‘SCIENCE FOR CHILDREN’

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Writing the preface to his children’s science book, *Madam How and Lady Why*, in 1870, Charles Kingsley (1819-75) cast his mind back to his childhood: ‘My dear boys – when I was your age, there were no such children’s books as there are now. Those which we had were few and dull, and the pictures in them ugly and mean.’1 In contrast, by the 1870s, children’s books routinely had detailed wood-engraved illustrations and the more expensive ones would have colour plates. They were far more varied – in terms of intended audience, subject matter and style – than in Kingsley’s youth, as writers tried to cater for the needs of real children, by using appropriate language and making efforts to keep their attention. There were certainly more books available, for publishing in all genres had flourished in the second half of the nineteenth century, partly due to the new technologies which allowed publishers to reach wider audiences. It was, therefore, not hard for Kingsley to argue that things had improved enormously since his childhood.

That an author as well-regarded as Kingsley should be writing a science book for children reminds us that the history of children’s literature was not solely about imaginative fiction, with optional moral lessons. Many writers wanted to play a part in the educational process by providing instruction, and this remained true throughout the nineteenth century. Since the nursery is commonly one of the most protected places in family life, children’s books provide an unusual way of investigating the social acceptability of different forms of knowledge, and the various purposes to which it might be put. Children’s books are also a fascinating source for examining science communication, for they can be seen as the essential form of popular writing on the sciences. For a young audience, it was vital for writers to avoid technical language, to explain concepts carefully and to provide clear illustrations. It was also crucial to blend the instruction with amusement, for while adults might be willing to persevere in the name of increased knowledge, bored children would be more likely to simply close the book.

It is worth remembering that no matter what the intentions of authors or publishers, readers often do unexpected things. No doubt there were some children who learned their science from books intended for adults, because those were the only books to which they had access. And similarly, we know that there were adults who learned their science from books intended for children. *Evenings at Home* (1792-96) was in the library of at least one Mechanics' Institute, while Michael Faraday famously became interested in chemistry by reading Jane Marcet's *Conversations on Chemistry* (1806).2 Working-class readers might have been attracted to children's books because of their low prices, since, while books for adults routinely cost around ten shillings (up to the 1840s), books for children were more likely to be two shillings. The simpler language in children's books might also have been helpful – although potentially patronising. Most popular science works for adults, until the middle years of the nineteenth century, were written for educated readers. Although working-class readers were often compared to children in their mental abilities, it was not until the 1830s and 1840s that there began to be some recognition of the need for simple introductory works for adults with limited educational opportunities. In contrast, science books for children had been an established genre since the late eighteenth century.

In the eighteenth century, the sciences had become part of a 'public culture', entering an increasingly commercialised marketplace in the form of lectures, demonstrations, books and periodicals.3 Among the other new commodities were products aimed specifically at children, such as books, games and puzzles.4 In such a context, it was not long before the first books for children on the sciences appeared. One of the earliest was the pseudonymous Tom Telescope's *Newtonian System of Philosophy, adapted to the capacities of young gentlemen and ladies* (1761), published and probably written by John Newbery (1713-67), the man generally credited with the creation of the children's book genre in the 1740s.5 In the *Newtonian System*, a group of budding young natural philosophers, the Lilliputian Society, attend lectures and demonstrations on natural philosophy delivered by a youthful 'Tom Telescope'. Many of the features which would become typical of children's non-fiction for the next sixty years were already present: in particular, the inclusion of moral lessons alongside the natural philosophy; the recourse to easy-to-understand examples from everyday life; and the use of a conversational format, in

which the information is conveyed as a dialogue between two or more characters, with only limited narration to set the scene.6

The new genre blossomed in the late eighteenth and early nineteenth centuries. Writers generally became the active agents in initiating new works, although booksellers were more than happy to publish them. A few firms, such as John Harris and Darton & Harvey, even specialised in children's books. By the end of the eighteenth century, children's books had become more didactic than Newbery's early works, although their writers routinely claimed to be amusing as well as instructive. The sciences, and particularly natural history, were typically presented as a means of leading young children to an understanding of the Creation and its Creator – as, for instance, in Sarah Trimmer's *An Easy Introduction to the Knowledge of Nature and Reading the Holy Scriptures* (1780). Some writers also argued that the sciences were becoming a sufficiently important part of British culture that they were essential parts of children's education, to fit them for their future role as responsible members of society. For instance, the Unitarian brother and sister, John Aikin and Anna Barbauld, emphasised the practical and social uses of natural knowledge, and limited their references to its religious roles.7 Aikin and Barbauld's *Evenings at Home* is an excellent example of the 'instructive and amusing' genre, and had an enormous influence on nineteenth-century children's books, due to its long career and numerous imitators.

In the first decades of the nineteenth century, hosts of 'conversations on…', 'dialogues about…' and 'letters concerning…' were published, all in the 'instructive and amusing' vein, although generally more restricted in subject matter than *Evenings* had been (e.g. to chemistry, or botany, or entomology). The genre clearly appealed to women writers, including Jane Marcet, author of *Conversations on Chemistry*, and her many imitators.8 The representation of girls learning from women within the books could help legitimate the authority of the female writer on the sciences. Nevertheless, there were well-known works written by men, including the *Scientific Dialogues* (6 volumes, 1800-1805) written by Jeremiah Joyce to continue where *Evenings* had left off. The number of children's books on the sciences published in the first two decades of the nineteenth century indicates that the sciences (or at least some of them) were not only acceptable in the nursery, but had become a standard part of childhood. Middle-class parents were eager to buy these works for their offspring, as a way of

introducing them to an important field of knowledge, and encouraging their religious development.

If I were writing about science books from the usual point of view of historians of children's literature, I would stop here. My interests from the 1820s onwards would be in fairy tales and the resurgence of imaginative fiction, leading to the so-called Golden Age of the 1860s.9 What the works in this collection clearly show is that the story of children's science books goes on, and is as rich a subject for study as children's fiction. Nor is this story part of the history of textbooks, although such books were certainly becoming more common as the century wore on. The absence of science teaching from most school curricula (and certainly most primary school curricula) meant that, until the last decades of the century, the majority of children gained their knowledge about nature from reading done in the home. And that means that there had to be an emphasis on entertainment in children's science books, because, although undoubtedly instructive, these books were intended to be read for pleasure.

'Instructive and amusing' books in the now-traditional style continued to be published up to the middle of the nineteenth century, although by then, alternative styles were beginning to emerge. Nevertheless, many features of the early books can be traced in their successors. Children were believed to learn more effectively when they were interested in the subject, and this meant that writers made attempts to excite the curiosity of their young readers, and to avoid going on at length in case they became boring. Quite how to manage this desirable blend of amusement with instruction was, however, a continuing problem. The standard solution in the early nineteenth century was to write in dialogue, as if for a mini-drama. This form became less popular later in the century, although it was still present in Sarah Tomlinson's *Starry Heavens* ([1847]), where the conversations were set within a skeletal story. Later writers who used it tended to work much harder to embed the conversation within a convincing fictional story, as in Agnes Giberne's *Among the Stars* (1885). Early attempts at using third-person narration tried to maintain interest by focusing on wonders and marvels, as is clear in Samuel Clarke's *Peter Parley's Wonders of Earth, Sea and Sky* ([1837]), and Charles Williams's *Wonders of the Waters* ([1842]). The narrators of both these works were given a strong persona as the favourite, well-travelled and knowledgeable uncle. Thus, although no longer written as conversations, they still mimicked the form of oral storytelling. Writers who wished

to cover certain basic principles in a certain order, rather than jumping around the wonders of creation found the problem of entertainment particularly acute. John Henry Pepper's emphasis on exciting experiments in his *Boy's Playbook of Science* (1860) and Arabella Buckley's use of fairies in her *Fairy-land of Science* (1879) illustrate two alternative strategies. In many works of the late century, including Buckley's work and Margaret Gatty's *Parables of Nature* (1855), there is also a greater concern with literary techniques of narration, which may be a reflection of similar (though earlier) developments within children's fiction.10

Drawing moral and religious lessons from nature was another feature that remained in children's science books well into the second half of the nineteenth century. In the first half of the century, it was utterly standard to present the natural world as God's creation. While some books might do little more, many, particularly those for the youngest readers, used the natural world to encourage feelings of awe, wonder and devotion for its Creator. A few writers regarded such feelings as the first steps towards a faith which would later be fully developed through reading the scriptures, but most, and particularly those on the evangelical wing of their churches, regarded the natural world as a way of making real the God already known from scripture.

In part, this reflects the situation in popular science more generally. Most such works did have a religious worldview for most of the century. Secular forms of popular science began to emerge in the 1840s, but did not become common until at least the 1870s. In addition, however, children's books were even more likely to make the religious worldview explicit. Children were assumed to be too young to discriminate for themselves, and had to be protected from potentially dangerous forms of science. Writing in the opening years of the century, Sarah Trimmer had criticised *Evenings at Home* for its lack of religious references, and for failing to lead its young readers up to nature's God.11 In Trimmer's eyes, the scarcity of references to religion was dangerous, as it tended towards the secular (even atheistic) science associated with the terrible effects of the French Revolution. Similar concerns remained with parents for the next forty years, although the dangers moved closer to home due to the links made between certain sciences and the cause of political reform in the 1830s.

Thus, works such as those produced by the British 'Peter Parleys' were widely welcomed for providing a 'safe' route into the sciences for young children, which

would firmly associate knowledge of the natural world with knowledge of God. Similarly, in the 1840s, parents knew that by purchasing books from reputable organisations such as the Religious Tract Society or the Society for Promoting Christian Knowledge, they could help their children to learn about nature without exposing them to the risks of atheism. As the evangelical clergyman Edward Bickersteth commented approvingly: 'You have confidence when you take a book of the Religious Tract Society, that it will be sound in principle and valuable in knowledge.'12 Such confidence was valuable for parents at a time when the literary marketplace was expanding, and it was virtually impossible to check the religious credentials of all the writers of books on the sciences. Naturally, parents of different denominations had different expectations of 'suitable' reading material for their children. Evangelicals, for instance, placed special emphasis on Christ the Redeemer, rather than God the Creator, and would have regarded references to the sinfulness of man's Fallen state and the necessity of faith in the Atonement as essential. They would not have found such references in, for example, the *Starry Heavens* despite its many Biblical quotations and frequent references to the Creator, but they would have been satisfied with *Wonders of the Waters*. Evangelical parents were thus far more likely to shop at the RTS depository than that of the SPCK. And for those with even more specific demands, there were denominational publishers specialising in similar works for Wesleyans or for Baptists.

By the 1850s, there was less concern about the potentially dangerous implications of the sciences. Chartism was over, and Britain seemed to have escaped the threat of revolution. The relaxation of political fears did mean that it gradually became possible to write about the sciences without introducing religion, or with only a very slight religious gloss, at least for older children. The Revd John George Wood limited his discussion of religion to the preface of *The Boy's Own Book of Natural History* (1861), as did Mary and Elizabeth Kirby in their *Stories About Birds of Land and Water* (1873). Nevertheless, Kingsley's *Madam How and Lady Why* explicitly discussed religion, and Agnes Giberne's *Sun, Moon, and Stars: A Book for Beginners* used the relatively old-fashioned trope of opening each chapter with a scripture quotation, despite being published in 1880. Although fears of secular science bringing down the establishment had diminished, parents clearly remained concerned for the eternal future of their children. Both the continuing support for the religious publishing societies, and the great success of Gatty's *Parables of Nature* in the third

quarter of the century indicate this. It is, however, noteworthy that most later nineteenth-century writers (for example, Gatty) who discussed religion took care to introduce it more subtly introduced than some of the earlier writers.

Another theme which runs through many of these books is the importance of active involvement while learning about the sciences. In books which tell a story of fictional children learning about the natural world, the children frequently go places, look at things, collect things, or try simple experiments – thus providing ideas for activities for the child-reader. At the most basic, this could mean paying close attention to the behaviour of toys in the nursery, such as the spinning top used in Tom Telescope's *Newtonian System*. Similarly, John Ayrton Paris's *Philosophy in Sport made Science in Earnest* (1827) used childhood toys and games to teach natural philosophy. For natural history, activities were more likely to start with a walk in the garden or the nearby fields, observing the local wildlife or collecting plants, as the tutor frequently recommends Harry and George to do in *Evenings at Home*. Astronomical knowledge would best be learned by looking at the stars, as Henry and his father do while walking home at the beginning of *Starry Heavens*. Chemical knowledge, too, could be learned at home by simple experiments with chalk, vinegar or salt. Although Greg Myers has noted the irony of books which encourage learning through practical activities while themselves imparting knowledge through the printed word, some writers made strenuous efforts to encourage their readers to really go and do things, rather than simply read.13 This is most obvious with Pepper's *Playbook*, which includes experiments with household objects such as glass jars or umbrellas to explain basic principles of science. It also included plenty of experiments which would have been more difficult to carry out in the home, but the emphasis on learning through doing was nevertheless clear.

So far, I have stressed the similarities over the century, but there were certainly some differences as well. Perhaps most striking is the stark visual contrast between the books in their original formats. The volumes of *Evenings at Home* were small, thin duodecimos, bound in marbled boards with paper labels on the spines. They had no pictures, and the text was uneven and sometimes blurry. By the 1840s, cloth on boards had become the standard binding for cheap books, so that *Wonders of the Waters* and *Starry Heavens* look rather more attractive. They have coloured cloth covers, with embossed patterns, and a hint of gilt in the decoration. They are still small and slim, as they were intended for young children, but books for older children

were by now more likely to be larger octavos, and thicker. The other clear difference concerned what was on the page. For a start, the print was clearer, although small, and was almost certainly printed from stereotype plates on a steam press, rather than from moveable type on a hand-operated press. But there were also pictures: admittedly mostly small, and still black and white, but nevertheless, pictures. Where colour was particularly necessary or desirable, it could be applied by hand to the black-and-white engravings after printing. The books of the 1870s finally take on the sort of colourful and decorative appearance we would (now) expect from children's books. Cloth-on-board bindings were still standard, but the cloth came in an increasing variety of bright colours, rather than the relatively drab greens, browns and blues of earlier days. Even better, techniques had been developed for decorating the cloth, either by printing directly with inks, or by embossing gilt patterns. Colour printing had been developed in the late 1840s, and, although expensive, was quickly introduced for illustrations in children's books, usually in addition to black-and-white wood engravings. Even at the end of the century, colour plates tended to be reserved for special occasions, such as gift books intended for prizes or presents. Gift books were the beneficiaries of the latest techniques in illustration and decoration, and some of them were striking indeed.

Another change was the late nineteenth-century recognition of sub-groups within the generic audience, 'children'. All the works in this set (with the possible exception of *Wonders of the Waters* in its original pamphlet format) were intended for the children of middle-class families. At the end of the century as at the beginning, these were the families which had disposable income to spend on their children, and whose children had the literacy, educational background and leisure time to read such books. However, there was greater differentiation by age, particularly from mid-century onwards, with writers producing books with differing levels of language skills, technical difficulty, and, not least importantly, numbers of pages. Most of the later books in this collection were for older children, but the difference in audiences can be imagined from the difference between the *Starry Heavens* (intended for children about seven years old) and the *Boy's Playbook* (written for teenagers). The gender label of Pepper's book suggests another way in which child-audiences could be more specifically targeted. The majority of children's science books seem to have been aimed at readers of both sexes. *Evenings at Home*, for instance, describes boys doing botany and a girl learning about astronomy. By the second half of the century,

experimental science was increasingly gendered masculine, and this is part of the reason for Pepper's title. However, children's literature in general was becoming more gendered. There were already different sorts of school stories for girls and boys, as well as family stories for girls and adventure stories for boys. The popularity of titles beginning 'Boy's own…' and 'Girl's own…' would soon be epitomised in the successful periodicals, the *Boy's Own Paper* and the *Girl's Own Paper*.

There was also a change in the sort of people writing children's books. In the early part of the century, children's writing was not regarded as a particularly high status activity. It was frequently done by women, or by men who were involved in teaching or publishing. By the second half of the century, the growing literary market had made it possible (just) to make a living from writing alone, although it was still easier to have another source of income. John George Wood was able to make his living as a popularizer of science by combining his public lectures with writing books for adults and children. Other authors who usually wrote for adults also turned their hand, at least occasionally, to children's books; Robert S. Ball, for instance, wrote *Star-land: Being Talks with Young People About the Wonders of the Heavens* (1889). This indicates that children were now regarded as an important audience for the sciences, and that it behoved serious popularisers to cater for them, rather than leaving that job to others.

A final difference would seem to be in the longevity of the books. Although Buckley's *Fairy-land* was deemed very successful, remaining in print until 1919, that is as nothing compared to *Evenings at Home*, which made it to 1915. While *Evenings* may well be a unique case, there was also a sense in which the sciences were moving faster at the end of the century. It was not only a matter of updating the facts of new discoveries, but the language used in science was changing. Books went out of date faster, and needed more than cosmetic revisions to modernise them. The demand for popular science books had also produced a horde of writers, and it was therefore far easier to get new books on the sciences written than it had been at the start of the century.

By the late nineteenth century, Kingsley was right to argue that there were more children's science books on the market, and they were more sophisticated in style and more decorative in appearance than their forerunners. Preferring to think of books from the literary point of view, however, he glossed over their status as consumer goods.

Further reading:

F.J. Harvey Darton, *Children's Books in England: five centuries of social life*, ed. Brian Alderson, 3rd ed. (Cambridge University Press, 1982).

Aileen Fyfe, 'Young Readers and the Sciences' in Marina Frasca-Spada and Nicholas Jardine (eds.), *Books and the Sciences in History* (Cambridge University Press, 2000), pp. 276-90.

M.V. Jackson, *Engines of Instruction, Mischief and Magic: Children's Literature in England from its Beginnings to 1839* (Aldershot: Scolar Press, 1989).

Bernard Lightman, "The Voices of Nature': Popularising Victorian Science', in Bernard Lightman (ed.), *Victorian Science in Context* (University of Chicago Press, 1997), pp. 187-211.

Harriet Ritvo, 'Learning from Animals: Natural History for Children in the Eighteenth and Nineteenth Centuries' *Children's Literature*, vol. 13 (1985), pp. 72-93.

James A. Secord, 'Newton in the nursery: Tom Telescope and the philosophy of tops and balls, 1761-1838', *History of Science*, vol. 23 (1985), pp. 127-151.

Notes:

1. Charles Kingsley, *Madam How and Lady Why*, (London: Bell & Daldy, 1870), viii-ix.
2. D.A. Hinton, 'Popular Science in England, 1830-1870', Ph.D., Bath University, 1979, 174, n40. The Faraday story is repeated in David M. Knight, *Natural Science Books in English 1600-1900*, (London: Batsford, 1989), p. 203.
3. Larry Stewart, *The Rise of Public Science: Rhetoric, Technology and Natural Philosophy in Newtonian Britain, 1660-1750*, (Cambridge University Press, 1992). Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820*, (Cambridge University Press, 1992).
4. J.H. Plumb, 'The New World of Children', in N. McKendrick, J. Brewer and J.H. Plumb (eds.), *The Birth of a Consumer Society: The Commercialization of Eighteenth-Century England*, (Indiana University Press, 1982), pp. 286-315.
5. James A. Secord, 'Newton in the Nursery: Tom Telescope and the Philosophy of Tops and Balls, 1761-1838', *History of Science*, vol. 23 (1985), pp. 127-151.
6. On the dialogue, see Greg Myers, 'Science for Women and Children: The Dialogue of Popular Science in the Nineteenth Century', in John Christie and Sally Shuttleworth

(eds.), *Nature Transfigured: Science and Literature, 1700-1900*, (Manchester University Press, 1989), pp. 171-200.

7. Aileen Fyfe, 'Reading Children's Books in Eighteenth-Century Dissenting Families', *Historical Journal*, vol. 43, no. 2 (2000), pp. 453-74.

8. Greg Myers, 'Fictionality, Demonstration, and a Forum for Popular Science: Jane Marcet's *Conversations on Chemistry*', in Barbara T Gates and Ann B Shteir (eds.), *Natural Eloquence: Women Reinscribe Science*, (Madison: University of Wisconsin Press, 1997), pp. 43-60. On the 'instructive and amusing' genre, see M.V. Jackson, *Engines of Instruction, Mischief and Magic: Children's Literature in England from Its Beginnings to 1839*, (Aldershot: Scolar Press, 1989).

9. For example, F.J. Harvey Darton, *Children's Books in England: Five Centuries of Social Life*, 3rd ed. (Cambridge University Press, 1982). Mary F. Thwaite, *From Primer to Pleasure in Reading: An Introduction to the History of Children's Books in England from the Invention of Printing to 1914 with an Outline of Some Developments in Other Countries*, 2nd ed. (London: The Library Association, 1972). Even Jackson's study ends in 1839, see Jackson, *Engines of Instruction* (1989).

10. On the fiction, see Darton, *Children's Books in England* (1982), pp. 220-49.

11. Sarah Trimmer, 'Review of Evenings at Home', *Guardian of Education*, vol. 2 (May 1803), p. 306.

12. Bickersteth's speech at the annual meeting of the Religious Tract Society, quoted in *Christian Spectator* (1847), p. 225.

13. Myers, 'Science for Women and Children' (1989), p. 179.