science as a career.

The amateur/professional dimension was, however, partly overlapped by the conflict between religion and science. The British scientific movement tried to break away from its religious roots and fairly quickly turned against any religious support. In Britain, where the scientific movement organized around natural sciences, and even the solution of social problems was expected from natural sciences, the tension between evolutionary theories and religious dogmas, and the formal and informal dominance of the church in cultural institutions and public thinking contributed to an early break. Thus, the main processes in Victorian scientific life did not only revolve around the issue of professionalization – their social and wider cultural aspects were at least as significant. All this is reflected in the functioning, and the changes therein, of formal and informal institutions of science.

From a theoretical, ideological point of view, British natural science of the period was dominated by theology of nature, which sought to uncover the manifestations of divine wisdom in the great variety and different phenomena of nature. This approach, represented by William Paley, Richard Owen and others, was a major obstacle to the wider reception of the new scientific – primarily evolutionary – approaches to nature that were emerging at the time. The belief in an unchanging nature and the literal truth of Biblical teachings, however, gradually started to erode as even natural

5 I use the term 'movement' in reference to the scientists and their aspirations who advanced the described changes in the scientific sphere. This term, although commonly used in historical analyses (e.g. in the writings of Ruth Barton and Frank Turner), serves the purpose of convenience here. The process of transformation under analysis was not the result of explicit goals and strategic activity alone, and the persons involved became organized around different alignments that were both fluid to some extent and also overlapped with a few issues of importance.

6 See Gieryn 1983.

theology incorporated the notion of a changing nature, and especially in the wake of widely read – and sometimes scandalous – books such as Ch. Lyell's *Principles of Geology* or R. Chambers' *Vestiges of the Natural History of Creation*. Nonetheless, the theology of nature continued to be influential right until the end of the century. The main purpose of the newly emerging scientific movement was to free the field of science from any religious considerations and establish autonomy for science both institutionally and theoretically.

Science in Britain enjoyed great support from the field of religion. From the 17th century, the clergymen naturalist was an important actor in British science. Clerics played a significant role in the founding of the British Association for the Advancement of Science in 1831. It was this link between the two fields that the conflict between science and religion in the second part of the century challenged. The representatives of the new science questioned the legitimacy of any religious influence in scientific institutions, instruction, and publications. In general, they questioned any religious authority over science that was hitherto taken for granted. The conflict was not between religious and non-religious scientists. Most of the scientists of the era were religious, even if the most radical ones, like Darwin and Huxley, declared themselves to be agnostic after the sharpening of the conflict.[7] It was not even as simple as a debate over the literal truth of Biblical content. The conflict emerged between those who envisioned and aspired to the creation of a scientific field where no religious influence whatsoever could exert itself, a science that would rely on no transcendental forces in its explanations and theories, and those, on the other hand, who considered science, however wonderful, to be inferior to religion and tried to keep religious moral and intellectual authority intact.

The question of the expertise deemed necessary to claim the title 'scientist' emerged as one of the focal points of scientific debates. As Th. H. Huxley wrote to J. D. Hooker in 1859 about a fundraising proposal: "If there is to be any fund raised at all, I am quite of your mind that it should be a scientific fund and not a mere naturalists' fund. Sectarianism in such matters is ridiculous, and besides that in this particular case it is bad policy. For the word 'Naturalist' unfortunately includes a far lower order of men than chemist, physicist, or mathematician. You don't call a man a mathematician because he has spent his life in getting as far as quadratics; but every fool who can make bad species and worse genera is a 'Naturalist'!"[8] Since Huxley and his allies soon succeeded in infiltrating the ranks of the Royal Society

7 Darwin himself was basically a religious man, and he saw the limitations of scientific knowledge. He had great dilemmas over the issue of science and religion, as one of his letters to Asa Gray indicates: "I had no intention to write atheistically. But I own that I cannot see, as plainly as others do, & as I shd wish to do, evidence of design & beneficence on all sides of us. There seems to me too much misery in the world. (...) On the other hand I cannot anyhow be contented to view this wonderful universe & especially the nature of man, & to conclude that everything is the result of brute force. I am inclined to look at everything as resulting from designed laws, with the details, whether good or bad, left to the working out of what we may call chance. Not that this notion *at all* satisfies me. I feel most deeply that the whole subject is too profound for the human intellect. A dog might as well speculate on the mind of Newton. – Let each man hope & believe what he can." http://www.darwinproject.ac.uk/entry-2814

8 Source: http://aleph0.clarku.edu/huxley/letters/59.html

and the British Association and taking over the control of the research funds thereof, these sorts of ideas, as Turner (1978) rightly points out, were more than just expressions of personal opinions – they were the basis of a conscious policy that aimed at excluding the enthusiastic 'amateurs' of natural science from financial resources, institutional positions, and stripping them of the legitimacy necessary for the practice of science. The proportion of clerical membership in main scientific organizations began to decrease radically, and soon religion and science constituted two more or less separate career trajectories.

Our notions of truth, according to Steve Shapin (1994), are not separate from our convictions about the credibility of others, since – however explicitly modern science advocates the omnipotence of direct experience – most of our knowledge comes from others. No scientific practice has been able to free itself of indirect knowledge, and therefore a rejection of testimony and authority is impossible. Even within the field of science, says Shapin, trust is one of the most important capitals. The fabric of our social relations is woven from knowledge, and our knowledge about the world is based on our knowledge about other people. The scientific life of early modern England was determined by the trustworthy individual, the gentleman. Scientific and social credibility, trustworthiness, were fully intertwined and not separable. Observing the scientific life of early 19th century England, Shapin's claims, made in reference to an earlier period, still seem to be plausible.

But the 19th century brought significant changes in this respect – just as with many other things. What had at the beginning of the century been the preserve of the passions of gentlemen became by the century's end a professionalized and specialized science. And yet, the impression that such a sharp distinction could be made about social and scientific knowledge was only superficial. Or more precisely: the threads of the fabric became interwoven in a more hidden, indirect manner. Social relations remained an integral part of the scientific field, but they operated on the basis of more complicated legitimizing processes, and exerted their influence in a more latent way. Social influence became more indirect, and – if you will – this kind of distancing was professionalization itself.

In yet another important work about 17th century English science, Robert K. Merton (1938) also expresses thoughts that seem of utmost importance in interpreting 19th century processes. Taking a stand against a positivistic notion of the internal, accumulative and linear progress of science, Merton rejects the idea of scientific development mostly carried forward by brilliant revelations and theories, as "[a] special talent can rarely find expression when the world will have none of it" (Merton 1938: 364). Thus, instead of analyzing brilliant ideas and theories, he studies the 'external', social and cultural circumstances, and emphasizes their primacy. Although this present article is based on the notion that, in the history of science, so-called external and internal factors are inseparable, the aspects Merton

deemed important play a major role in 19th century England as well – even if they should not be considered merely 'external'.

As Merton points out, socio-economic needs directly influenced scientific research – favoring some areas and pushing others into the background. He also claims that a positive attitude towards change as such was a significant element of the context within which 17th century science developed. In my opinion, it is exactly the belief, blooming in the 19th century, in the desirability of change understood as progress, that was the most important and fundamental ingredient of Victorian English scientific life – and not only as an 'external' cultural factor, but also as a focal question within the scientific discourses themselves. Thus, progress became a desired and even expected social and political goal, which concerned practically every area from the politics of Empire to the sanitary state of public places – and, at the same time, a point of scientific interest addressed within the framework of different, and gradually separating, scientific disciplines. As progress was elevated to the rank of the highest value by modernity, the prestige of science rose with it, and its practitioners became ever better versed in posing as the holders of the key to progress.

The changes in the modus operandi of the institutions of 19th century English science show, among other things, that science thus redefined took on an increasingly public role in two senses. First, it became able to attract the interest of an ever-growing audience; and second in the sense that the scientists started, much more consciously and efficiently, to argue that science is a matter of concern, and what is more, is in the interests of society at large. A utilitarian approach to science which emphasizes that scientific results are not only valuable in themselves but rather can be utilized specifically for the benefit of society could only thrive in the receptive soil of a broader way of thinking impregnated by the idea of progress. And this is a defining characteristic of modernity.

A Company of Cultured Aristocrats: the Royal Society

At the beginning of the 19th century, The Royal Society of London, established in 1660, the British counterpart of an academy of science, was more akin to a "fashionable club" (Turner 1978) than a major scientific institution, in the sense that its membership was largely based on social background and connections rather than scientific excellence.[9] In accordance with a ruling from 1731, recruitment of a new member required the recommendation of three members. The letter of recommendation, signed by these members and hung on the wall, often did not contain many details about the candidate's scientific work, and sometimes only contained generic text[10]. Obviously, it was, more than anything else, the names – the

9 About the Royal Society, see Turner 1978, Boas Hall 1984, Morrell–Thackray 1981. Notes and records of the meetings, information on the members and other related materials are available: http://royalsociety.org/library/collections/#archive.

10 This merely stated that a certain gentleman of great knowledge "in various branches of science", wishes to become a Fellow, and the undersigned believe him to be "fully worthy of this honour". The exact texts of recommendation for the

standing – of the candidate and of his mentors that were decisive in the matter. This is not to say that the question of members' scientific achievements did not arise at all. Nonetheless, it can be argued that an excellent naturalist could only become a Fellow of the Royal Society if he possessed the right connections, whereas a gentleman of high standing could achieve the same without any actual scientific work, were this his ambition. In his sharply critical and, as a result, highly controversial book, Charles Babbage described the process as the following: "A. B. gets any three Fellows to sign a certificate, stating that he (A. B.) is desirous of becoming a member, and likely to be a useful and valuable one. This is handed in to the Secretary, and suspended in the meeting-room. At the end of ten weeks, if A. B. has the good fortune to be perfectly unknown by any literary or scientific achievement, however small, he is quite sure of being elected as a matter of course. If, on the other hand, he has unfortunately written on any subject connected with science, or is supposed to be acquainted with any branch of it, the members begin to inquire what he has done to deserve the honour; and, unless he has powerful friends, he has a fair chance of being black-balled." (Babbage 1830: 50-51)

General changes, however, slowly started to influence the ways in which scientific organizations operated as well. British society and social thinking from the 1820s to the 40s was heavily impregnated by the issue of reform. The 'Age of Reform' was characterized by demonstrations, violent action against striking workers, organizations emerging along different ideological lines, a widening middle class, and the birth of new industrial and cultural centers that created alternatives to London. New and faster ways of transportation and communication made new alliances possible that stretched beyond the immediate locality; it is not surprising therefore that the number of different societies and unions multiplied. Even legislation passed in 1831 banning all kinds of new organizations could not hinder this process. Since they were formed under the ideology of science, the attraction of the new scientific societies, as Morrell and Thackray point out (1981), lay in the idea that they represented universal values and thus bridged political and social differences. This was the time of the establishment of *the British Association for the Advancement of Science* too, based on a wider social background: its membership was recruited from not just the aristocracy but also the gentry and the middle class.[11]

As opposed to the new societies that were formed under and adjusted to the changed circumstances, the aristocratic club of the Royal Society seemed less and less compatible in this context. The question of reform was kept at the fore during the 1820s, but as the leadership was held by a "comfortable, insulated, controlling oligarchy" (Morrell–Thackray 1981: 36), changes remained only a wish for some. The Royal Society continued to be satisfied with its old and convenient positions. The first three charters

candidates can be viewed here: https://collections.royalsociety.org/?dsqIni=Dserve.ini&dsqApp=Archive&dsqDb=Catalog&dsqCmd=Overview.tcl&dsqSearch=(((text)%3d%27conditions%27)or((text)%3d%27for%27)or((text)%3d%27fellowship%27))and(RefNo%3d%27EC*%27)

11 The BAAS will be discussed in detail below.

of the Society, issued between 1662 and 1669 (the second two being additions to the first one), which describe the structure and the privileges of the organization, and name the King as the main founder and patron of the Society[12], established a framework that seemed to suit members until the first half of the 19th century. The Royal Society of the early 19th century maintained a fundamentally passive, comfortable modus operandi, and, as Morrell and Thackray emphasize (op. cit.), in contrast to some of the newly formed societies, it expressed its views and gave advice to the government only when asked, and never aspired to explicitly and actively take a stand on any issue. Its lobbying never extended beyond utilizing informal relations and neither did the Society lobby for government funding and support for science as such, an objective that soon became the driving aspiration of other organizations.

The idea that the Royal Society, and with it science as a whole, was in dire need of reform was first proposed from outside the ranks of the Society. In 1830, the excellent mathematician Charles Babbage published his above-mentioned book, *Reflections on the Decline of Science in England and on Some of Its Causes*. Not only did it provoke controversy but it also created new frontlines within scientific life. The work offers a highly unfavorable picture of the Royal Society and describes it as a somewhat pathetic 'flagship' of British, or even, international, scientific life, and strongly argues for profound changes. However, there were many who were satisfied with current operations who felt the work was an unreasonable attack. Similarly controversial opinions were expressed by David Brewster, the inventor of the kaleidoscope and editor of the *Edinburgh Journal of Science*, in the pages of his journal.[13] They both deemed the state of science to be a source of grief and shame. According to them, the reasons for the shameful state lay in a combination of institutional passivity; an inability to represent interests and old-fashioned, aristocratic ways which relegated science to no more than a mere hobby. As a consequence, real scientific achievements did not enjoy any support. They drew attention to the sharp contrast to the situation in France, where science could lay a legitimate and rightful claim to state support, and scientific accomplishments received their due recognition.

These ideas served as the bases of a reform plan to introduce radical changes to the Royal Society. The advocates of reform chose John Herschel, the outstanding scientist – astronomer, photographer, meteorologist, and botanist, one to have received the Copley Medal – as their candidate for president at the elections in the autumn of 1830. His rival, none less than the Duke of Sussex himself, eventually won by a slight majority of votes – and the reform did not materialize.

12 Source: https://collections.royalsociety.org/DServe.exe?dsqIni=Dserve.ini&dsqApp=Archive&dsqDb=Catalog&dsqCmd=show.tcl&dsqSearch=(RefNo==%27DC%2F1%2F1%27)

13 Brewster serves as a good illustration that 19th century British scientific discourses were fractured along several different lines, and therefore we cannot talk about homogenous or united camps. Brewster took a strong stand in supporting the institutional reform of scientific life, while just as strongly opposing even the early, less radical versions of evolutionary theories that were about to start gaining ever greater intellectual traction. This is not simply because what seemed progressive in 1830 became obsolete within a couple of decades, but rather because even the most controversial issues that created the sharpest structural divides within the scientific field, such as religion and evolution, did not create fully unambiguous and permanent camps.

This attempt offered several lessons. On the one hand, it became clear that a majority within the Royal Society still considered it to be an aristocratic organization, and attached more significance to rank and social background than to scientific activity. On the other, it also became apparent that the cause of modernization needed far wider support, and reformers needed to make alliances. As Morrell and Thackray show through detailed documentation (1981), this failed attempt, and the lessons learnt, gave birth to the British Association of the Advancement of Science in 1831.

As to the Royal Society, it continued to operate, undisturbed and unperturbed, along the lines of its old modus operandi for a while longer. Although by the middle of the century the number of scientist members had increased, and a committee was appointed in 1831 "to consider the best means of limiting the numbers admitted into the Royal Society"[14], this was as yet not reflected in the organization's rules. It remained an issue of debate whether the Society should continue its existence as a company of influential aristocrats, or become one composed of men who excelled at science. In view of the continental example, the question of whether to seek support from the state, or to remain a fully independent, private body, relying on the beneficence of supporters, remained a controversial issue (Boas Hall 1984). To put it differently, it was not clear whether it was better to depend on state funding or to remain relying on aristocratic patronage.

Real changes eventually started in 1847 with the introduction of significant reforms – reforms that initiated the process whereby the Royal Society turned into a modern scientific body. Rules regulating membership were changed so that henceforth only 15 members a year could be newly elected, thus reducing the size of the membership in the long run. Also, more importantly, in selecting new members scientific criteria were accorded more weight than social ones (Boas Hall 1984: 155-156). The key to the changes lay clearly within the composition of the membership: the Royal Society was unable to catch up with ongoing processes that altered scientific life as long as members predominantly represented and expressed an older view of science. Thus, at the middle of the century, the Royal Society stepped onto the road that led to the modernization of scientific institutions; that is, towards an explicit reduction of the influence of the political, social and religious and more emphasis on a more 'purely' scientific approach.

However, it would be highly misleading to conclude that social relations were no longer an integral part of the working of either the Royal Society, or any other scientific body, or the whole of the scientific field. Influence, informal relationships, social capital and other ingredients of social and cultural relations remained organic elements of science. And yet, a process which would render the influence of these 'external' factors within the scientific field illegitimate, and thus limit it, began to

14 Source: https://collections.royalsociety.org/DServe.exe?dsqIni=Dserve.ini&dsqApp=Archive&dsqDb=Catalog&dsqCmd=show.tcl&dsqSearch=(RefNo==%27DM%2F1%2F37%27)

thoroughly change scientific life. Such disguising of social embeddedness constituted a significant element of the younger, but immediately more 'professional' *British Society for the Advancement of Science*.

'Gentlemen of Science': the British Association for the Advancement of Science

A lot is revealed about the nature of how science is conducted by the fact that the term 'scientist' itself was only coined in 1833 by William Whewell, the Cambridge professor of mathematics. But it is not without good reason either that this happened at the third annual meeting of the BAAS. For this was the society in which – regarding both its notions and practice – the germ of 20th century science production can be identified right from the beginning.[15]

The formation of the British Association was initiated by men of science who were dissatisfied by the old-fashioned ways and inertia of the Royal Society, by its incapacity to lobby for the cause of science, and especially by the fact that, despite all these drawbacks, it still dominated the field of science. At the 'Age of Reform' the necessity of reforming science was clearly expressed. But this necessity was not understood as a cause in itself, but rather an expression of a higher social goal: science needed to be reformed in order that society could be reformed.[16] Unsurprisingly, personal ambitions also played a role in establishing the BAAS: some of its primary advocates had not been able to achieve what they thought was their due in hitherto socially rather closed scientific life. Brewster, for example, who dreamed up the British Association, was the son of an Edinburgh teacher, an excellent inventor, who, considering his achievements, received little institutional recognition.

The Association was formed in an era, when, on the one hand, in the wake of rapid industrialization, there was an unparalleled growth of interest in science. This era saw an abundance of new 'learned societies' and journals, and a proliferation of popular scientific writing. Data gathered by Morrell and Thackray clearly show a marked increase during the decades between the end of the 18th and middle of the 19th centuries (Morrell–Thackray 1981: 13). Furthermore, societies formed in the countryside had a greater share in the overall increase: urbanization, as we have seen, resulted in, among other things, a growing number of new cultural centers. Enthusiastic hobby naturalists, excited about the newest geological discoveries and theories, could enjoy the opportunities better communication channels offered for

15 Thorough documentation and analysis of the first years of the British Association can be found in Morrell and Thackray 1981, which serves as the major source for the overview below. If not otherwise stated, data and information used on the following pages can be found there. The notes and records of the first five annual meetings of the BAAS are available here: http://baas.research.glam.ac.uk/.

16 The organic relationship between the reform of science and that of society was an idea put forward ever more explicitly. This was the very notion that helped scientific bodies to grow more powerful in representing their interests, and became a major rhetorical device used in the struggle for the autonomy of science. It even formed the background of more abstract philosophical debates, such as, for example, the debate between Whewell and J. S. Mill. (For this see Snyder 2006.)

the countrywide distribution and discussion of fossils and other findings[17]. On the other hand, in an era of sharpening political conflicts and disturbances, science as the representative of universal values appeared to be a means to bridge ruptures, and to create a politically and ideologically independent, peaceful island. The universal nature of the science represented by the BAAS was also indicated by the aspiration to include as many foreign scientists as possible within its ranks. And although most foreign members were not active, the Association could pride itself on having the membership of scholars such as the famous Belgian statistician A. Quetelet, who even participated at some meetings. This universalistic approach, the idea that scientific societies, and more precisely the BAAS could unite very different groups in the name of science, that it was independent of political and religious values, and that it could dissolve tensions and oppositions – this self-identification was one of the most important keys to the success of the Association.

Another highly important innovation was the novel modus operandi of the BAAS. Apart from the Geological Society, established in 1807, the BAAS was the only scientific body at this time to introduce a system of presentations and discussions of scientific papers at its annual meetings. This made active participation possible for many, and significantly contributed to the spread of the institution of scientific discussions and of the ideas presented therein. The system of research funds and grants (also first introduced by the British Association) was no less attractive. All this was possible because of the unexpected and unparalleled success of the Association: the first meeting in York was attended by more than three hundred people, and within a couple of years this number grew to several thousand, just like the number of permanent members. Attendance at meetings and membership cost money, forming the basis of a research fund. The regularly published *Reports* were another success – after the first few years, they contained summaries of original research. All this was greatly different from how the Royal Society worked, and made the British Association within a very short time the most popular, and, when it came to lobbying and advocacy, the most authoritative and most powerful scientific body.

The British Association posed, right from the beginning, in the role of an instrument of social cohesion. It aspired to appear to be a neutral body, existing above and transcending social, political-ideological, religious and geographical differences and opposition. The British intelligentsia of the time were rather mixed: their ranks composed of bankers, entrepreneurs and aristocrats alongside countryside teachers, vicars, physicians, and gentlemen of independent (often inherited) means. The decentralizing effects of industrialization manifested themselves geographically in the emergence of cultural centers outside London: several country towns became the homes of scientific societies, clubs and journals. The increasing religious heterogeneity of society was another significant aspect of pluralization: while the

17 For the significance of this see McGowan 2001.

cultural and political dominance of the Anglican Church was sanctioned by written rules, the proportion of nonconformists increased significantly, and Methodism grew in strength as well, especially among the working class.[18] The major political frontlines were marked by the Whig/Tory opposition, and the strengthening socialist movement.

The British Association was meant to embody the independence and autonomy of science from all this. In comparison to the situation with the Royal Society, this is, beyond doubt, a not fully unrealistic picture. There is a vast abyss, however, between the notion that the British Association was an inclusive, all-encompassing, uniting and neutral body and the reality that emerges from looking closely at the membership of the BAAS, and more significantly at the narrow group that actually controlled the Association. For they were a group with a homogeneous social background, representing very clear political and religious values.

After analyzing the first six years of the BAAS, Morrell and Thackray (1981) consider that a circle of 23 men were the most influential. They held the most important offices within the Society, decided about the distribution of research grants, determined the contents of the yearly *Reports* – and what is more, largely wrote them themselves, just as they were the main beneficiaries of the research grants. They decided where to hold the yearly meetings – a decision of high strategic significance. In short, they decided about every single issue of importance. This group included the above-mentioned Charles Babbage and David Brewster who had voiced their discontent and ideas about reform in their writing. John Dalton, renowned for his theory of the atom, and William Whewell, the Cambridge mathematics professor of growing reputation and respect, both belonged here, just as did another Cambridge professor: the botanist John Henslow, young Darwin's mentor.

In contrast to the universalistic image, this group can be defined by indicators of status: almost all of them were Anglicans, more specifically Anglicans belonging to the relatively more liberal, but basically centrist Broad Church. Neither Methodists, nor Catholics or Jews were to be found within their ranks, there were only two nonconformists, and the only Quaker, Dalton. Politically, they supported the Whigs – several of them were MPs – that is, they were on the side of centrist politics, supported cautious reform, and they demarcated their views from those of radical conservatives and socialists or utilitarians of the ilk of John Stuart Mill.[19] Geographically, the London-Cambridge axis dominated. The men of science controlling the BAAS in its first period of existence were typically Cambridge professors or prominent figures from the London scientific scene, members of London scientific societies, especially of the Geological Society. This group had significant social capital, and was bonded to the political and cultural elite by strong ties. In comparison to the Royal Society, it

18 For the religious diversification of British society during the era, see Wolffe 1994, Larsen 2004, 2011, or the data of the religious census conducted in 1851 (Census 1854). (The Census data need to be interpreted with reference to the circumstances of the gathering of the information.)

19 About the connection between science and Whig politics see Bord 2009.

was, nonetheless, typically less conservative and positioned lower in terms of social background.[20]

While there is no doubt that the BAAS had a more democratic base than the Royal Society, the Association was also strongly dependent on support from aristocrats.[21] Within its rapidly increasing membership the aristocracy was significantly represented until the 1840s, and by 1844 they exceeded the number of academics (Morrell–Thackray 1981:110). Exclusive dinners and balls were organized at the annual meetings, not least for the purpose of gaining and maintaining the support of the best circles, and the presidency of the BAAS was held several times by an aristocrat who lacked scientific credentials but possessed a good name. From the end of the 1830s, voices demanding that a prominent scientist be president became louder, and Lyell expressed his view that the 'dignity' of science required a man of science to be the first man of the Association (ibid. 117). Eventually, from the middle of the 1840s, by which time the BAAS had grown into an unquestionably powerful body, less dependent upon the benevolence and practical support of the aristocracy, this became the actual guiding principle.[22]

But what did science itself, in its form represented by this excellent society, look like? First of all, their science was *natural science*. Philosophy and classics were left out, and even anthropology and statistics were interpreted as quasi-natural sciences. According to Morrell and Thackray (op. cit.), this was because subjects like social sciences and philosophy were controversial fields, evoking issues leaden with tension, which a balanced, or rather, cautious society that scrupulously avoided openly taking sides could not afford.

Also, in accordance with their universalistic mission, in answering an important – perhaps the most important – question of the era, they advocated the mutual independence and autonomy of science and religion. The suitable approach was a form of theology of nature. As a reply to the increasingly obvious and better-accepted notion of permanent change within nature, this approach sought out and discovered signs of Divine providence and wisdom in the processes taking place within nature. That is, it advocated harmony between Scripture and natural science. For the wary British Association, natural theology offered a perfect theoretical framework for the dual purpose of not having to deem latest scientific results blasphemy, but at the same time not having to challenge the validity of religious dogmas either.

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20 As we shall see, members of the more radical X Club, which was formed later, represented the social elites even less. Although this suggests a very definite tendency, in my opinion, scientific life in Victorian England was far more complex than predominantly manifesting unambiguous processes like this. Different groups and networks overlapped other along various important lines of dispute and interest. Hence, we cannot talk about the unambiguous victory of science over religion, or the middle classes taking over the important positions from the aristocracy, or even about these – or any other clearly delineated – groups confronting one another.

21 Exact data can be found in Morrell–Thackray 1981: 549. The tables here show that the proportion of the aristocracy within the membership gradually decreased between 1831 and 1844. At the same time, the number of academics with university positions fell too. This indicates that it was not so much the composition of the membership, but rather the distribution of influential or symbolic positions that marked the slow process of becoming more independent that was beginning to take place. The same process is marked far more clearly by the decrease in religious membership (the number of Anglican vicars), which was quite spectacular as early as the first 15 years of the organization.

22 However, scientific activity remained a kind of fashion within aristocratic circles. Many people of rank established 'scientific centres' on their estates, some even housing laboratories after their emergence and spread in the 1870. See Opitz 2006.

Nevertheless, even the BAAS could not avoid addressing the controversial issue of the tense relationship between religion and science altogether. Advocates of a more dogmatic version of religious teachings attacked the British Association, claiming that by promoting the self-value of science it was really promoting secular ideas, and by doing that it was threatening the moral unity of society. William Vernon Harcourt, a member of the inner circle of the BAAS and its president in 1839, who was not only an Anglican minister (similarly to many others from this group), but had a church career, had to, in his presidential address, explicitly raise the issue and try to convincingly argue for the mutual independence of religion and science (Morrell–Thackray 1981: 243). Harcourt and others fought hard against the allegation that science – at least in the form represented by the BAAS – would inevitably lead to religious teachings being replaced by materialistic notions. Their argument centered around a harmonious picture of the relationship between the two fields.

By this time, certain religious tenets had already become burdened with sensibilities and tension. Increasingly deep fractures and hostilities between different denominations, and within the Anglican Church itself, had made the whole issue harder to tackle. Things did not become easier when newer and newer ideas about a changing nature, ancient Earth and extinct species appeared on the scene. It became practically impossible for scientific bodies to face the problem. The seemingly best strategy was that taken by the BAAS: defense of both fields of study through expressing a vision of the harmonious coexistence of religion and science. However, in a country where a strong tradition of the literal interpretation of the Bible still flourished and had many supporters despite recent geological findings which clearly contradicted this perspective, this point of view was not easy to maintain.

Many historians of science attribute great significance to a work published in 1844 by an anonymous author under the title *Vestiges of the Natural History of Creation*.[23] In Morrell and Thackray's interpretation, this book evoked outrage and resentment from BAAS scientists because it explored the relationship in exactly the way that they had fought against: this book pursued an explanation of the changes in nature much further than they did themselves, emphasizing their scientific, materialistic bases. From the early evolutionist works, this is the book that James Secord (2001) also considers to be of utmost importance, arguing that its sensational publication and the following debates prepared the Victorian public to receive ideas about evolution that came later. Whereas I fully agree with the claim about the significance of the *Vestiges*, in my view, neither this nor other early evolutionary publications managed to prepare the soil for evolutionary theory to be fully received, at least in its Darwinian version. The intensity of the heated debates that followed the 1859 publication of the *Origin of the Species* had a lot to do with the genius of Darwin's model, and it was exactly the radically novel element of his theory that prompted so much controversy,

23 The author of the *Vestiges* was Robert Chambers, the Scottish publisher. His identity remained publicly undiscovered until 1884 (the 12th edition of the book), and until then the mystery caused a lot of attention.

at times bordering on outrage: the emphasis on the contingent character of evolution. For the idea of a nature producing its wonders in a basically random fashion, in an unpredictable process that could not even be entirely understood as progress, was almost completely alien to Victorian notions of the world. And herein lies the explanation for the long-term rejection of this version of Darwin's theory, and the fact that even most evolutionary scientists refused to accept the element of randomness in the mechanism that Darwin called 'natural selection'. Thus, we can say that nothing had actually prepared Victorian audiences for such a shock, and that indeed, for many decades to come, different, more domesticated iterations of evolutionary theory were produced which ensured that Darwin's theory was not rejected altogether. The *Vestiges* attracted huge attention for many reasons, not just because of the mystery surrounding their author, but the document still remained within the framework of natural theology, described a predictable, unilinear, teleological process that even then was a big enough bite for most of the Victorian reading public, and did little to increase the uptake of more radical notions.

It nonetheless remains the case that from the point of view of the BAAS leaders – who, even if not in their political values but certainly with regards to their social networks and modus operandi, were conservative and deeply embedded in Anglicanism – the Vestiges was a dangerous book, since it actually represented a more secular scientific approach.

The spectacularly successful Association grew significantly within a very short time. It became clear almost immediately that the meetings could only be organized along disciplinary divisions, thus creating sections was necessary. At the beginning, Section A, including mathematics, physics and astronomy, was the most favored.[24] These fields of study remained at a distance from the problematic, controversial disciplines, and were also perfect for showcasing the objectivity of science and the applicability of its results, while at the same time their 'perfection' corresponded with ideas about divine wisdom and harmony. These areas of study dominated in both the publications of the *Reports* and the distribution of grants. Geology and geography (Section C) were also important. Geology was especially significant, since – aside from botany, which was considered to be a feminine and therefore inferior area[25] – it was the discipline most capable of involving enthusiastic amateur naturalists, the pillars of Victorian English science. Furthermore, this was the area that, after Charles Lyell's *Principles of Geology*, and later the Vestiges, first raised the issue of evolution, and thus evoked interest outside the BAAS. It is for good reason, therefore, that the meetings of Section C were always well-attended. However, for a few years this was not reflected in the financing of research. From 1835 onwards these topics took up greater space in the *Reports*, but still in a form that expressed a strictly natural theological approach. Of

24 For exact data about the distribution of research grants by section or name, and about publications of members see Morrell–Thackray 1981: 550, 551, 552.

25 For such a perception of botany see Endersby 2009.

course, as a result of the developments soon to take place (from the end of the 1850s) in the famous Section D, botany and zoology entered the limelight.

The Association's scrupulous avoidance of the political is visible in its treatment of ethnology (anthropology) and statistics. Ethnology endangered the popular – and, from today's viewpoint, racist – Eurocentric notions of superiority, and at the same time raised awkward questions about Britain's colonial politics.[26] The Aborigines' Protection Society was established in 1837 to advocate for aboriginals living in the colonies, and tried to scientifically found itself of the notion that colonialism was cruel. This kind of anthropology was not acceptable to the BAAS. Not because its scientists supported oppressing and inhumane politics, but because they would not accept any scientific theory that had clear political implications, whatever it might be. As a result of controversies amongst anthropologists of the time, the Ethnological Society of London was established in 1842, although this association restricted its activities to documenting linguistic, archeological and other facts about aboriginals, and thus neutralized the field. Even though the opposing scientific body – the Anthropological Society – advocated a racist and oppressive politics, and therefore, in this context, the Ethnological Society also represented a political stance by refuting this, in practice, their descriptive and neutral approach was acceptable to the BAAS (Barton 1998, Morrell–Thackray 1981).

Something similar happened with the also problematic field of statistics. During the first decades of the century a great deal of attention was directed at demographic issues because of the appearance of urban masses and the pace of population growth henceforth considered dangerous. For the British Association, only a neutral statistics that lacked political implications was acceptable.[27] This was despite the fact that the 1833 meeting in Cambridge saw the participation of Thomas Malthus and Adolphe Quetelet, the prominent Belgian statistician, and papers published on statistics were attracting crowds – all of which indicated an obvious interest in a less politically neutral approach towards the topic. The leaders of the Association, however, made sure to draw the lines between a descriptive and ameliorate statistics, and to keep their own approach within the former. Applications for research grants for research on statistics were rejected, and the editors of the *Reports* habitually cut statistical-related papers down to mere overviews of 'facts'.

Another novelty of the British Association stemmed from its sheer size and visibility. Membership was in the thousands within only a few years[28], which

26 Adding to this, it also offered 'scientific' entertainment by organizing 'aboriginal exhibits'. In 1847, for instance, Londoners could inspect bushmen, Zulus, pygmies, etc. 'exhibited' in Exeter Hall. See Qureshi 2011.

27 Population growth had, by this time, been targeted by different practical policies and interventions, raising various political, philosophical, ideological and moral questions (see Robinson 2002). Thus, a 'scientific', 'neutral' conception of any issue related to this problem indicated that the strategy of ignorance of the BAAS was fully conscious.

28 For different indicators of membership see Morrell–Thackray 1981: 548-550. The approach that tied membership to fees differed significantly from that of the Royal Society. This latter had far fewer members (even prior to the reforms of 1847 only about 20-25 new members were accepted a year), but since its finances did not depend on fees, it did not need a wider membership. As we have seen, the opposite strategy was later to be followed: the Society moved towards a stricter selection of members from the middle of the century.

provided a steady income and also secured an excellent lobbying position for the Association. Even more significantly, the BAAS was the first respected scholarly body that turned its events into real festivals, marked by spectacular symbols and pomp – and thus, both recognized and deepened the relationship between science and publicity. Meetings, abundant in spectacle and 'celebrities', prominent scientists and nobilities, attracted not only thousands of people, but also the attention of the press. Thus, apart from cultivating a clear science politics, directing energies into lobbying and advocacy, and nurturing both formal and informal relationships, the BAAS was able to communicate the values of science in a visual manner, and thus to widen its scope of audience. In this sense, science did indeed become a public matter.

Expressing his concern in 1840, the physicist and mathematician Humphrey Lloyd, a later president of the BAAS, stated: "The only thing that seems to me doubtful is the propriety of the Association itself meddling with the ladies, or taking their money. Is it not rather American?" (quoted in Morrell–Thackray 1981: 148).

'Meddling with the ladies', however, proved to be of great benefit to the British Association. Until the second half of the 19th century women were excluded from all scientific bodies and positions, so it is not surprising that they were not invited to attend the first meeting of the BAAS at all. Mrs. Somerville, the grande dame of science of the time, was herself of the opinion that female participation would decrease the prestige and solemnity of the Association. However, changes in personal attitudes are also telling: by the end of the 1860s, Mary Somerville went so far as to sign Mill's petition for giving the right to vote to women. The iconic figure of the times eventually came to contribute to a slow change in women's role in culture and science[29], but during the first half of the 19th century women could not demand a place within the field of science. However, as BAAS meetings were held in country towns, many of those attending brought along their wives and daughters, and so, in practice, the life of the Association was from the beginning colored by the presence of women. In 1833, 'ladies' tickets' were introduced, offering a significant source of income for the BAAS. Ladies' tickets notwithstanding, women were barred from membership for a long time, and even with their tickets could only attend evening lectures and social events connected to meetings. The letter quoted above reflects the situation the Association had to face by the end of the 1830s: women had actually become an organic feature in the life of the BAAS, mainly because of their financial contribution and permanent presence. The ambivalence about this situation is quite typical of the whole era, or in fact suggests a relatively tolerant attitude, given the circumstances of women in Victorian England, where, for instance, they were not permitted to attend universities, and were restricted in their other rights as well. In my opinion, the reluctant tolerance of the BAAS is not so much a manifestation of the expression of a value system, but rather an unintended consequence of the new modus operandi. For the creation and

29 For more about Mary Somerville see Neely 2003.

significance of the research fund, and the importance of the grandiose meetings meant that the Association could not afford to fully exclude a group that bought more than a thousand tickets a year. The female presence was also desirable at meetings that were highlighted by ceremonies, balls and dinners – all utilized for gaining wide social support. Thus, their partial inclusion was a result of a compromise made between the demands of necessity and reputation.

Science represented by the BAAS was therefore not devoid of values and ideological implications. In fact, we cannot even claim that it was in practice more neutral than the form advocated by the Royal Society. However, a highly important *differentia specifica* of modern science can be grasped here, at the moment of its birth: science does have to appear to be useful and objective, and if it does represent any kind of value, it must be nothing other than the common good, the cause of humankind. Science is a value in itself, and as such, its criteria must be concerned with finding the truth, but at the same time it serves the good of society, and in that respect its value system relates to serving the cause of progress. Any other feature that threatens to surface and influence the scientific field creates a bias and weakens its powers. This is why the autonomy of science needs to be protected. This ideology, from which scientists of many developed countries have profited since the 19th century, demanded that the workings of the scientific field which – necessarily and inevitably – continued to be socially and culturally embedded, should appear to be autonomous, and 'external' influences should be limited and masked.

Darwin's 'Young Guard': the X-Club

19th century English science existed in the age of clubs. Besides official scientific associations and universities, many informal groups were formed, some of which exerted a decisive influence on the workings of the official bodies. The informal club was an accepted means of exchanging and discussing new ideas and information. Besides the Red Lion Club, or the renowned Philosophical Club, and other similar groups, Herbert Spencer and his friends founded the X-Club in 1864. The Club had nine members, all prominent scientists, and during the two and a half decades of its existence its members managed to significantly shape and influence the scientific life of Victorian England.[30]

Any interpretation of the Club's modus operandi is not unambiguous. The explicit intention of the scientists that belonged to this club was only to nurture their old relationships through regular conversations over dinner, but it is also obvious that they had a clear view of how scientific life and thinking should be transformed. As Th. A. Hirst recalled of the founding of the club: "Besides personal friendship,

30 Members of the X-Club were the following: J. D. Hooker: botanist, T. H. Huxley: naturalist, physiologist, W. Spottiswoode: mathematician, J. Tyndall: physicist, E. Frankland: chemist, Th. Hirst: mathematician, G. Busk: physician, naturalist, J. Lubbock: naturalist, and the philosopher H. Spencer. About the X-Club see Jensen 1970, MacLeod 1970, Turner 1978, Moore 1991, Barton 1990, 1998, Desmond 2001.

the bond that united us was devotion to science, pure and free, untramelled by religious dogmas." (quoted in Jensen 1970:1). In the contemporary mind, the group was held to be the most influential scientific lobby; some referred to the members as "the Albermarle street conspirators" (referring to where the hotel they met at was located), and a newer article calls them a "guerilla army" (Moore 1991). These adjectives, even if somewhat exaggerated, are in fact supported by historical insight. What can certainly be stated is – as an American advocate of evolutionary ideas wrote during his visit to England – that these were a set of highly "influential chaps" (quoted in Barton 1990: 58). What their personal intentions at the first meeting were is hard to establish. Perhaps this circle of friends only founded the club in order to nurture their personal relationships, but it is more likely that they suspected, as early as in 1864, that – as Hirst put it in his diaries (Jensen 1970: 1) – there would come a time when coordinated action would prove useful. Regardless of their explicit intentions and plans, the X-Club became one of the most influential groups in 19th century English scientific life, and this informal body exerted a decisive influence upon the processes that took place within the official organizations of science for more than two decades.

In the narrative outlined in the present article, the emergence of this group indicates a decisive advance in the process that led to the transformation of the old-fashioned, gentlemanly, 'amateurish' science into a modern, disciplinarily-divided, politically and socially more neutral science: in short, professionalization. This new understanding of science brought a greater degree of autonomy, made the role of 'external' – social, political, cultural – factors more indirect, and parallel to the transformation of the scientific field, it also significantly changed every day popular thinking.

Members of the dining club knew each other from the 1850s, many of them as close friends. Spencer, Huxley, Hooker and the others had different social and financial backgrounds, but at the beginning of their careers they were all in marginal positions within a scientific field mostly comprised of gentlemen of privileges who were conducting a traditional and largely religious science. Ruth Barton (1998) outlines the early networks between the members. According to her description, there were basically two circles of three friends – one containing Tyndall, Hirst and Frankland and one containing Huxley, Busk and Hooker – that the group organized around and grew out of. It took longer for those in the first group to become naturalists as they came from less privileged backgrounds. The father of the Irish Tyndall, for instance, was a police constable, and Tyndall himself started his career as a land surveyor. He met both Frankland and Hirst at university. Hooker, Huxley and Busk had worked as physicians for the navy before embarking upon a scientific career in London in the early 1850s. The last ones to join the group were Spencer, Lubbock, and Spottiswoode, and soon after their appearance on the scene the X Club was formed. Lubbock and Spottiswoode represented the privileged Anglican milieu. The wealthy Lubbock, who happened to be Darwin's neighbor in Down, was an influential supporter of

scientific work, and, significantly, the treasurer of the Royal Society. Hence, Lubbock and Spottiswoode had the necessary connections to promote entry into the 'proper' circles, and increased the Club's prestige in general. And Spencer, the eternal outsider, who came from a Nonconformist family, had gained enough recognition with his publications on the philosophy of evolution by the 1860s to be an important link to more radical literary and philosophical circles. This was clearly rather heterogeneous company, but members typically – in comparison to the dominant members of either the Royal Society or the BAAS – had a more marginalized social background.

Beyond their personal relationships, the main bond between them was the rejection of Christian orthodoxies in their scientific understanding of the world. The nine members covered much of the scientific spectrum, and for a good reason: representing 'Science' was an explicit intention of theirs, right from the moment of the founding of the Club. The group was also, especially at the beginning when the members were young, a vehicle for mutual career support. Higher ambitions, the cause of science as such, came into the forefront when their own institutional positions became more secure.

Several of them had, by 1864, been accepted into the Athenaeum Club, the organized body of the intellectual elite which offered them access to different elite groups. They increasingly became involved in different public issues. They joined the Ethnological Society, for instance, which got into a stormy conflict with the racist Anthropological Society. The latter, founded in 1863, in contrast to the Ethnological Society that by then supported evolutionary theories, refuted Darwinism and its political-ideological connotations: it questioned, for example, the idea of the common origin of humankind. The X-Club members furthermore supported clerical reform in alliance with leading liberal thinkers such as Mill. They collectively and publicly defended the Essayists (the authors of *Essays and Reviews*) and Bishop Colenso, who in their work (published in 1860 and 1862 respectively) – scandalous according to many – challenged the literal truth of the Bible. Overall, there were hardly any controversial public issues about which the members of the Club did not voice their opinion. Obviously then, this group, unlike the British Association and the Royal Society, did not shy away from making open political statements of a type far more radical than the more latent but still fairly clear orientations of the other two bodies. By the time of the founding of the X-Club, this kind of collective and organized action was not new its members.

The members met regularly until 1892, but during the last years – because of deaths, illnesses and some personal conflicts[31] – as a group they were less efficient. Until then, together they catalyzed processes within the scientific field in a major way.

31 The most important of these was when – indicating the impending collapse of the group – in 1889 Huxley criticized Spencer's radical laissez-faire ideology on the pages of the Times. Huxley always supported central reform, whereas Spencer advocated a very limited role for the state and an unrestricted market economy. This difference of opinion remained secondary for a long time in comparison to their fight for the omnipotence of science, and gained greater significance only after they had achieved a lot as the vanguard of science. Of course, they always knew about their ideological differences, but this time Spencer was outraged because Huxley attacked him publicly.

One of the main topics for discussion at their regular dinners was the candidate list for Royal Society membership. Dinners usually took place immediately before Royal Society meetings, and thus at the following meetings they represented a united front and pursued their interests rather efficiently. During the 1850s and 60s, X-Club scientists were already active, albeit only 'junior', members of the Royal Society. Spencer was the only exception: this was partly due to hurt feelings as he had been refused the recognition of the Society at an earlier date, but much more because of his voluntary, and almost vocational, outsider status. Despite this fact, even he actively participated in discussing and influencing Royal Society affairs. Club members quickly climbed the ladder of Royal Society hierarchy, and several of them (Hooker, Huxley and Spottiswoode) later became presidents. Between the years of 1870 and 1882, at least three X-Club members were members of the presidential committee (Barton: 1990: 60). By 1864, all except for Spencer had become members of the BAAS, and the Club had provided five Association presidents. They played leading roles in the most important discipline-based organizations (for instance, in the Geological Society), and participated in the life of the Royal Institution of Great Britain, one of the most important scientific centers of the time, where they gave numerous public lectures. As Spencer put it in his *Autobiography* (1904, II: 134): "to enumerate all their titles, and honours, and the offices they filled, would occupy too much space. Of the nine, I was the only one who was fellow of no society, and had presided over nothing."

It was interest in Royal Society affairs that gave the immediate incentive for the founding of the X-Club. Despite the reforms of 1847, the society remained characterized by a certain kind of 'amateurishness' for the next two decades – in selecting presidents, for example, social background and proper networks continued to be at least as important factors as scientific excellence. The X-Club members were also highly dissatisfied by the procedural and substantial matter of the giving out of awards and official recognition. In 1864, when Darwin received the Copley Medal, the Society's most prestigious distinction, the group members were outraged by the words of the president George Sabine, who said that in their decision to commend Darwin they had to ignore his theory of natural selection (Barton 1990: 61).

Among other things, the X-Club was also glued together by the decisive advocacy of Darwin's theory, and their endeavors to disseminate to the widest circle possible. Darwin himself was not a member of the Club, although he nurtured close relationships with several of them. (Hooker was one of his oldest and closest friends.) There were disagreements about the details of evolutionary theory[32], but

32 Spencer, for example, did not agree with Darwin about the bases of the process: he did not accept that variations of character appeared randomly, and instead held that the Lamarckian mechanism of the inheritance of acquired characteristics was the major engine of evolution. But, in fact, the overwhelming majority of scientists as well as the public had a problem with accepting contingency. This remained the case for decades more, as, while accepting that the book of Genesis may not contain literal truth, and that species do actually change, was perhaps not all that difficult by then, believing in a process that is random, purposeless and non-directional was way too hard. (Of course, to digest the fact that man was also a subject of the very same process was not easy either.) Moore analyzes the significantly different meanings attributed to the expression 'Darwinism' in 19th century understandings (Moore 1991).

they shrunk in significance in the light of their highest goal: to fight against science that was conducted in a natural theological framework, and in parallel with this, to take over formal and informal positions of authority.

Besides the Royal Society, the British Association occupied a lot of the X-Club members' energies and attention. Again, it was only Spencer who refrained from joining the Association, while the others were active members, or even presidents. They also joined the most important disciplinary bodies such as the Mathematical, Geological, and Chemical Societies.

It would be an exaggeration to claim that they were first and foremost, or even exclusively, motivated by their personal ambitions. The Royal Society represented science itself. Questions like who occupied presidential and other influential positions, who received research grants and different awards were matters of power relations within the field, and of the authority and status of science within a wider public sphere. Hence, they did everything to sever the link between the legitimacy of science and political, aristocratic and religious support, and whereas they also emphasized the utility of science, they wanted the pure value of science recognized too.[33]

Other institutions of science also gained the attention of the X-Club. Huxley and Hooker invested great effort into widening the laboratory networks, increasing the acceptability of laboratory findings and increasing their prestige and role in science instruction as well. Huxley participated in the training of teachers (Desmond 2001). And although they did not acquire positions in major universities – which was not their ambition – they gave lectures in many different institutions of education. In this sense, they did not aspire to an elitist isolation; what is more, they endeavored to disseminate their ideas in the widest possible circles.

the popularization of science. As Lightman (2007) shows, even Huxley, who became known as one of the most vehement, energetic and best popularizers, was not only reluctant about this activity at first, but also explicitly considered popularizing to be an inferior activity. His and his allies' attitudes changed in the context of the rising eminence of natural science instruction in the aftermath of world exhibitions as a result of the Education Act and similar events, all of which showed the importance of educating the public. By the 1860s, upon realizing the outstanding significance of popularizing science, even for their own cause, the

33 The discourse about the utility of science was not independent from questions about the Empire, sharpening international competition, and mainly the rapid and spectacular strengthening of Germany. Talk of a 'Darwinian industrial war' was not rare in political discourse. The scientific movement profited vastly from the expectation that scientific findings could ensure that the industrial superiority of Britain was sustained. But it came under attack as well for the very same reason, since on the one hand it did not quite succeed in meeting these high expectations, and on the other, it met them too well when trying to base the understanding and management of different segments of social life on mere material findings. This was the time when, for example, resistance against newly-introduced vaccinations began (Desmond 2001, MacLeod 1982). It should also be noted here that, even though a widely-held interpretation of Darwin's theory understands it as an application of the theory of competition in classic economics applied to the field of nature, this is in fact difficult to support. Darwin seems to have been more greatly influenced by earlier natural scientific concepts, especially Carl Linneus' Oeconomia Naturae, and there are few traces indicating that the basis of his theory of natural selection lay in his personal experiences of the era, or a theoretical impression of classic political economics (cf. Hull 2005, Pearce 2010).

scientific elite entered the field. Rather than managing to question the legitimacy of the popularizers, they turned into successful popularizers themselves.

The industry of popularizing science was of utmost importance to the paradigm change that took place in Victorian England in scientific thinking. The success of popular scientific work provided huge impetus for the scientific elite to enter this industry, by which they managed to spread their ideas outside the restricted field of pre-existing practitioners and advocates (Lightman 2007). And although, despite their efforts, religious themes continued to impregnate scientific publications and scientific thinking in general right until the end of the century (most of the new and popular scientific works did not meet the criteria of the new scientists who tried to draw a hard line between these fields), we can still say that these publications contributed to the success of the scientific movement. They disseminated scientific knowledge and advocated the importance of natural sciences to a massive audience drawn from different strata of society. This could not have been achieved independently by a scientific elite that isolated itself from the public.

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It is a well-known fact that the 1859 publication of *The Origin of the Species* was followed by lively debates and heated dispute. The reception of Darwin's work was far from a glorious and smooth conquest of ideas. Certain elements of the theory were not accepted by even the majority of the evolutionists for a while. There were many among them who, while claiming to be evolutionists, either somehow smuggled drops of theology of nature back into Darwin's theory or, similarly to the overwhelming majority of the Victorian public and scientists, were simply unable to accept the contingency of the process described by Darwin and thus interpreted it in a teleological manner on the basis of Lamarckism. Hence, there was far less than full agreement, even among the evolutionists. In retrospect, however, it seems that the new scientific approach firmly and unambiguously won over the old, religiously-framed scientific thinking. Eventually, that is what happened. But the process that ultimately separated the fields of religion and science was not one of straight secularization. The cultural and institutional role of the church strengthened in other spheres, and thus the scientific movement was paralleled by a religious revival in Britain (Turner 1978). As a result, the separation of scientific and religious fields became increasingly marked.

From the point of view of the history of science, the most significant feature of the processes taking place was a realignment of the boundaries between religion and science, and 'amateur' and 'professional' science. The representatives of the new science in England wanted to establish an autonomous science completely free from the influence of religion, politics and social background. This can of course never be fully achieved, but the transformations made in earlier age were radical. The new science became far more independent of 'extra-scientific' influence than it had been

before – but ironically, to achieve this goal, the new scientists relied primarily on 'extra-scientific' means.

Autonomy, in this context, can only be understood as a relative term. Inspection of the process that is indicated by the changing modus operandi of the scientific institutions actually reveals, rather than a straightforward increase of autonomy, an increase in the value of the autonomy of science. And, as a consequence, the natural absence of autonomy had to be disguised by a covering of embeddedness and the rendering of different influences more indirect. Social background, political and religious values, financial aspects, personal relationships, trust, or even emotions, and many other phenomena that are normally considered to be extra-scientific, continued to impregnate the sphere of science. These influences, however, were made less direct by the imposition of clearer boundaries, a modified institutional structure, crystallized rules of research and theory building, and clearer criteria for scientific achievement. But these changes do not amount to some sort of deceit or lie; the redefined role of science actually demands the appearance of autonomy – without this, it cannot function as an organic part of a changed social context.

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