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Science and popular education in the 1830s: the role of the Bridgewater Treatises†

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As is widely known, the Bridgewater Treatises on the Power, Wisdom and Goodness of God as Manifested in the Creation (1833–36) were commissioned in accordance with a munificent bequest of the eighth Earl of Bridgewater, the Rev. Francis Henry Egerton (1756–1829), and written by seven leading men of science, together with one prominent theological commentator. † Less widely appreciated is the extent to which the Bridgewater Treatises rank among the scientific best-sellers of the early nineteenth century. Their varied blend of natural theology and popular science attracted extraordinary contemporary interest and ‘celebrity’, resulting in unprecedented sales and widespread reviewing. ‡ Much read by the landed, mercantile and professional classes, the success of the series ‘encouraged other competitors into the field’, § most notably Charles Babbage’s unsolicited Ninth Bridgewater Treatise (1837). As late as 1882 the political economist William Stanley...

† Editor’s note. This essay was one of the joint winners in the Society’s Singer Prize Competition.
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‡ Each of the Treatises passed through several large editions, the series totalling more than 60,000 copies in print by 1850. Details of the publication history and a full bibliography of more than 150 contemporary reviews are given in my forthcoming Lancaster University thesis: ‘An Infinite Variety of Arguments’: The Bridgewater Treatises and British Natural Theology in the 1830s.

§ ‘Analysis and notices of books’, London Medical Gazette (1838), 22, 809. One such competitor was Charles Mountford Burnett, whose The Power, Wisdom, and Goodness of God, as Displayed in the Animal Creation, London, 1838, not only borrowed the Bridgewater title, but was largely ‘made up of quotations from the Bridgewater Treatises and other similar productions’. ‘Mr. Burnett’s Power, &c. of God’, British and Foreign Medical Review (1839), 7, 227–8 (227). Frederick C. Bakewell described his Natural Evidence of a Future Life, 2nd edn, London, 1840, as ‘a contribution to natural theology designed as a sequel to the Bridgewater Treatises’. J. S. Bushnan advertised his Introduction to the Study of Nature, Illustrative of the Attributes of the Almighty, as Displayed in the Creation, London, 1834, as being uniform with the Bridgewater Treatises. ‘Literary notices’, Magazine of Natural History, (1834), 7, 96. See also [Anon.], Of the Power, Wisdom, and Goodness of God, as Shewn in the Works of the Creation, London and Worcester, 1835, which was described as ‘a Bridgewater Treatise for the young and thoughtful enquirer’. ‘Critical notices of new publications’, Analyst (1835), 2, 441.
Jevons was intending to write an unofficial *Bridgewater Treatise*, and even an author of the prominence of Lord Brougham could not escape having his *Discourse of Natural Theology* (1835) described by Edward Lytton Bulwer as 'the tenth Bridgewater Treatise'.

I have argued elsewhere that one overriding reason for the extraordinary success of the *Bridgewater Treatises* was that they presented the pious middle classes with a largely non-technical and religiously conservative compendium of contemporary science, written by men whose scientific and religious credentials had been vetted by authorities as impeccable as the President of the Royal Society and the Archbishop of Canterbury. While the series could certainly prove useful in confirming faith and inspiring devotion, few commentators regarded it as being primarily a contribution to demonstrative natural theology, or to formal apologetics. Charles Gillispie has written that 'the series was intended to offer a working epitome of each of the main branches of natural science, and its final impact was expected to demonstrate the higher meaning of the order of nature and, in Sedgwick's phrase, to “ennoble” empirical discovery into morality'. Although the publication of a scientific encyclopaedia was manifestly not the intention either of the Earl of Bridgewater or his literary executors, it was undoubtedly one of the more important results of the bequest. Furthermore, this reading of the *Bridgewater Treatises* is consistent with the stated intentions of several of their authors. Sir Charles Bell captured the tone when he told his brother that 'from the Chancellor [Lord Brougham] to his little bookseller [Charles Knight] (who writes better than any of us), the encyclopaedists are all writing the same stuff. And here are eight men more to wear the subject to the bone — all at the same work.'

While the *Bridgewater Treatises* were undoubtedly successful in presenting a science acceptable to many middle-class readers, they also formed an important part of the pedagogic apparatus of those engaged in popular education. In his study of the *Bridgewater Treatises*, John Dahm emphasized the compendious character of the series, arguing that it 'helped to fill the gap caused by a lack of adequate science texts in England'. Similarly, the historian of popular science, D. A. Hinton, has noted that the *Bridgewater Treatises* 'were taken as standard popular reference works on contemporary science and extracts

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5 [E. L. Bulwer], 'Lord Brougham', *Monthly Chronicle* (1838), 1, 249–58 (257).

6 See Topham, op. cit. (2), ch. 5.

7 The authors were selected by Davies Gilbert, President of the Royal Society; William Howley, Archbishop of London; and Charles James Blomfield, Bishop of London. See Brock, op. cit. (1) and Topham, op. cit. (2), ch. 3.

8 This interpretation is supported by J. D. Yule, who considers that 'in general, as works of natural theology, the Bridgewater Treatises were unoriginal; they were probably superficial — and certainly they were insignificant'. Yule also argues that some of the Treatises were 'valuable popular accounts of the subjects of which they treated quite apart from their having had any theological interest'. J. D. Yule, 'The Impact of Science on British Religious Thought in the Second Quarter of the Nineteenth Century', Ph.D. Thesis, University of Cambridge, 1976 (BLLD Accession No. D17081/76), 189n.


10 C. Bell to G. J. Bell, 3 September 1831, G. J. Bell, *Letters of Sir Charles Bell, Selected from his Correspondence*, London, 1870, 320. I give a more detailed account of the authors' intentions in Topham, op. cit. (2), ch. 4.

11 Dahm, op. cit. (1), 195.
were commonly published in improvement journals as straight-forward scientific exposition'. Relatively little is known about the scientific texts which were used in early popular education and it is therefore particularly interesting both to analyse the functions which natural theology and natural science fulfilled in such contexts, and to investigate the role of the Bridgewater Treatises in performing those functions. This account focuses, not on the intended working-class recipients of such education, but on the educationalists themselves, and on the different ways in which they appropriated the Treatises. Indeed, it is important to note that many of the educational media intended for the working classes were actually used predominantly by the petit bourgeoisie. Since, however, the educationalists were not at first aware that their fire was falling wide of the mark, this fact does not materially affect discussion of their intentions.

The paper begins with a general consideration of the Bridgewater Treatises as works of popular science, focusing on the inappropriateness of their form of publication for such a purpose. Attention is then switched to the actual use made of the series by three distinct groups of would-be educators. First, I consider the various activities of the Broughamite educationalists – the diverse forces which massed under the banner of the Whig Lord Chancellor, Henry Brougham, achieving a clear institutional basis in the Society for the Diffusion of Useful Knowledge (SDUK), and in the loose network of mechanics' institutes. Secondly, I focus on the educational activities of the High Church party, particularly as represented by the Society for Promoting Christian Knowledge (SPCK). Finally, I give some attention to the evangelicals – both within the Church and without – and to the activities of such educational bodies as the Sunday School Union and the Religious Tract Society (RTS).

THE BRIDGEWATER TREATISES AS POPULAR LITERATURE

In the age of 'the march of mind', it is significant that several of the Bridgewater authors displayed a profound interest in the subject of popular scientific education. Both Sir Charles Bell and Peter Mark Roget were, in 1826, founding members of the SDUK, and they continued to be very active in its business, each writing scientific treatises for the Society's Library of Useful Knowledge (1827-46). The Society's publisher, Charles Knight (1791-1873), considered that 'upon all questions of Physiology, Peter Mark Roget and Charles Bell [were] the great authorities in the Useful Knowledge Society' and that 'amongst the founders of the society, Dr Roget was, from his accepted high reputation, the most eminent of its men of science'. Roget, a tireless organizer, was 'a diligent attendant on its committees; a vigilant corrector of its proofs'. The Rev. Thomas Chalmers, in his original and forthright manner, also displayed a profound interest in popular education.

13 I have dealt with the working-class context in Topham, op. cit. (2), ch. 7.
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and control. Not only did he concern himself with the theoretical problem of pauperism in his *Christian and Civic Economy of Large Towns* (1821-26), but he made noteworthy attempts to deal with the practical problems facing the urban poor, first in the poorest parish in Glasgow, then in the notorious West Port in Edinburgh. Chalmers’ scheme for the social management of the working classes depended crucially, as we shall see, on the effects of Christian and scientific education. Others of the authors, though less involved in educational schemes, clearly hoped that their *Treatises* might contribute to recapturing the common mind for the Anglican hegemony. William Whewell, for instance, sent copies of his *Bridgewater Treatise* to the London and Lancaster Mechanics’ Institutes, and to a mutual improvement society in Lancaster which was patronized by the Rev. Joseph Rowley (1769-1864), Whewell’s former headmaster at the Royal Grammar School.

Notwithstanding the aspirations of their authors the *Bridgewater Treatises* seemed, in the words of one radical Whig commentator, ‘from their price and size, likely to remain GREAT UNKNOWNS to the mass of the community’. The price of the *Treatises* was a general cause of complaint, and the *Magazine of Natural History* actually refused to review William Kirby’s *Treatise* because of its expense, grumbling:

The type is large, and the page not so, and the quantity of words in the two volumes, we guess, about equal to the quantity in a few ninepenny parts of the *Penny Cyclopaedia*; yet 30s are asked for this quantity and the plates! Who can profit by the teaching of a Kirby while the bookseller precludes access to his lessons?

The *Bridgewater Treatises* were by no means expensive when considered as philosophical works, but their prices of between 9s 6d and £1 15s were clearly prohibitive for even the best provisioned working-class readers – for the mechanics and artisans who generally earned less than 30s per week – and for the *petit bourgeois*. With the exception of Whewell’s *Treatise*, which in the sixth edition of 1837 became available in a smaller format for 6s, the *Treatises* did not enter the ranks of cheap literature until they were republished by Bohn’s Scientific Library in the 1850s. This was a source of great dissatisfaction to many commentators who considered it to be an unnecessary restriction of the potential readership of the new series. The anonymous reviewer in the *Quarterly Review* protested:

Is it likely that a series of treatises, so numerous and expensive, will attain any wide circulation in these days of cheap literature? Could it have been the intention of the testator that the argument


16 Rowley to Whewell, 23 March 1833, Trinity College, Cambridge, Add. Ms. a. 6648. The society had no established library, but sold its books biannually. Joseph Rowley retired from the Grammar School in 1812, and it seems most likely that the society met at the Lancaster Castle prison, where he was chaplain until his death. It was said that ‘many young men anxious of self-improvement, have reason to remember with gratitude the assistance they derived from Mr. Rowley’s free instruction and sympathy’. ‘Death of the Rev. Joseph Rowley, M.A.’, *Lancaster Guardian* (1864), 27, 9 January, 4b-c.

17 ‘Useful books’, *Johnstone’s Edinburgh Magazine* (1833), 1, 95-100 (95).

18 ‘Works on natural history’, *Magazine of Natural History* (1833), 8, 471.

19 Even a comfortably middle-class £10-householder, who would have been enfranchised after 1832, might easily have had as little as 48s per week. See the sample domestic budgets in C. S. Peel, ‘Homes and habits’, in *Early Victorian England* (ed. G. M. Young), 2 vols., London, 1934, i, 79–151 (especially 104–8, 126–34).
for which he so liberally provided, should be thus rendered inaccessible to the less wealthy classes of society...?20

The Quarterly reviewer regarded the Treatises as a lost opportunity to argue the High Church case among the ungodly working classes, a fact which was "deeply to be regretted by all persons friendly to the diffusion of really useful knowledge".21 Reviewers of almost every political and religious complexion were angered that the Bridgewater Treatises were not better suited to the diffusion of what each party considered to be "really useful knowledge". Welcoming the 6s edition of Whewell's Treatise, the Wesleyan Youth's Instructor and Guardian looked for cheaper editions of the other Treatises, in order that the testator's wishes should have "a more extensive accomplishment".22 Likewise, at the other theological extreme, the Unitarian Christian Reformer considered that:

"[I]t might have been reasonably expected that these volumes would have been brought forward in a less expensive form, and afforded at a price which would have rendered them accessible to a large, and happily an increasing class of readers, to whom it is more especially desirable that subjects of this kind should be rendered familiar."23

Such a broad consensus is striking, and raises the question why the Bridgewater bequest was so widely interpreted as an opportunity to publish a cheap and educational treatise of scientific natural theology. The reviews themselves provide a number of markers: this was (as the Quarterly indicated) the age of cheap literature, in which (as the Christian Reformer remarked) literacy was on the increase. The advent of the steam press had made accessible a whole new class of readers, whose minds were the battle-ground for competing groups of would-be educators. All such paternalist educators, however, had a common enemy in the established cheap press: the sensational broadsides and ballad-sheets which were hawked in the streets, and the radical unstamped press which had burgeoned with the Reform Crisis. In those turbulent days the power of the written word to control the working classes was conceived, if not for the first time, at least with a new conviction; and all parties sought to use the weapon for their own ends. It was in this context that the Bridgewater bequest was seen as an opportunity to publish an "ennobling" scientific series which was sufficiently cheap to compete with less wholesome street literature. Indeed, several groups of paternalist educators actually made significant use of the Bridgewater Treatises despite their cost, but commentators were none the less diffuse about how the Bridgewater bequest might have been better managed in order to meet educational criteria. Several reviewers suggested that there should have been competition for a prize,24 but the most popular solution was that expounded in the Edinburgh Review by David Brewster:

[A] splendid edition might have been provided for the opulent purchasers of expensive publications; and one or two thousand pounds of the original bequest might have been employed

20 'The Bridgewater Treatises — the universe and its author', Quarterly Review (1833—34), 50, 1—34 (2—3).
21 Ibid., 2.
22 'Review', Youth's Instructor and Guardian (1838), 22, 61—3 (63).
23 'The Bridgewater Treatises on Natural Theology', Christian Reformer (1834), 1, 146—52 (147, emphasis mine).
24 E.g. 'Dr. Buckland's geology and mineralogy considered with reference to natural theology', Congregational Magazine (1837), 13, 42—7 (42); and 'Kirby on instinct', Medico-Chirurgical Review (1835), 23, 400—13; (1836), 24, 79—93, 358—65 (400).
in defraying the expenses of an extremely cheap edition, which would have circulated, among the reading classes, the most salutary and elevating instruction.\textsuperscript{25}

While Brewster believed the Bridgewater bequest to be 'an event without parallel in the history of our literature', the \textit{Congregational Magazine} could recall a precedent for defraying publishing costs.\textsuperscript{26} Only recently William Ramsay Henderson (1810–32), 'a young enthusiast in phrenological pursuits', had bequeathed in trust more than £5000 for the advancement of phrenology, with the suggestion that the fund might subsidize the cheap re-publication of George Combe's \textit{Constitution of Man} (1828), 'so as to be easily purchased by the more intelligent individuals of the poorer classes, and Mechanics' Institutions, &c'. The judicious use of monies from Henderson's bequest set in motion a publishing snowball which made Combe's the best-selling scientific book of the first half of the century, with 101,000 copies sold by 1865.\textsuperscript{27} The \textit{Congregational Magazine} contrasted the management of this bequest with that of the Bridgewater bequest, and enquired why 'the munificence of Lord Bridgewater' had not 'been thus employed to provide a healthful aliment for the minds of that important portion of the community' and to ensure a 'wide diffusion among that class of the community which stands most in need of such instruction'. Such a step was, however, too daring for the triumvirate who disposed of the Bridgewater bequest, and the \textit{Congregational} reviewer argued that the \textit{Treatises} were 'sold at higher prices than booksellers would have charged, had they published them as speculations of their own'.\textsuperscript{28} The moderately reformist \textit{Medico-Chirurgical Review} saw this failure as a reflection of the corruptions of the Anglican establishment from which the \textit{Treatises} sprang:

[T]hink of printing these treatises, designed for universal dissemination, in a style, and at an expense, that must limit their circulation to the narrowest compass. Between the lines of the work before us the Earl of Bridgewater might almost have driven his cab! Are scepticism and irreligion confined to a few of the upper classes? It would seem so, from the means which have been taken by the Earl's executors to prevent any but a few of the wealthy from having access to the Essays — Essays meant to illustrate the power, wisdom, and goodness of God! But, as usual, the whole business was a job — and the products have done little credit to this country.\textsuperscript{29}

The hour being too late for the publication of an edition subsidized from the bequest, commentators suggested remedial action. Brewster proposed 'that one of the eight authors...should be requested by the trustees to execute a popular volume out of the materials furnished by himself and his coadjutors';\textsuperscript{30} and the \textit{British Critic} considered that

\textsuperscript{25} [D. Brewster], 'Whewell's Astronomy and General Physics', \textit{Edinburgh Review} (1833–34), 58, 422–57 (424).
\textsuperscript{26} Ibid., 422. \textit{Congregational Magazine}, op. cit. (24), 43.
\textsuperscript{29} \textit{Medico-Chirurgical Review}, op. cit. (24), 400.
'a popular synopsis' of the series 'might be of considerable service to the young whose minds are uninformed, and to the busy whose time is much occupied'.\(^\text{31}\) Even so staunch a critic as the High Tory \textit{Church of England Quarterly Review} would have been glad of an abridgement of the series, 'in three pocket volumes, for 18s'.\(^\text{32}\) The \textit{British and Foreign Medical Review} had hoped that C. M. Burnett's Bridgewater-inspired treatise on \textit{The Power, Wisdom, and Goodness of God, as Displayed in the Animal Creation} (1838) might supply the need, but it was measured and found wanting.\(^\text{33}\) The \textit{Naturalist}, however, considered the requirement to have been met by the Rev. Henry Duncan's \textit{Sacred Philosophy of the Seasons} (1835–36):

The Bridgewater Treatises have supplied much of the materials; and, indeed, as far as natural phenomena are concerned, whatever was available for his purpose in these bulky and expensive volumes has, by our author, been brought together and placed within the limits of the purse, as well as the time, of ordinary readers. When completed it will form an excellent epitome of these treatises, and be more in accordance with what we are persuaded was the intention of the noble testator than the plan adopted by those who undertook to give effect to his will.\(^\text{34}\)

A few reviewers considered that there was little to be lamented 'in the cheap diffusion of these Essays being retarded yet a while', since there were works available which were 'popular, and yet solid and comprehensive, [and] adapted to the improvement of those who are neither among the learned nor the leisured'.\(^\text{35}\) In this category fell Henry Fergus's \textit{Testimony of Nature and Revelation to the Being, Perfections, and Government of God} (1833), which was described by the \textit{Spectator} as 'an attempt to do in one volume what the Bridgewater Treatises are to do in eight'. Not only was Fergus's work 'an excellent volume', but it was to be had 'for somewhere about half the price of one Bridgewater octavo'.\(^\text{36}\) Yet the availability of cheaper works of scientific natural theology only serves further to highlight the question why the Bridgewater Treatises were so widely used in popular education, despite their considerable expense.

It is the argument of this paper that the strictly apologetic functions of the Bridgewater Treatises were not of primary importance in any of the educational contexts examined. On the contrary, as we shall see, all three groups of educators considered such functions to be at best futile, and at worst counter-productive. As the comments of a wide variety of reviewers make clear, the works were, instead, chiefly attractive for the qualities of their scientific exposition. Written by leading men of the scientific establishment, and at the behest of the President of the Royal Society, the Bridgewater natural theologies were 'much more methodical, in a scientific point of view, than Paley's, and in this respect superior to it'.\(^\text{37}\) Although not uniformly endowed with such attributes, the Treatises were generally contemporaneous and systematic, and at the same time introductory and eminently

\(^{31}\) 'Babbage's Ninth Bridgewater Treatise', \textit{British Critic} (1837), 22, 88–94 (88).
\(^{33}\) \textit{British and Foreign Medical Review}, op. cit. (3), 227.
\(^{34}\) 'Review', \textit{Naturalist} (1836–37), 1, 274–8 (276).
\(^{36}\) 'Books on the table', \textit{Spectator} (1833), 6, 360.
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readable, being divested of all unnecessary technical detail. This combination of qualities alone was rather uncommon, and made the series attractive to many educationalists. However, the Bridgewater Treatises possessed further attractive attractions. Writing in the Athenaeum, William Cooke Taylor (1800–49) commented that if William Whewell's Treatise had 'been published in a shape and at a price rendering it available for purposes of education', he would 'have confidently recommended it to youth...as a safe guide to science, and as worthily inculcating...sublime truths'.38 I shall argue that for many educators, the science of the Bridgewater Treatises was particularly valuable because it was not subversive of their various religious, social and political commitments, and was thus far 'safe'.

In stating that the Bridgewater Treatises were valued for their safe science, rather than the strictly demonstrative functions of their natural theology, I am not attempting to reintroduce the old science/religion dichotomy in another guise. Indeed the distinction between safe science and demonstrative natural theology is one which was used by contemporary commentators, many of whom expressed reservations about the necessity or propriety of having detailed scientific treatises to prove design. According to the Spectator:

It is true, that evidences of design and the most elaborate contrivance are everywhere evident, and force themselves upon the least observant and the most unreflecting; and in this view the Bridgewater Treatises may be held as unnecessary. It was, however, important to be shown that the extensive modern discoveries of science — the nearer view our philosophers had got into its arcana — did not militate against the conclusions obtained in former times.39

Whilst it might be unnecessary to maintain a theological argument, science had still to be so constituted as to support safe religious (as well as social and political) views. This idea clearly reflects widespread fears concerning the various dangerous kinds of science which had currency in Britain during the tumultuous 1830s.40 Of course, what constituted safe and dangerous science was context-specific, and depended on the ideology of the party in question. Hence I will argue that each of the three groups which used the Bridgewater Treatises in popular education employed a somewhat different notion of safety in science. It might reasonably be asked how it was possible for the Treatises to appeal to groups with such diverse requirements. One reason for so broad a spectrum of interest is that the groups shared a great deal of common ground. All, for example, considered the notorious surgeon Sir William Lawrence's materialist science to be unsafe in the highest degree; and consequently much of the science in the Bridgewater Treatises which was opposed to Lawrence's views was welcomed as safe by all three groups. A further reason consists in the variety of the Bridgewater Treatises. Although it is not clear how one could rigorously analyse the relative popularity of the several Treatises in the different educational settings, a clear impression emerges that certain Treatises approached more nearly to each group's ideal of safe science than did others. It is, then, the purpose of this paper not only to illustrate the extent to which the Bridgewater Treatises were valued for the safety of their

38 [W. C. Taylor], 'Bridgewater Treatises', Athenaeum (1833), No. 282, 184.
39 'Whewell's application of astronomy and physics to natural theology', Spectator (1833), 6, 331—2.
science, but also to elucidate the different ideals of safe science to which the several groups aspired.

**BROUGHAMITE EDUCATION**

The Broughamites set the pace of early nineteenth-century education by pioneering several new educational media, most notably the mechanics' institutes which appeared in many localities during the period immediately after 1823. While the movement was not centrally co-ordinated, the bourgeois patrons and managers who promoted the institutes in particular localities generally shared some elements of the educational philosophy elaborated in Henry Brougham's *Practical Observations on the Education of the People* (1825). Brougham's epoch-making pamphlet also led in 1826 to the formation of the SDUK, which provided important support for the mechanics' institutes, including much-needed cheap literature of a kind which conformed to the aims of the movement. Science formed the paradigm of Broughamite educational practice, both in the institutes and in the SDUK. According to Henry Brougham's *Objects, Advantages and Pleasures of Science* (1827), there were four reasons why science was particularly appropriate for working-class education. First, a scientific education helps a man 'to provide for his daily wants', not merely by increasing his skills, but also by inculcating 'habits of regular labour'. Secondly, 'it enables men to make improvements in the arts, and discoveries in philosophy, which may directly benefit themselves and mankind'. The third benefit is the abstract pleasure of discovery, which is associated with the advantage of becoming 'a wiser and therefore a more exalted creature'. Finally, 'the highest of all our gratifications in the contemplation of science' is that 'we are raised by them to an understanding of the infinite wisdom and goodness which the Creator has displayed in his works'.

Although the argument from design was prominent in the rhetoric of many Broughamite educationalists, who emphasized — with one eye to clerical detractors of scientific education — that the teaching of science could only strengthen the cause of religion, there was some degree of ambiguity about the actual role of natural theology in scientific education. It is significant, for instance, that the SDUK declined to publish a scientifically-illustrated education of Paley's *Natural Theology* which Brougham had proposed. Brougham later recalled that some members of the Society had feared that the publication 'might open the door to the introduction of religious controversy among us, against our fundamental principles'. While a number of authors have recently shown that natural theology

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43 H. Brougham, *Discourse of Natural Theology*, London, 1835, 2. Brougham took on the publication himself, with the assistance of Charles Bell. The complete edition occupied five volumes (of which the above is the first) and was entitled *Paley's Natural Theology Illustrated*, London, 1835–39.
performed mediating functions in certain sectors of early Victorian society, it is clear that the subject was potentially controversial within the SDUK. As Adrian Desmond has indicated, the Society's committee was by no means unified, with 'moderate Broughamites of the Bell—Roget camp' standing opposed on the 'Unitarian Left' by Thomas Southwood Smith and James Mill. In such a context, the subject of natural theology was potentially divisive.

In their stimulating and controversial discussion of the mechanics' institute movement, Barry Barnes and Steven Shapin suggest that the Broughamites increasingly eschewed natural theology because they sought to imbue this new educational venture with the appearance of objectivity and disinterest. They argue that, while natural theology had previously failed to effect social control, because the working classes had rejected such 'recognizably ideological formulations', the Broughamites hoped that they might manage the working classes by the power of highly objectified natural science. This demanded great faith in the controlling power of science, but, as we shall see, many Broughamites were possessed of such faith. They were convinced that, if the working classes were given a scientific education, their sensuality and shallowness would be overcome, and they would become peacable, respectable and diligent. Speaking of mechanics' institutes in 1826, the Bridgewater author Thomas Chalmers wrote:

[T]here obtains a very close affinity between a taste for science, and a taste for sacredness. They are both of them refined abstractions from the grossness of the familiar and ordinary world; and the mind which relishes either has achieved a certain victory of the spiritual or the intellectual, over the animal part of our nature. The two resemble in this, that they make man a more reflective and less sensual being, than before; and, altogether, impress a higher cast of respectability on all his habits, and on all his ways.

Thus, Chalmers considered a well-stored book-case to be 'the unfailing index of a well-conditioned family; and this, whether it be loaded with the puritanic theology of our forefathers, or with the popular science of the present day.'


45 A. Desmond (1989), op. cit. (40), 406. Another part of the SDUK constituency was Evangelical in religion, and, as G. S. Kitteringham has noticed, the inclusion of natural theology in the early publications of the Society 'was controversial in a period where evangelicals emphasized revelation and believed that the teaching of natural theology on its own was Deistic'. G. S. Kitteringham, 'Studies in the Popularization of Science in England, 1800–30', Ph.D. Thesis, Kent University, 1981 (BLLD Accession No. D40577/82), 60.


48 Ibid., 379.
The Bridgewater Treatises—especially those of Whewell, Bell, Roget, Prout and Buckland—were well-suited to the educational programme of the more moderate Broughamites. The comments of the Spectator's reviewer nicely reflect the extent to which the series had fulfilled Broughamite educational desiderata:

The still more important view which may be taken of these treatises, is not the light they cast upon natural theology—which, truly, wants none—but the light they reflect on natural science: its relations, its mutual adaptations, its curious phenomena, the initiation into its secrets, the reward of a sincere love of truth, and a severe mental discipline, are all exhibited in this treatise under so beautiful an aspect, that the student can hardly fail, though his resolution may be but transient, to abjure the grovelling intrigues, the selfish passions, the degrading influences of the world, and dedicate himself, or aspire to dedicate himself, to the ennobling pursuit of knowledge.49

This quotation makes clear that Gillispie's description of the series as 'a working epitome of each of the main branches of natural science' which would "ennoble" empirical discovery into morality', very accurately describes the functions which the Treatises were intended by more moderate Broughamites to serve. Not only were these works authoritative, systematic, contemporary, and readable (all important Broughamite criteria) but they also made no concessions to the rabble-rousers of the revolutionary underworld. There was no dangerous materialism here—neither D'Holbach nor Lawrence—to lead working-class readers astray. The Broughamite concern with safe science was explicit. In his address to the Fifth General Meeting of the Leeds Mechanics' Institute in September 1830, Henry Brougham told his audience: 'It is of high importance that the bulk of the community should have sound and rational and safe views...[I]t is my object to make the bulk of the people philosophers.'50 Some of the particular scientific bugbears from which 'the people' were to be protected are illustrated later in this paper by reference to the SDUK's rigorous vetting of its scientific publications. The quotation from the Spectator makes clear, furthermore, that the Treatises were valuable quite independently of the theological argument which they were intended to maintain, and it was arguably only the supposedly objective scientific credentials of the Treatises that reconciled their natural theology with the Society's avowed secular policy.

The mechanics' institutes

The practice of the mechanics' institutes in our period falls into three main categories: lectures, classes and libraries. Although the first two of these might be dispensed with in smaller institutes, the last was indispensable. The establishment and maintenance of a library was not only the most expensive item involved in the formation and running of a mechanics' institute,51 but it was often the main attraction, and a major source of recruitment.52 Because of the investment made in them, the institute libraries were

50 Quoted in Kitteringham, op. cit. (45), 329.
51 'The collection of a library at little cost is generally a task of greater difficulty than that of procuring a suitable building.' [B. F. Duppa], A Manual for Mechanics' Institutes, London, 1839, 102.
52 M. Tylecote, op. cit. (41), 73.
frequently the grounds for disagreements over educational philosophy. Familiarity with the local institutional politics is essential therefore in order to understand library practice, a fact which makes generalization about holdings difficult. Often, too, the libraries were dominated by books which had been donated, and were not chosen by either educationalists or members. As one Broughamite commentator complained, many of the libraries were miscellaneous rather than scientific, because patrons 'made presents of duplicates and of such books as they did not want'; and he argued that the 'varied and unconnected character' of libraries would discourage rational patterns of study.

Because the actual practice of libraries was partly determined by many local idiosyncrasies, it is particularly interesting to discover the practice advocated by the SDUK. In 1839 the Society published a *Manual for Mechanics' Institutes*, written by a London barrister, Baldwin Francis Duppa, which gave detailed advice about their foundation and management. One of the appendices to the *Manual* is a subject catalogue of about 500 books which were considered desirable for inclusion in institute libraries. Among the recommended books were the *Bridgewater Treatises* of Whewell, Bell, Roget and Buckland. The only other works of natural theology suggested by the Society, however, were Joseph Butler's *Analogy of Religion* (1736), and Henry Brougham and Charles Bell's five-volume edition of Paley's *Natural Theology* (1835–39). Considering the importance of the argument from design in the rhetoric of Brougham and his associates, the occurrence of only six works of formal natural theology in the SDUK list tends to confirm that the Society was by this time increasingly shying away from its earlier commitment, in the manner suggested by Barnes and Shapin. The book-list had, of course, no section for religious or theological books, but the works of Butler and Paley were classified under the studiously neutral heading 'Moral and Political Philosophy - Metaphysics - Law'. By contrast, the four *Bridgewater Treatises* were classified under the several sciences which they represented, confirming their status as scientific rather than 'metaphysical' texts.

While the SDUK saw itself as the patron of the mechanics' institute movement, the individual institutes were often, as we have stressed, very idiosyncratic. However, Brougham and the Society's secretary, Thomas Coates, claimed with respect to the Society's book-list that 'constant applications are made to us for such lists', and it seems

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53 In view of the central role which the libraries played in the life of mechanics' institutes, it is surprising to find so little written on their history. Some details are given in Tylecote, op. cit. (41), and in the various localized studies which exist. There is yet to appear a detailed comparative study of mechanics' institutes libraries which discusses the authors and titles of the books which were prevalent in them. D. A. Hinton makes some important comparisons between a number of mechanics' institute libraries at different periods, but this is restricted to a comparison of subjects rather than individual books. Hinton, op. cit. (12), ch. 7.

54 In most mechanics' institutes new books were selected by a library committee. Members were normally able to make suggestions for purchases in a book kept in the library, but library committees were not bound by such suggestions. Even books donated to the institute might be rejected as unsuitable, although this was probably a rare occurrence.

55 Duppa, op. cit. (51), 50, 51. See also George Dawson's evidence in the *Report of the Select Committee on Public Libraries*, 1849, Q.1214.

56 The book-list was compiled by George Long (1800–79) and Thomas Falconer (1805–82). M. C. Grobel, op. cit. (14), Bibliography. George Long also edited the Society's *Quarterly Journal of Education* (1831–35), in which, rather surprisingly, the *Bridgewater Treatises* were not reviewed.
Table 1. *The Bridgewater Treatises in mechanics' institutes*

<table>
<thead>
<tr>
<th>Location of mechanics' institute</th>
<th>Date of foundation</th>
<th>No. of members (1841)</th>
<th>No. of volumes (1841)</th>
<th>No. of members (1849)</th>
<th>No. of volumes (1849)</th>
<th>Bridgewater Treatises</th>
<th>Date of catalogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ashton-under-Lyne</td>
<td>1825</td>
<td>191</td>
<td>764</td>
<td>150</td>
<td>1420</td>
<td>0</td>
<td>1849</td>
</tr>
<tr>
<td>Bradford</td>
<td>1832</td>
<td>483</td>
<td>2630</td>
<td>180</td>
<td>—</td>
<td>7</td>
<td>1836</td>
</tr>
<tr>
<td>Burnley</td>
<td>1834</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>349</td>
<td>2300</td>
<td>1844</td>
</tr>
<tr>
<td>Bury</td>
<td>1837</td>
<td>128</td>
<td>713</td>
<td>232</td>
<td>1000</td>
<td>1</td>
<td>1844</td>
</tr>
<tr>
<td>Glasgow</td>
<td>1823</td>
<td>572</td>
<td>—</td>
<td>—</td>
<td>8</td>
<td>—</td>
<td>1848</td>
</tr>
<tr>
<td>Keighley</td>
<td>1825</td>
<td>100</td>
<td>1022</td>
<td>—</td>
<td>1537</td>
<td>4</td>
<td>1846</td>
</tr>
<tr>
<td>Lancaster</td>
<td>1824</td>
<td>193</td>
<td>1697</td>
<td>145</td>
<td>2000</td>
<td>2</td>
<td>1841</td>
</tr>
<tr>
<td>Leeds</td>
<td>1824</td>
<td>268</td>
<td>1356</td>
<td>1700</td>
<td>6300</td>
<td>8</td>
<td>1847</td>
</tr>
<tr>
<td>Liverpool</td>
<td>1825</td>
<td>3460</td>
<td>6000</td>
<td>3123</td>
<td>14160</td>
<td>2</td>
<td>1840</td>
</tr>
<tr>
<td>London</td>
<td>1823</td>
<td>1144</td>
<td>7000</td>
<td>704</td>
<td>7000</td>
<td>6</td>
<td>1837</td>
</tr>
<tr>
<td>Manchester</td>
<td>1824</td>
<td>—</td>
<td>—</td>
<td>2300</td>
<td>12500</td>
<td>8</td>
<td>1834, 1849</td>
</tr>
<tr>
<td>Miles Platting</td>
<td>1836</td>
<td>—</td>
<td>623&lt;sup&gt;a&lt;/sup&gt;</td>
<td>147</td>
<td>1500</td>
<td>8</td>
<td>1841</td>
</tr>
<tr>
<td>Nottingham</td>
<td>1837</td>
<td>—</td>
<td>—</td>
<td>904</td>
<td>4500</td>
<td>8</td>
<td>1845</td>
</tr>
<tr>
<td>Preston</td>
<td>1828</td>
<td>456</td>
<td>2875</td>
<td>620</td>
<td>3800</td>
<td>8</td>
<td>1868</td>
</tr>
<tr>
<td>Warrington</td>
<td>1825</td>
<td>—</td>
<td>2458&lt;sup&gt;a&lt;/sup&gt;</td>
<td>431</td>
<td>2700</td>
<td>0</td>
<td>1841</td>
</tr>
</tbody>
</table>


<sup>a</sup> No. of books in 1841 catalogue.

<sup>b</sup> Before publication of Buckland's *Treatise*.

likely that many institutes paid some attention to their patron Society's advice.<sup>57</sup> As Table 1 shows, the *Bridgewater Treatises* were widely prevalent in mechanics' institutes libraries, a situation which contrasts sharply with an almost complete absence of the series from working-class libraries established by churches and chapels.<sup>58</sup> While it is generally impossible to identify the origins of the books in institute libraries,<sup>59</sup> it is clear from their high prices that the *Treatises* could not have been acquired casually. The *Manual for Mechanics' Institutes* warned librarians that ‘few are the new books of value which are

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<sup>57</sup> Duppa, op. cit. (51), p. vi. There is some discussion concerning the importance of the SDUK recommendations in Hinton, op. cit. (12), especially 223, 236–7, 263. Hinton is sceptical of the extent to which the *Manual* affected book selections, but there is little direct evidence either way.

<sup>58</sup> The main Quaker, Baptist, Congregational and Unitarian chapel libraries in Leeds possessed none of the *Bridgewater Treatises*, and all reports suggest that that was also the case at the Church of England Central Library. Topham, op. cit. (2), ch. 5.

<sup>59</sup> Only a minority of the library catalogues provide such information, and even the minute-books do not usually reveal the sources of books. Evidence exists for only two of the institutes in Table 1. At Bradford Mechanics' Institution the *Treatises* were purchased by the library, while the Glasgow Mechanics' Institution received its copies as gifts. Thomas Chalmers presented the Glasgow Institute with a copy of his own *Treatise*, and the remaining *Treatises* were given by a certain Hugh Cogan.
immediately necessary!" and the *Bridgewater Treatises* must obviously have been carefully selected either by library committees or by patrons.

The secular policy of the SDUK contrasts with the varied practice of the mechanics' institutes. Many institute libraries possessed works of natural theology in which the scientific content was subservient to the theological argument and was consequently unsystematic. A large number of the eighteenth-century classics of natural theology appeared in the libraries, although with the exception of Butler's *Analogy* they were in old editions, and were probably gifts. However, the institutes also possessed a good selection of those contemporary works of natural theology in which apologetic or devotional functions predominated over more systematically scientific ones. Usually such books were catalogued under the heading 'Theology' (or 'Metaphysics and Morals'), but the institute librarians agreed with the SDUK *Manual* that the *Bridgewater Treatises* should appear under the several sciences which they represented. Furthermore, in most libraries some indication was given that the individual *Treatises* were interconnected, almost in the manner of an encyclopaedia. The catalogue of the Nottingham Mechanics' Institute, identified each *Bridgewater Treatise* with the letters 'B.W.T.' in a manner identical to that in which each volume in the *Library of Useful Knowledge* was designated 'L.U.K.'. Each *Treatise* was evidently to be considered as part of an educational series, bearing a strong analogy to the cheap educational 'libraries' of the age. The compilers of the catalogues perhaps heeded B. F. Duppa's plea in the SDUK *Manual*, to aid the uninformed reader who 'is at a loss how to carry on his studies in a connected chain'. By reading the *Bridgewater Treatises* such a reader could, the catalogues suggested, make a systematic tour round the circle of the sciences.

If many of the mechanics' institute libraries purchased the *Bridgewater Treatises* because they provided an acceptable encyclopaedia of current science, rather than for apologetic purposes, we might still expect to find them in libraries which were not so much patronized by middle-class Broughamites. From the figures in Tables 1 and 2, no clear correlation

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60 [B. F. Duppa], op. cit. (51), 53.

61 William Derham's *Physico-theology* (1713) and *Astro-theology* (1715) appeared quite regularly. John Ray's *Wisdom of God in the Works of the Creation* (1690), Samuel Clarke's *Demonstration of the Being and Attributes of God* (1705), and William Wollaston's *Religion of Nature Delineated* (1724) were less often present.

62 Especially common were James Hervey's *Meditations and Contemplations* (1746–47), Christopher Sturm's *Reflections on the Works of God* (1772), and Henry Duncan's *Sacred Philosophy of the Seasons* (1836–37). Of nineteenth-century natural theology, Paley's (1802) was almost universal; John Bird Sumner's *Treatise on the Records of Creation* (1816) was popular, as were Chalmers' *Astronomical Discourses* (1817) and Thomas Dick's several works. Although not as widespread as the *Bridgewater Treatises*, Brougham and Bell's *Paley's Natural Theology Illustrated* (1835–39) was very prevalent. The works of scriptural geologists, such as George Fairholme, William Higgins, and John Pye Smith, appeared in several institutes. William Scott's *Harmony of Phrenology with Scripture* (1836) and John Epps' *Evidence of Christianity Deduced from Phrenology* (1828) both occasionally appeared on the shelves.

63 Chalmers' *Treatise* was catalogued variously under 'Metaphysics', 'Theology', or 'Moral Philosophy'. Only one of the libraries in this study catalogued the *Treatises* solely as 'Theology', although others catalogued some or all of the *Treatises* under 'Theology' in addition to their respective sciences.

64 The other series which appeared in the Nottingham abbreviation list included *Lardner's Cabinet Cyclopaedia*, the SDUK's *Library of Entertaining Knowledge*, John Murray's *Family Library*, and Sir William Jardine's *Naturalist Library*.

65 [B. F. Duppa] op. cit. (51), 49.
emerges between the social alignment of a mechanics' institute and the presence of the *Treatises* in its library. For instance, the institute in Burnley was essentially working class, originating 'in the activities of "a few poor men" who wished to establish a library on a self-help basis'; 66 and at Keighley the institute was founded for mutual improvement by four working-men who continued to dominate the institute; 67 yet both Burnley and Keighley possessed more of the *Bridgewater Treatises* than the similarly sized, but frankly paternalistic, institute at Lancaster. This may be attributable to the fact that even the most proletarian institutes had to show caution in order to gain necessary middle-class patronage. Religious or political discussion at Keighley was a finable offence, 68 and in 1834 the committee announced to the members:

As the library will always be considered the basis and stamina of the Institution, and the best means of refuting the falsehoods that have been...circulated against your Society – namely, that of propagating irreligion and sedition, your Committee would recommend that great care be exercised in the proper choice of books, and...the Committee ought never to lose sight of the solid and useful information contained in our great standard works. 69

Even the few secular working-class libraries which existed outside the mechanics' institute movement appreciated the need for such caution, 70 and in this context the *Bridgewater Treatises* were an appropriate means of indicating the library's wholesomeness.

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66 Tylecote, op. cit. (41), 60. See also Watson, op. cit. (46), passim.
67 Tylecote, op. cit. (41), 224–40 passim. See also W. Keighley, *Keighley, Past and Present; or, an Historical, Topographical, and Statistical Sketch of the Town, Parish and Environs of Keighley*, Keighley, 1879, 204–14.
70 While the Mechanics' and Apprentices' Libraries at Sheffield and Edinburgh were run democratically by working-men, they relied heavily on middle-class support, and at Sheffield books 'containing principles subversive of the Christian religion' were excluded. At the village library in Dukinfield four-fifths of the committee were working-men, but books of controversial divinity were none the less banned. Some radical workers criticized this kind of caution and sought greater independence. The most notable instance of a genuinely working-class mechanics' institute is the Manchester New Mechanics' Institute, founded in 1829 by disgruntled working-class members of the grossly paternalistic Manchester Mechanics' Institution. The institute folded in 1833, and there is unfortunately no extant library catalogue. See R. G. Kirby, 'An early experiment in workers' self education: the Manchester New Mechanics' Institute, 1829–35', in *From Artisan to Graduate: Essays to Commemorate the Foundation in 1824 of the Manchester Mechanics' Institute* (ed. D. S. L. Cardwell), Manchester, 1974, 87–98. For an account of radical working-class reactions to the science of the Broughamites, see Topham, op. cit. (2), ch. 7.
to prospective patrons.\footnote{46} At the same time, however, it appears that the *Bridgewater Treatises* had other attractions even for the more independent working-class libraries. Some indication of the opinions of more proletarian educationalists is given by the *Mechanics' Magazine* (1823–72), which was begun jointly by the patent agent Joseph Clinton Robertson (1788–1852) and the radical political writer Thomas Hodgskin. This important magazine advocated the formation of truly popular mechanics’ institutions, under proletarian management. The picture which emerges of the *Bridgewater Treatises* from this perspective is somewhat mixed. The magazine lavished scorn on the management of the bequest, and it implied nepotism from the circumstance that the Archbishop of Canterbury and Bishop of London had been involved with the selection of authors, four of whom were ‘gentlemen of the clerical profession’\footnote{47}. Charles Bell’s *Treatise* was the only one of the series reviewed, on the grounds that its subject was the most germane, and although it was condemned for being ‘deficient in arrangement’, it was also reported to bring together ‘a vast multitude of facts, of the most curious and important character’.\footnote{48} Thus, even the more proletarian educationalists gave the *Bridgewater Treatises* serious consideration as a resource in scientific education.

The classes and lectures held at mechanics’ institutes, like the libraries, have yet to receive anything like systematic treatment by historians.\footnote{49} Once again, however, the *Manual for Mechanics’ Institutes* sheds an interesting light on the question. One of the appendices to the *Manual* gave lecture outlines to assist those who sought to compensate for the dearth of scientific lecturers. The author of six outline lectures on mechanics referred the aspiring lecturer to Whewell’s, Bell’s and Prout’s *Bridgewater Treatises*.\footnote{50} Moreover, there is evidence that lecturers did actually use the *Treatises* in this way. Nicolaas Rupke cites the example of Dr Lloyd – probably Dr Thomas Lloyd (1802–49) of Ludlow, friend of Buckland and contributor to Roderick Murchison’s *Silurian System* – who discussed Buckland’s *Bridgewater Treatise* at length in the series of six lectures he gave before Leamington Mechanics’ Institute in 1837.\footnote{51} Similarly, David Mackintosh (1815–91), one of the best-known itinerant science lecturers of the period,\footnote{52} published in 1843 a book

\footnote{46} Considering that the purchase of Roget’s *Treatise* represented 7 per cent of the Dukinfield Village Library’s annual book budget in 1835, it was obviously very desirable. One of the patrons boasted of the books in the library that ‘they are almost all modern, containing the latest information; they are all excellent authors, and have the advantage of being chosen with an express reference to the wishes and wants of the working man’. Duppa, op. cit. (51), 63.


\footnote{48} Ibid., 379.

\footnote{49} Information about lectures appears in T. Coates, *Report of the State of Literary, Scientific and Mechanical Institutions*, London, 1841, 58–61, 106–12; in Tylecote, op. cit. (41); and in several localized studies. Attempts to generalize have been made by Hinton, op. cit. (12), 138–66; and Kitteringham, op. cit. (45), 313–46.

\footnote{50} Duppa, op. cit. (51), 237.


with the extraordinary title: *Supplement to the Bridgewater Treatises: The Highest Generalizations in Geology and Astronomy, Viewed as Illustrating the Greatness of the Creator; Being a Collection of Fragments from the Lectures Delivered by D. Mackintosh, in a Series of Orations*. Apologizing for trespassing on the ground assigned to Whewell and Buckland "in their invaluable treatises", Mackintosh hoped that his production would lead the reader "to return with a more excited interest to the works of these eminent philosophers".78

Further direct evidence of the use of the *Bridgewater Treatises* in mechanics' lectures comes from George Birkbeck, to whom William Whewell had sent a copy of his *Bridgewater Treatise* intended for the London Mechanics' Institute. Birkbeck ingratiatingly told Whewell that:

> On the evening in which it was deposited there I had occasion to notice in a lecture the subject of vapour and its relation to the atmosphere; and upon adverting to your striking expression that in reference to the surface of the earth the atmosphere might be considered a mighty 'watering machine', I seized the opportunity of paying a public tribute to the ingenuity and information which you have brought to bear upon the great questions you have discussed; and strongly recommending to every individual the sober and diligent perusal of your most instructive and powerful treatise.79

Even allowing for Birkbeck's courtesies, it is likely that the *Bridgewater Treatises* were frequently the textbooks to which lecturers directed their pupils for further study. They were probably also used in some of the classes, especially since these were often run in tandem with lecture-courses.

**The Library of Useful Knowledge (1827–46)**

The SDUK came into existence at a watershed in the history of printing technology — just as the new steam presses made possible the publication of books at unprecedented prices — and it was active in pioneering various new cheap publication media in an attempt to further its programme of popular scientific education. The Society's first publishing project, the *Library of Useful Knowledge* (LUK), was one of the earliest truly popular ventures in scientific educational publishing, and it has received considerable attention from historians.80 Each fortnightly number of the *LUK* consisted of thirty-two pages of woodcuts and closely-printed type in double-columns, with narrow margins and on cheap paper. By these expedients the equivalent of one hundred octavo pages of standard type could be sold for as little as 6d. The treatises dealt with serious subjects — mainly the sciences, history and biography — and were generally written by very capable and original authors. Although the early numbers were spectacularly successful, however, sales fell

79 Birkbeck to Whewell, 16 April 1833, Trinity College, Cambridge, Add. Ms. a.201 31.
Jonathan Topham

rapidly away\(^{81}\) and the \textit{LUK}, in common with the Society's other publications, sold more copies among the \textit{petit bourgeoisie} than among its intended working-class audience.\(^{82}\)

The Society promised in its prospectus that no treatise would 'contain any matter of controversial Divinity, or interfere with the principles of revealed religion'.\(^{83}\) However, Brougham wrote to Lord Althorp that 'all our scientific lectures are in fact to be largely mixed up with the sublime truths of natural theology without which science cannot be well, any more than fairly taught'.\(^{84}\) When Charles Knight edited the three entomological volumes written by the naturalist James Rennie (1787–1867) for the \textit{Library of Entertaining Knowledge} (1829–38), he confessedly 'laboured hard...to trace those evidences of Design, which lift the mind...to the constant feeling of the Living Principle of all things'.\(^{85}\) We have seen above that in later years the SDUK shied away from explicit natural theology, but in the early years of the \textit{LUK} the Society deliberately encouraged the inclusion of design arguments in its treatises. Since the \textit{LUK} was the Society's first publication it seems likely that the strategy of excluding natural theology was only adopted, as Barnes and Shapin suggest, as a consequence of its rejection by an ideologically discriminating working-class audience.

As has been noted, two of the Bridgewater authors, Peter Mark Roget and Sir Charles Bell, wrote treatises for the \textit{LUK}. Roget's popular treatises dealt with \textit{Electricity} (1827), \textit{Galvanism} (1829), and \textit{Magnetism and Electromagnetism} (1831); subjects very different from those covered in his \textit{Bridgewater Treatise}. These productions were highly praised, and sold many thousands of copies.\(^{86}\) In this account, however, attention is focused on Charles Bell's \textit{Animal Mechanics, or, Proofs of Design in the Animal Frame} (1827–29).\(^{87}\) Bell's treatise is so closely related in subject and argument to his later contribution to the Bridgewater series — though it was written in a popularist form, and cost just over one-twentieth of the price — that it might almost be called a working-man's \textit{Bridgewater}

\(^{81}\) The first number, Brougham's \textit{Objects, Advantages, and Pleasures of Science} (1827), had sold 42,000 copies by December 1833. By 1835 each number was selling only about 4000 copies. See Smith, op. cit. (80), 29; and Webb, op. cit. (80), 70.

\(^{82}\) R. K. Webb's conclusion is that 'sales [of the Society's publications] among the working classes were very small and proportionately of no importance at all', but that 'some of the little treatises on science were adequate and probably instructed a fair number of people especially interested'. Webb, op. cit. (80), 72.


\(^{84}\) Quoted in Kitteringham, op. cit. (45), 60.

\(^{85}\) Knight, op. cit. (14), ii, 152.

\(^{86}\) On Roget's treatises see Grobel, op. cit. (14), 168–70, 681–3. The referees were much pleased with all Roget's treatises. See SDUK papers, University College, London. The two \textit{Electricity} numbers each sold 25,000 copies by 1833; \textit{Galvanism} sold 20,000 copies by the same date. The individual scientific numbers of the \textit{LUK} were later republished as \textit{Natural Philosophy}, 4 vols., London, 1829–38; Roget's treatises appeared in volume 2, Bell's in volume 4.

\(^{87}\) See Grobel, op. cit. (14), 174–6. The Society considered asking Bell to undertake the cheap publication of anatomical plates for use by medical students, but although he drew up a plan, and organized the engraving of several specimen plates, the Committee abandoned the scheme. See Grobel, op. cit. (14), 235–6; Bell to Coates, 28 December 1832; 'Anatomical Plates — Charles Bell's Report', November 1832, University College London, SDUK Papers 29; Bell to Coates, 1 February, 8 March, 18 May, 24 August, 10 December 1833, University College London, SDUK Papers 30 (References hereinafter given in the form UCL, SDUK 30). Bell also prepared a life of John Hunter for the Society, which was apparently never published. Bell to Coates, [December 1832], UCL, SDUK 29; Bell to Coates, 7 January, 10 July 1833, UCL, SDUK 30.
Treatise. The continuity between the two projects is something which Bell acknowledged in the preface to the latter work, describing how 'from at first maintaining that design and benevolence were every where visible in the natural world, circumstances have gradually drawn the author to support these opinions more ostentatiously and elaborately than was his original wish'.

Bell wrote his two-part LUK treatise at Brougham's suggestion, and it earned him high praise from many quarters. On the publication of the first part, Brougham wrote to him from Lancaster: 'I cannot refrain from telling you the prodigious success your admirable treatise has among us on this circuit – judges, lawyers, wranglers, metaphysicians, and theologians, men who are devoid of science, saint, savage, and sage, all unite in its praise, and in gratitude to you.' The future Lord Chancellor also wrote for the Edinburgh Review a laudatory (not to say puffing) review of the treatise; and when he later sought Bell's assistance in editing Paley's Natural Theology Illustrated (1835–39) he reported that the 'admirable treatise on Animal Mechanics [had] pointed him out as the fellow-labourer I should most desire'. Charles Knight, too, was effusive about Bell's LUK treatise: 'No higher service could have been rendered to the association in its early stages than Mr Bell's contribution to its treatises. His Animal Mechanics is a model of popular writing upon subjects which demand high scientific knowledge.' This opinion was apparently shared by readers of the LUK, since Bell's treatise sold better than previous numbers. Compared with the earlier treatises, Animal Mechanics was remarkably lucid, partly because it was the first of the treatises to deal with the less abstruse biological sciences. The treatise met with approval from Brougham and Knight because it satisfied the main Broughamite criteria: it evinced 'an extraordinary union of profound anatomical and physiological knowledge, with the power of striking illustration, and plain, perspicuous writing'; it possessed 'very great originality', was 'profoundly scientific, and yet perfectly popular; any attentive reader may follow, and comprehend, and remember its contents'. Moreover, it is evident that Bell's treatise was also valued, at this early stage in the SDUK's development, for its design arguments. Brougham was particularly delighted that the author had 'lent a much more scientific aspect to the doctrines of Natural Theology, than they before had possessed'. In so doing, Bell had conferred greater objectivity on the argument from design:

The treatise before us is not the work of a declamatory moralist, or a sentimental enthusiast, or a narrow-minded bigot; but of a man of profound science, who does homage to the truths of

89 Brougham to Bell, n.d. 1827, Bell, op. cit. (10), 295.
90 Brougham, op. cit. (43), 2. See also Bell, op. cit. (88), p. x.
91 Knight, op. cit. (14), ii, 123.
92 When the first part of Bell's treatise was published in August 1827, the LUK's sales were already falling. However, by December 1829 the first part of Bell's treatise had sold 25,025 copies, while the previous number in the Library (Mechanics, Part II: The Elements of Machinery) had sold only 22,350 copies. By 1833 the first part of Animal Mechanics had sold 30,000 and the second part 20,000 copies. See Grobel, op. cit. (14), 681–3; Webb, op. cit. (80), 70.
94 Ibid., 519.
religion, because they cross the path of his philosophic inquiries; who bears the testimony of facts to the doctrines of a sublime theology, which those facts inculcate, along with the other lessons he had gone in quest of.95

Independently of its design arguments, however, it is apparent that the Society valued the safety of Bell’s scientific exposition; a distinction which became progressively clearer as explicit references to design were excluded from the Society’s publications. A tight editorial rein was kept on all the works published by the SDUK—with expert referees appointed to vet all manuscripts submitted to the Society—so that the publications provide an ideal opportunity to assess the features which characterized safe science in the Broughamite context. Some of the salient characteristics are nicely illustrated by the contrast between Charles Bell’s *Animal Mechanics* and the LUK treatise on *Animal Physiology*. This contrast highlights not only the imperative which existed in the SDUK for the production of safe science, but also the internal divisions concerning the precise nature of such science. The treatise on *Animal Physiology* was originally assigned in 1826 to Roget, who had written a lengthy article on physiology for the *Supplement to the Encyclopaedia Britannica* (1816–24), and who later wrote his *Bridgewater Treatise* on the same subject. When, however, nearly three years later, the Unitarian minister and Edinburgh MD, Thomas Southwood Smith (1788–1861), volunteered to write a treatise on the subject, the Society had accepted his offer before anyone recalled Roget’s earlier appointment.96 Roget graciously stood down,97 but a more serious problem emerged when Southwood Smith’s proofs came under the eyes of the Committee’s referee, Charles Bell. Southwood Smith was on the Benthamite wing of the SDUK; a member of the coterie which founded the *Westminster Review*, made notorious by his public dissection of Bentham’s body in 1832. Bell, who was a leading light in the opposing moderate camp on the SDUK Committee, wrote to Thomas Coates, the Society’s secretary, declaring

I object to the opinion expressed in the first page. I do not think that the Society should identify itself with these opinions about life. Life *is nothing but organization in action* (§iv of p. i) you ought to know is an opinion highly objected to by many good men, and is certainly incorrect. This is the line of argument which Mr. Lawrence followed, borrowing from the French, and is objected to by the physiologists of this country.

There appears to me no call upon the Society to propagate these opinions. Were they correct I would disregard the consequences but they are incorrect and offensive to many.98

Bell’s reference here to the notoriously materialist surgeon, Sir William Lawrence (1783–1867), is of particular significance in understanding why Southwood Smith’s science was dangerous for the moderates. Although Lawrence suppressed his *Lectures upon Physiology, Zoology, and the Natural History of Man* (1819) because their materialist sentiments had brought down on him the wrath of the medical establishment, they were cheaply reprinted by a number of radical publishers, and reached a large working-class

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95 Ibid., 521.
96 Roget to Coates, 10 January 1829, UCL, SDUK 25; Southwood Smith to Coates, 6 February 1829; Southwood Smith to Matthew Davenport Hill, 12 February 1829, UCL, SDUK 26; Coates to Roget, 6 June 1829, UCL, SDUK 18, fols. 147–8. See Grobel, op. cit. (14), 176–80; and Desmond (1989), op. cit. (40), 118.
97 Roget to Coates, 8 June 1829, UCL, SDUK 26.
98 Bell to Coates, 2 September 1829, UCL, SDUK 26.
readership. Richard Carlile (1790–1843), the most notorious working-class atheist of the 1820s, was one of the publishers who reprinted the volume, and Lawrence's Lectures had thus become incorporated into the ideology of freethinking and republican demagogues. In this way Southwood Smith's science possessed unequivocally dangerous social, political and religious connotations. Bell's letter consequently set alarm bells ringing in the SDUK Committee room, and in a carefully worded and diplomatic letter, Thomas Coates told Southwood Smith that they were desirous of some modifications in the offending passages.

These passages when attentively read contain no meaning to which most persons would not willingly subscribe, but they are so expressed as to afford an easy handle to those who have long been watchful for an opportunity of imputing to the Society a design to subvert religion. I believe indeed that an eminent teacher in London derives much of his notoriety from having promulgated, somewhat indiscreetly, similar doctrines.

Southwood Smith was politely requested to modify the passages 'in such a way as to protect the Society from all risk of controversy [sic] which would undermine the confidence of the public and materially impair our means of doing good'. Coates received an equally polite reply from the author who expressed himself 'not only desirous but anxious to obviate all possibility of misconstruction', and who considered that his 'guarded expressions' and 'studied correctness and precision of language' had secured that object. In order to remove 'all possibility of misunderstanding' he suggested the inclusion of a note which distinguished two senses of the word 'life': a physiologist's definition, referring solely to 'certain phenomena discernible by the senses, without reference to the causes of the phenomena'; and a layperson's definition, referring to 'the supposed cause of life as a principle single, undivided, and distinct from organisation'. The tone of the note suggested, however, that the existence of a vital principle was at least doubtful; and Southwood Smith argued that the future existence of the soul should not be made to depend on the supposed existence of such a principle. The Committee was dissatisfied with this note, which was consequently omitted, and the offending fourth paragraph was amended to read:

As far as can be determined by observation, organization has an inseparable relation to life, and life to organization. We see life only in organized bodies: we see organization only in living beings. That peculiar series of phenomena which is exhibited by organization when in action, that is, by living beings, constitutes the subject of Physiology.

This incident clearly illustrates not only the kind of dangerous scientific doctrines which the moderates in the SDUK were anxious to exclude from the Society's publications, but also Charles Bell's role as a guardian of safe science. Furthermore, it raises an issue to

99 On the dangerous science of William Lawrence see L. S. Jacyna, 'Immanence or transcendence: theories of life and organization in Britain, 1790–1835', Isis (1983), 74, 311–29; and Desmond, Politics, op. cit. (40).
101 Coates to Southwood Smith, 11 September 1829, UCL, SDUK 18, fols. 175–6.
102 Southwood Smith to Coates, 29 September 1829, UCL, SDUK 26.
which this paper cannot do full justice: namely, the ideological diversity of the SDUK, and of Broughamites generally.\textsuperscript{104} The above example suggests, however, that the Benthamite wing of the Society was to a considerable extent marginalized by a more moderate political consensus.

The safety of Bell's \textit{Animal Mechanics} can now be clearly seen. The treatise was, like Bell's \textit{Bridgewater Treatise on The Hand: Its Mechanism and Vital Endowments as Evincing Design}, constructed around a mechanical–vital dichotomy. While the first part of the \textit{LUK} treatise (published August 1827) dealt with mechanism and functionalist anatomy, the second part (published in February 1829) was concerned with 'showing the application of living forces'.\textsuperscript{105} In contrast to the strictly mechanical natural theology of Paley, Bell considered vital phenomena to form the more important branch of the subject.\textsuperscript{106} Indeed, he found Paley's mechanistic natural theology too close for comfort to the radical materialism of the 1810s and 1820s. Thus he wrote:

\begin{quote}
When we have admired the connections of the several parts, or organs, thus made manifest by comparison with machinery, we may go too far, and say, that the material structure and mechanical relation are to be found in still greater minuteness and perfection in the finer textures of the body, proceed to call this organization, and erroneously conclude, that out of organization comes Life.\textsuperscript{107}
\end{quote}

This passage stands in direct contradiction of those sections in \textit{Animal Physiology} to which Bell strongly objected, and it provides a good example of what the moderates considered to be safe science. Quite independently of his references to design, Bell's science was clearly opposed to that of more radical anatomists like William Lawrence. Attempting to counteract such influences, Bell assured his readers that 'the highest medical authorities have seen reason to conclude that life is an endowment, not resulting from organization or construction, but, on the contrary producing it'.\textsuperscript{108} In so doing, he indirectly opposed the dangerous ideology associated with Lawrence's materialist science. This point is nicely illustrated by the fact that a copy of the first part of Bell's \textit{Animal Mechanics} was presented to the arch-infidel, Richard Carlile, by a Scotsman who thought its argument unanswerable, and who considered it a direct challenge to Carlile's atheist materialism. Carlile made a lengthy extract from the treatise in his weekly freethought journal, the \textit{Lion} (1828–29), as the basis for an attack on Bell's theistic beliefs and on the ideology of the SDUK.\textsuperscript{109} Thus, it is quite clear that Bell's science, once shorn of explicit references to design in the manner later expected by the SDUK, was still constructed in such a way as to oppose the radical...

\textsuperscript{104} Adrian Desmond argues from this incident that 'the entire Broughamite educational empire suffered from a radical–Whig ideological split, with the radicals arguing for a more materialist self-determining nature, and the Paleyites promoting a delegated divine power of arrangement'. A. Desmond, 'Lamarkism and democracy: corporations, corruption and comparative anatomy in the 1830s', in \textit{History, Humanity and Evolution: Essays for John C. Greene} (ed. J. R. Moore), Cambridge, 1989, 99–130 (118).

\textsuperscript{105} [C. Bell], \textit{Animal Mechanics}, London, 1827–29, 33.

\textsuperscript{106} 'We have taken mechanics in their application to mechanical structure in the living body, because they give obvious proofs of design, and in a manner that admits of no cavil. Yet, although those proofs are very clear in themselves, they are not so well calculated to warm and exalt our sentiments, as these which we have now to offer, in taking a wider view of the animal economy.' Ibid.

\textsuperscript{107} Ibid., 45.

\textsuperscript{108} Ibid.

\textsuperscript{109} [R. Carlile], 'Design: is there any, beyond the animal or moral world?' \textit{Lion} (1829), 3, 281–4.
scientific, social and religious doctrines of the working-class demagogues who were the moderates' greatest bêtes noires. This was one important reason why the SDUK found the science of the Bridgewater Treatises an attractive resource, even though the argument from design had ceased to be a positive element in the Society's strategy.

The Penny Magazine (1832–45) and the Penny Cyclopaedia (1833–46)

From the early 1820s mass-circulation periodicals played an increasingly important role in the popular educational programmes of most paternalist groups, although once again most ventures appealed more to the middle than to the working classes.110 The Penny Magazine of the SDUK, although not quite the first in the field, became the type which a host of other 'useful knowledge' miscellanies attempted to imitate.111 At the height of the Reform crisis in 1832, the SDUK was seeking new strategies to divert the attention of working-class readers from revolutionary radical prints to more 'rational' pursuits. The Penny Magazine was designed as a means of swamping out the 'blasphemous and seditious press' with more wholesome material, and the same themes prevail in this medium as in the other educational media employed by the Society. In contrast to the LUK, however, the design content of the magazine was extremely limited, and it was consequently widely criticized by religious observers as being 'atheist'.112 Not only were there no religious articles, but the natural history articles were almost entirely devoid of references to design. Only six extracts from the Bridgewater Treatises appeared in the Penny Magazine, but they were almost the only passages from works of natural theology to be published in the journal.113 Several of the extracts were incorporated into original scientific articles, in keeping with the high standards of originality which the Penny Magazine maintained. Forming a modern encyclopaedia of safe science, the Treatises were well suited to the magazine's style, and their design content was thus sufficiently masked as to be acceptable. This appears also to have applied in the case of a number of commercial 'useful knowledge' miscellanies, in which extracts from the Treatises were presented as straightforward scientific exposition.114

110 'It was said in 1830 that a middle-class household with an income of £200–£300 p.a. could not afford a taxed daily paper at 7d. per issue, and it was evidently to such people that the penny magazines mainly appealed.' R. Williams, The Long Revolution, London, 1961, 190.


112 'Lord Brougham on Natural Theology', Eclectic Review (1835), ii, 14, 165–85 (185n); Knight, op. cit. (14), ii, 192; W. D. Washington, op. cit. (111), 181ff.

113 There were also a couple of extracts from Brougham and Bell's Paley's Natural Theology Illustrated.

114 The Bridgewater Treatises were often used as a scientific resource in Chambers's Edinburgh Journal (1832–1956), and extracts were on several occasions incorporated into the original scientific articles written by Robert Chambers. See J. A. Secord, 'Behind the veil: Robert Chambers and Vestiges', in History, Humanity and Evolution: Essays for John C. Greene (ed. J. R. Moore), Cambridge, 1990, 165–94. The Treatises also provided scientific articles for the Mirror of Literature (1822–47) and Holt's Magazine: A Journal of Literature, Science and Education (1836–37).
Further confirmation is provided by the SDUK's authoritative and original reference work, the *Penny Cyclopaedia* (1833–46), which in weekly numbers ultimately filled twenty-nine volumes. Edited by George Long, one of the compilers of the book-list in the SDUK *Manual*, the *Cyclopaedia* manifested that aversion to the design idiom which was typical of the Society's later publications. There were, however, a number of references to and extracts from the *Bridgewater Treatises*. Such extracts eschewed theological references, and related entirely to the scientific exposition of the *Treatise* in question.\(^\text{115}\)

Although Broughamite educationalists held diverse views on natural theology – views which underwent development during this period – there is much to suggest, in conclusion, that they did not value the *Bridgewater Treatises* for their apologetic functions, or even, strictly speaking, for their theologies of nature. Indeed, these *Treatises* were apparently regarded as almost the only natural theological books with sufficient scientific credibility not to tarnish the apparent objectivity of the mechanics' institutes or the *Penny Magazine*. They provided a working epitome of contemporary science, uncorrupted by radical ideas, and set out in a relatively systematic and introductory form – exactly the sort of meat which the Broughamites thought would produce rationality, respectability and religion among the working classes. At the same time, the imprimatur of the Archbishop of Canterbury – however ambiguous a sign – might mean that some opponents of secular learning would view the use of the *Bridgewater Treatises* in a library or a periodical as an indication of its wholesomeness.

**HIGH CHURCH EDUCATION**

With the exception of Sunday and elementary schools, the only medium of popular education and apologetics used by the High Church party at the start of the nineteenth century was the religious tract of the type produced by the SPCK.\(^\text{116}\) Founded in 1698, this High Church society gradually languished in the latitudinarian atmosphere of eighteenth-century England, but began to be revitalized in the 1790s, under the influence of a group of young and talented High Churchmen who became known as the Hackney Phalanx.\(^\text{117}\) By the 1810s the Society had begun seriously to revise its tract library, since the older tracts were anachronistic in both style and content, and could not be expected to appeal to the newly-literate working classes. They were predominantly essay-like sermons, explaining and defending the beliefs and practices of the Anglican religion against dissenters, Roman Catholics and deists; or providing devotional resources. The SPCK increasingly addressed itself to a working-class audience after 1819, when, at the height of the post-war depression

\(^{115}\) See for instance the articles 'Digestion' and 'Nutrition' (Prout's *Treatise*); 'Megatheriidae' and 'Dinotherium' (Buckland's *Treatise*); and 'Man' (Bell's *Treatise*).


and the associated radical ferment, an 'Anti-infidel Committee' was formed. This Committee met regularly for the next four years, publishing thirty-five new tracts for the working classes in an attempt to counteract the radical street literature. Almost a million copies were distributed by 1821, and the Committee was revived during the Reform crisis of 1830–32, reprinting many of the tracts of 1819, together with sixteen new titles. However, since the tracts produced by the Anti-infidel Committee were not entered in the Society's permanent catalogue, they are unfortunately unavailable to the historian.

In his study of popular religious tracts D. R. Knickerbocker draws conclusions about the SPCK's anti-infidel tracts on the basis of some of their titles, and by comparison with the tracts of the evangelical RTS. On the whole, the tracts dwelt not on the substantive issues between Christianity and infidelity (such as belief in the existence and attributes of God, or the divine inspiration of the Bible) but on their supposed results. Deism and infidelity were held invariably to result in misery, and death-bed scenes were frequently used in an attempt to frighten the infidel. Another common strategy was to stress 'the contentment of the poor but pious Christian characters, whose refusal to engage in abstract argument is entirely consonant with the anti-intellectual bias expressed elsewhere in the tracts...especially in any work intended for the labouring classes'. The available evidence, then, suggests that natural theology played little part in the High Church programme of popular apologetics in the early part of the century. This is not particularly surprising since, as John Gascoigne has recently shown, the High Church party began in the late eighteenth-century to reassert the priority of revelation over 'a rationally constructed natural theology'. However, in the light of this, it is all the more noteworthy that the Bridgewater bequest was interpreted by High Church organs such as the British Critic as an opportunity to educate 'young minds'.

As the century progressed, the High Church party adopted more adventurous modes of reaching working-class readers, and it was in these contexts that works of natural theology began to be useful. A signal departure in policy was made at the height of the Reform Crisis when the SPCK, like the SDUK, felt the need to swamp out radical street literature with more acceptable cheap non-religious publications. For some time the SPCK had circulated books for use in Church schools, but these were generally reprints of successful educational and religious books which had merely been approved by the General Committee. In 1832, a Committee of General Literature and Education was formed for the provision of 'all kinds of useful and interesting works, which would serve to counteract the mischievous papers in circulation'. One of the Committee's first publications was the weekly Saturday Magazine (1832–44), which was begun as a 'counterblast to the secularism of the Penny Magazine', the format of which it closely followed. As in the SDUK journal,
natural history featured prominently, but in this case it was replete with the design idiom. Quotations were made from all the popular natural theologians, and during the years 1833–38, the *Saturday Magazine* included seventy-six extracts from the *Bridgewater Treatises*, far in excess of any other periodical.

The primary object of the *Saturday Magazine* was not directly to convey religious instruction or apologetics, but to supplant the subversive politics of the radical press and the equally subversive secular ‘useful knowledge’ of the *Penny Magazine*. In order to attract the desired audience of working-class autodidacts it was necessary to include general and scientific material, but the SPCK sought to alloy these with suitable religious and political sentiments. While the Broughamites believed that science could be rendered safe without recourse being made to the design argument, the High Church party considered such secular science to be potentially subversive. Thus, High Churchmen from a number of localities established ‘Church Institutes’ where scientific education was blended with religious instruction, in opposition to the secular mechanics’ institutes. Unlike the more strictly religious libraries intended for the working classes, such institutes as the ‘Lancaster Church of England Instruction Society’ (founded 1848) included copies of the *Bridgewater Treatises* in their libraries.123 For the Church Institutes and the editors of the *Saturday Magazine*, science could only be considered safe if it was imbued with the design idiom in a way which explicitly reinforced a belief in the creative activity and superintending care of a Deity. The *Bridgewater Treatises* apparently provided them with a science, the political and religious credentials of which were unobjectionable. While the scientific articles of the *Saturday Magazine* did not formally maintain the design argument (much less any of the other arguments of natural theology), they were generally informed by a Christian theology of nature. Extracts from the Bridgewater Treatises were thus intended to serve devotional rather than demonstrative or apologetic functions; they were intended to confirm rather than to convince. The position is well characterized by the aphorism which the magazine quoted from Thomas Chalmers: ‘It is a most Christian exercise to extract a sentiment of piety from the works and appearances of nature.’124

This ‘sentiment of piety’ involved a strong social element, and one quarter of the *Bridgewater* extracts in the *Saturday Magazine* were taken from William Kirby’s *Treatise*, which preached an unmistakable natural theological apology for the social *status quo*. Kirby was the *Bridgewater* author whose theology most resembled that of the SPCK and its productions. He had long-standing associations with the High Church Hackney Phalanx, and in the 1790s was involved with the anti-Jacobin ‘Society for the Reformation of Principles’, for which he wrote an anti-infidel tract entitled *Tom Paine’s Picture*.125


Many of the extracts taken from Kirby's *Treatise* included passages emphasizing the perfect adaptation of each species to its 'station' in the economy of nature. Kirby's use of the word 'station', a word commonly used to denote social rank and calling, clearly implies a parallel between perfect adaptation in nature and society. In Kirby's words: 'Every created thing glorifies God in its place, by fulfilling his will, and the great purpose of his providence.'  

Many of the quotations from other *Bridgewater Treatises* established the same principle of perfect adaptation. Whatever their original signification, in the context of the *Saturday Magazine* these passages contributed to the SPCK's overt apology for resignation to social station. Other quotations from Kirby displayed his strong tendency to moralize nature. Whether he was advocating the 'industry and foresight' of rat-hares or the 'honest industry' of his beloved bees, Kirby's style was clearly very suitable for the tract-like moralizing purposes of the SPCK's 'useful knowledge' miscellany. Kirby also emphasized the 'the superintending care and wise provisions of a Father Being' for the most insignificant creatures. The God who arranged the anatomy of garden snails would not, Kirby was sure, leave the allocation of social station to chance: 'We may feel a comfortable assurance...that the eye which regards even these seemingly-insignificant creatures, will, if we cast not off our confidence, never overlook us, or be indifferent to our welfare.'  

In its use of the *Bridgewater Treatises* the *Saturday Magazine* explicitly drew out a social apology from the design idiom in order to divinize the High Tory view of society. Its object was arguably religious, but the religion was one of rigid social stratification, and of working-class resignation and deference. This was presumably the type of 'really useful knowledge' which the Quarterly reviewer had hoped Bridgewater's bequest might yield. It was defined in contrast to Brougham's secular useful knowledge, since the SPCK considered it necessary to imbue all scientific exposition with references to design. However, the apologetic functions of natural theology apparently played no part in the educational strategy of the SPCK. Thus the *Bridgewater Treatises* were attractive to the Society, more for their exposition of a science which would reinforce the High Church ideology, than for their strictly theological functions.

**Evangélical Education**

The word 'evangelical' as used here refers not only to the Evangelical party within the Church of England, but also to the evangelical nonconformists - Methodists, Baptists and Congregationalists - who shared a similar theological outlook. There is good reason to treat these somewhat disparate groups together since, in addition to their several sectarian educational organizations and publications, they also co-operated in more broadly-based evangelical organizations; archetypically the RTS (founded 1799). A further reason for considering all evangelical educationalists together is that they displayed a common

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126 *Saturday Magazine* (1836), 9, 226. See also 'Local distribution of animals', ibid., 181; and 'Instinct', ibid., 221.
127 'Garden snails', ibid., 179.
128 Ibid., 189.
ambivalence towards natural theology. In fact, there existed within evangelicalism as a whole, a non-sectarian spectrum of opinion regarding natural theology, and the subject could raise controversy within any of the evangelical denominations. This diversity of opinion is nicely illustrated by an exchange of letters on the use of natural theology in religious education, which appeared between 1833 and 1834 in the Sunday School Teacher's Magazine (1813-43) – the 'unofficial house organ' of the pan-evangelical though largely dissenting Sunday School Union (founded 1803). A letter from 'W.M.' initiated the correspondence by expounding the most liberal evangelical attitude towards natural theology, namely that it is an essential preparation for the reception of revealed theology. He deplored 'the common mode of education' in which the child is taught to believe that there is a God, but 'is furnished with no evidence to prove that fact'. Quoting the apostle Paul, 'W.M.' considered it incumbent upon the apologist to "Prove ALL things"... (that is, all things capable of proof). He also adduced scriptural authority to show that natural theology was competent to prove the existence and attributes of God:

For the wrath of God is revealed from heaven against all ungodliness and unrighteousness of men, who hold the truth in unrighteousness; because that which may be known of God is manifest in them; for God hath shewed it unto them. For the invisible things of him from the creation of the world are clearly seen, being understood by the things that are made, even his eternal power and Godhead; so that they are without excuse.

However, 'W. M.' made quite clear his belief that the study of natural theology should be only the 'precursor' of revealed theology. He shared with Thomas Chalmers (the most evangelical of the Bridgewater authors) the belief that natural theology had both 'uses' and 'defects'. According to Chalmers, the great use of natural theology is to convince sceptics of the being and attributes of God, and to demonstrate to them the depravity of the human heart. 'Natural theology', he writes, 'may see as much as shall draw forth the anxious interrogation, "What shall I do to be saved?"' but the great defect of natural theology is that it cannot answer that question. The answer must come 'from a higher theology', and thus natural theology leads the sceptic to consider the claims of revelation.

This view of natural theology, while gaining some support in the Sunday School Teacher's Magazine, prompted a strong reaction from other correspondents, several of whom protested vigorously against the belief 'that the religious instruction of children

129 On the range of evangelical attitudes to natural theology see B. Hilton, op. cit. (15), especially ch. 5.
132 Ibid., 645. Quotation from 1 Thessalonians, 5.21.
133 Ibid. Quotation from Romans 1.18-20.
135 < A Teacher), 'Natural theology, viewed as a preparative to religious education', Sunday School Teachers' Magazine (1834), ii, 5, 13-19.
should commence with natural, and be completed with revealed theology'.

Indeed, it was argued that natural religion is a barrier on the path to revealed religion, and is 'that very wisdom...of which God says they that have it must become fools before they can be made wise'. According to these correspondents, natural theology, by encouraging the pride of human reason, reduces the sense of human sinfulness, and of the need of grace. Thus, 'the religion of the natural heart, by whatever names of philosophy it may be called, is enmity, unmixed enmity against the Lord Jesus Christ'. Proponents of this view could also invoke the authority of St Paul: 'Beware lest any man spoil you through philosophy and vain deceit, after the tradition of men, after the rudiments of the world, and not after Christ.'

It is difficult to assess which of these views was most widely prevalent among evangelical educationalists. One reason for this is that, while the apologetic functions of natural theology were of dubious value in some evangelical circles, the devotional functions of a theology of nature were often highly prized. The main opponent in the Sunday School Teacher's Magazine of apologetic natural theology conceded that 'the word of God and the works of God should be employed together in the instruction of the young'. While the study of nature might not be the best way of teaching the attributes of God, it was acknowledged to be 'a useful appendage to Christianity', which inspired in the student 'wonder and admiration'. Furthermore, natural theology could be used to bolster established faith against the attacks of the infidel.

This concern was related to a further issue - the advance of secular 'useful knowledge'. Natural theology may not be necessary in strictly religious education, but as evangelicals began to appreciate the need to compete with the secular and radical publications which were available to working-class readers, works of natural theology became attractive as a means of conveying religious sentiments amalgamated with general knowledge. One Sunday school teacher expressed the consideration thus:

It should not be forgotten, that at the present period there appears to be a general desire to extend the education of children in what is termed 'useful information'. We look upon no information

136 (Orthodox), 'The use of natural theology in religious education', Sunday School Teachers' Magazine (1833), ii, 4, 705–13 (705). See also (Orthodox), 'The union of natural with revealed theology', Sunday School Teachers' Magazine (1834), ii, 5, 151–5; <C.F.>, 'The inapplicability of literary and scientific attainments to the exercises of the Sunday School', Sunday School Teachers' Magazine (1834), ii, 5, 203–7; and [Anon.], 'Revealed and natural theology', Sunday School Teachers' Magazine (1834), ii, 5, 253.

137 <C.F.>, op. cit. (136), 203.

138 <Orthodox> (1833), op. cit. (136), 708. Quotation from Colossians 2.8.

139 <Orthodox> (1833), op. cit. (136), 710.

140 <W.M.> (1833), op. cit. (131), 649. This was also the reason given for including an article on the arguments of natural theology in the Youth's Magazine. <R.C., Penryn>, 'The Existence of God', Youth's Magazine, and Evangelical Miscellany (1837), iii, 10, 84–90.

141 <W.M.> (1833), op. cit. (131), 649.
as really useful unless it adds to the moral as well as physical happiness of man... The great and most fearful error that appears likely to be made, is that a vast fund of knowledge will be brought out in education not having a reference, as it assuredly ought to have, to the Creator, Father, and Preserver of all.142

Natural theology was thus a means of sanctifying science for evangelical consumption. This process was of particular importance among the working classes, where secular science was associated by some evangelicals with revolution. It was argued in the Teachers’ Magazine that, if a person studies science ‘simply for its own sake’ and without reference to ‘the supreme claims of God our Maker’, then ‘it is perfectly natural that such a student of the works of God should be a sceptic in religion, a tyrant in power, and a rebel in the humbler stations of life’. This results from ‘the obvious tendency of science to flatter the pride of our fallen nature, and to fill its subjects with a spirit of scornful ambition and restless insubordination’.143 Thus, many evangelicals, like the SPCK committees, perceived the need to produce general knowledge with ‘a religious bias’.144

One of the great attractions of the Bridgewater Treatises to evangelical educationalists was professedly that they combined entertaining and useful knowledge with ennobling sentiments. The Wesleyan Youth’s Instructor and Guardian (1817–55) argued that Whewell’s Treatise ‘should always, where it can be procured, form a part of the juvenile library’, because, while Whewell maintains the design argument ‘clearly and forcibly’, he also ‘instructs and delights’ the reader. Consequently, Whewell’s Treatise would be an ideal preservative against the insidious attractions of fiction and secular useful knowledge:

If our young friends once begin to taste the sweets of reading like that which we are now recommending, they will be in no danger of being drawn aside by the exciting poison of fictitious narrative. In works like those before us... they will have the usefully fascinating charms of truth; and accustomed to these, error and falsehood will be seen in all their deformity and danger.145

The manner in which the Treatises maintained and defended what some evangelicals considered safe scientific views is further illustrated by the comments of ‘Esto’, the pseudonymous reviewer of Kirby’s Treatise in the Sunday School Teachers’ Magazine.146 Kirby had made critical reference in his Treatise to the ‘favourite theory of some modern physiologists that God “hath not made of one blood all nations of men for to dwell on all the face of the earth”, but that there are different species of men as well as of animals’.147 Although neither Kirby nor his reviewer mentioned by name the infamous surgeon William Lawrence, the reviewer identified that ‘this was the position assumed in the celebrated “Lectures upon Physiology, Zoology, and the Natural History of Man”’;148 and it is

142 Ibid., 651. As Thomas Laqueur has shown, this view of scientific knowledge was widely reflected in the practice of working-class Sunday schools. There were, however, some exceptions, such as the popular evening lectures on chemistry and electricity offered at the Leeds Ebenezer Methodist New Connexion Sunday school in 1848. Laqueur, op. cit. (130), ch. 4.
144 [W.M.] (1833), op. cit. (131), 651.
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evident that Lawrence was the target for the attack. ‘Esto’ explained that Lawrence’s notoriously materialist Lectures had been suppressed by their author as ‘an act of succumbency to the public voice’, but that they had been ‘surreptitiously republished in a form much cheaper, and, therefore, more mischievous’. As we have seen above, the Lectures had a wide currency in working-class radical circles, and ‘Esto’ was probably close to the mark when he suggested that the suppression of the work had led to a thirty-fold increase in its circulation.

The great danger of Lawrence’s polygenism was ‘the cool, calm, and positive manner in which he draws conclusions, which, without being directed point blank at Scripture, do insidiously undermine its authenticity’.149 Moreover, the doctrine had ‘been made the basis of an argument to justify slavery, and to prove that the black man could not have been the brother of the white man’.150 What made Lawrence’s book ‘one of the most dangerous’, however, was his celebrity as a surgeon and physiologist, and ‘his reputation as a man of science’. The growing cultural authority of science meant that Lawrence’s views could not be effectively met by the theologian. Instead, he must be met ‘upon his own ground’ by ‘the student of natural history’, and the reviewer was happy to report that Kirby had successfully performed this service.151 ‘Esto’ stressed the particular necessity of Kirby’s remarks at a time ‘when works are acquiring a wide circulation and insidiously obtaining popular sanction, which hold forth a different doctrine’.152 The role of the Bridgewater Treatises in promulgating safe science, and in opposing the doctrines of infidel science, was thus of increasing importance as literacy became the norm among the working classes, and as secular learning became more widely available.

There was, then, a variety of reasons why evangelical educationalists might show interest in natural theology in general, and in the Bridgewater Treatises in particular. The actual educational practice of evangelicals reflects something of this variety. As we have seen, the Treatises were welcomed by a number of those involved in the Sunday school movement. The Sunday School Teacher’s Magazine reviewed three of the Treatises at unusual length, and with considerable approbation. Likewise, both the Wesleyan bookroom’s Youth’s Instructor and the Sunday School Union’s Youth’s Magazine and Evangelical Miscellany (1805–67) contained numerous extracts from the Bridgewater Treatises. In this context, the Treatises served both theological functions in bolstering faith against scepticism; and general educational functions, in providing safe science. However, these two children’s publications cost between 3d and 6d, and ‘were aimed more at the children of ministers and the pious laity than the masses’.153 In the more popularist

149 'Esto', op. cit. (146), 119.
150 Ibid., 181. It was, ‘Esto’ thought, ‘worthy of the slave-holder that he should borrow his argument from the infidel’.
151 Ibid., 119.
152 Ibid., 185.
children's magazines, such as Carus Wilson's *Children's Friend* (1824-1930), the *Bridgewater Treatises* apparently played no part. Such penny monthlies were dominated by tract-like moral tales and pious discourses. While they began increasingly to address the popular thirst for general knowledge, their main scientific preoccupation in the 1830s was with scriptural natural history.

This reflects the reluctance among some evangelicals to pander to the popular taste for "useful knowledge". Some commentators believed that for "the children of the more respectable classes" nothing was so desirable, with the exception of revealed religion, "as the study of nature in every branch of its philosophy". Yet with "the lower classes" it was doubted whether "the addition of this and various other knowledge to the plain reading and writing that sufficed their forefathers, be good or evil". Evangelicals of this opinion refused at first to accept the need for sanctified science to swamp out more secular fare, and they insisted that "the instruction of the Sunday school should be religion exclusively". Instead of natural theology, an anti-intellectual gospel was called for, since "with the lowest classes we well know that the less educated preachers of the dissenting churches succeed better than our Oxford and Cambridge scholars". This class-based distinction is reflected in the popular tracts of the RTS, which at this time repudiated the apologetic functions of natural theology. Like the anti-infidel tracts of the SPCK, the RTS tracts defended the faith on pragmatic and anti-intellectual grounds.

However, the perceived need for "useful knowledge" of a religious cast soon led some evangelicals to emulate the format of the *Penny Magazine*, though none ever achieved the same degree of success. Like the SPCK, the RTS felt the need "of stemming the torrent of moral poison with which the Penny Press is inundating the land", and the Society undercut the opposition with its half-penny *Weekly Visitor* (1833-35). Smaller in size, but very similar in content to the *Satdurt Magazine*, this journal included among its many scientific articles numerous extracts from the *Bridgewater Treatises*. A similar venture, the *Christian's Penny Magazine* (1832-38) made no such use of the *Bridgewater Treatises*. Edited by John Campbell, a Congregationalist minister and founding member of the Scottish Religious Tract Society, the magazine contained, in addition to much tract-like anti-infidel propaganda, numerous articles on natural history. At the end of the first year the editor could claim to have furnished "a series of the most instructive papers, illustrative of the WONDERFUL WORKS...the UNIVERSAL PROVIDENCE...and the INSPIRED WORD of the ever-blessed GOD", but the scientific articles either related to scriptural natural history, or were taken from works of scriptural geology, such as Sharon Turner's *Sacred History of the Earth* and William Higgins' *Mosaical and Mineral Geologies Illustrated*. This evidently reflects the fear of some evangelicals that works of natural theology which made no reference to the Judaeo-Christian Scriptures would undermine the

154 <C.F.>, op. cit. (136), 205.
155 Ibid., 206-7.
156 Knickerbocker, op. cit. (116), especially 288-94. From the 1830s onwards the RTS showed increasing interest in popular science. In 1846 the Society published Thomas Dick's *The Solar System*, which was presented by at least one Sunday school as a prize. A study of the scientific publications of the RTS is a major desideratum.
157 Quoted in Altholz, op. cit. (153), 53.
authority of revealed religion, and it is noteworthy that a number of other Evangelical useful knowledge miscellanies maintained a similar emphasis.159

The practice of evangelical educationalists suggests that the apologetic functions of natural theology were largely irrelevant to their schemes of working-class education and apologetics. Some of those producing educational materials considered it imperative, however, to use works of natural theology as a means of presenting scientific knowledge with a religious cast. This was largely in response to the increasing availability of secular 'useful knowledge', which was seen by many evangelicals as subversive, both religiously and politically. The Bridgewater Treatises were regarded by some evangelicals as providing a suitable theology of nature to reinforce religious faith, to inspire awe, and to counteract infidel science. Others, however, obviously regarded the Treatises as insufficiently related to the Judaeo-Christian Scriptures, and preferred to rely on works of Mosaic geology or scriptural natural history.

CONCLUSION

Although the Bridgewater Treatises were much too expensive for working-class readers to buy, their proletarian readership was undoubtedly increased through the efforts of paternalist educators. Workers could read the Treatises in mechanics' institutes, and other such libraries; they could hear them expounded or referred to in lectures and classes; they could follow the argument of Bell's Treatise in that author's earlier publication; and they could read extensive extracts from them in various 'useful knowledge' miscellanies. However, as I have been anxious to point out, none of these media was used chiefly by the working classes, and this paper is not so much concerned with proletarian reactions to the Bridgewater Treatises as the preoccupations of those who made educational use of the series. Both in the rhetoric of literary commentators, and in educational practice, the Treatises were far more widespread in popular education than has been appreciated. This is perhaps not altogether surprising, considering the remarkable public profile of these books in the 1830s. However, neither the price nor the size of the Treatises adapted them to use in such contexts, and one might have expected the many cheaper works of popular natural theology to have been generally more prevalent. The Bridgewater Treatises were, however, considered by most contemporaries to be unique among the natural theology literature in their degree of scientific system. Furthermore, as working-class literacy increased, and as science became a more regular component of working-class education, the Bridgewater Treatises provided science which was culturally appropriate to a wide range of paternalist educators, notwithstanding their great divergence in educational philosophy.

159 The Journal of Literature, and Herald of Temperance (1837), produced in Warrington by an evangelical 'Association for the Promotion of Useful Knowledge in Connection with Temperance', was more interested in scriptural natural history and the death-bed scenes of infidels, than in the scientific natural theology of the Bridgewater Treatises, although one extract was made from Buckland's Treatise. The pattern is less pronounced in Ward's Miscellany (1837), which was published 'under the superintendence of a Society for the Advancement of Literature, Science and Religion'. A number of extracts were taken from the Bridgewater Treatises, but the scientific articles were still more usually connected with the Scriptures, as typified by a series on 'The Cosmogony of Moses'.

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It has been a central claim of this paper that the *Bridgewater Treatises* presented several groups of educators with science that was safe. In particular, I have striven to describe the divergent visions of safe science entertained by the several constituencies. The essentially secular nature of Broughamite science nicely illustrates that safe science is not simply to be identified as science shaped by an acceptable theology of nature. Quite independently of theological references, science could — in so far as it did not subvert supposed religious and political truths — be accredited as safe. Broughamites were not, of course, by any means unanimous about the higher truths which were thus to be protected. At the same time, however, science without a theological reference was considered dangerous in the extreme both by High Churchmen and by evangelicals. While members of both these parties were more or less resistant to the notion that demonstrative natural theology had a significant role to play in Christian apologetics (especially among the bestial and irrational working classes) they were insistent that the language of science must make explicit reference to divine activity if it was to be safe. Indeed, for the more extreme evangelicals, science could not be rendered safe without direct and continual reference to Holy Writ. By concentrating on this notion of safety in science, I have sought to transcend the sometimes rather sterile discussions of early nineteenth-century natural theology, and to identify some of the non-apologetic functions which works of this type could perform in a society where working-class scientific education was becoming increasingly prevalent.