

3. MORE THAN STORY-TELLING—REFLECTING ON POPULAR SCIENCE

Read them [popular science books] closely to appreciate how the authors sustain interest, how they impose order on seemingly disparate facts and events, how they communicate ideas and information without being pedantic, how they inform by telling stories.

Wilford, 1998, p.50

1. THE NATURE OF THE BEAST

Contemplating the contribution of popular science books to contemporary science communication is both exciting and daunting. Exciting because if you happen to like your science packaged in that good old-fashioned commodity the printed book there are more science titles in the bookstores now than ever before. Daunting for the same reason, and for a couple of others too.

One is that this profusion of titles in the basic publishers' category 'popular science' is rather diverse. There is no single, easily defined genre here, rather an area in which many styles and formats co-exist (Jurdant, 1993, Turney, 1999). A more serious difficulty, though, is that it is not obvious where to look for ideas about how to evaluate this growing body of literary work. In 1962 the critic Martin Green declared that 'There is no serious or stringent idea available of what makes a book a worthy example of popularization' (Green, 1964, p.34). Although there are worthwhile critical essays on a number of individual authors (McRae, 1993), it is still true that we lack an effective critical vocabulary for discussing popular science books.

That vocabulary, I think, will have to be quite extensive, and even if I were in a position to do so there would not be space here to develop it in full. But this chapter will offer some hints about the kind of critical work we might expect it to do. As I elaborate them, I have three guidelines in mind. My comments should relate to the particular characteristics of books about science for non-professionals which may set them apart from other non-fiction. They should, if possible, make use of the academic literature in science studies or science communication. And they should offer some grounding for advice to those who wish to write such books, as well as a basis for analysing aspects of those already published.

I will mention three such aspects briefly, then go on to discuss two of them in more detail. The first is the kind of story-telling which goes on in these books. Every successful non-fiction writer will tell you that the way to engage the general reader is to tell a story. Many of these stories are pretty much like stories about anything else - they involve struggles, conflicts or adventures, have heroes and villains, complication and resolution.

There is at least one kind of story, though, which is largely confined to the pages of science books—the story of the universe. The historical sciences are obliged to create accounts of change through time. This is perhaps better termed a narrative rather than a story, but it does give these sciences an obvious framework for popular authors to adopt. The fact that the narrative has recently been both extended and filled in with more detail makes the framework even more attractive. One important influence on science as story in the latter half of this century—along with the extraordinary vistas opened up by modern astronomical observation—has thus been the rise of cosmology as a scientific specialty. As Timothy Ferris observes, ‘From the perspective of cosmic history, all scientific questions turn ultimately into narratives’ (Ferris, 1997, p.21).

This puts cosmology alongside the other sciences whose business it is to reconstruct a timeline: geology, evolutionary biology and paleoanthropology. One could add developmental biology for completeness’ sake. All of these are inevitably in the business of narrative, and the details of the narrative are influenced by theoretical commitments of scientific authors, as Misia Landau, for example, has documented thoroughly for stories of human evolution (Landau, 1991).

It is also easy to observe that a large proportion of recent popular science texts draw on the work of these sciences, often recasting the technical narratives relatively lightly. Martin Eger has characterised this ensemble of texts as a new and important sub-genre of popular science, which collectively relate what he dubs the ‘new epic of science’ (Eger, 1993). However, while the existence of this evolutionary epic is important for understanding the appeal of many popular science books (Turney, 2001), there is more to popular science than this. And there is more to the art of writing popular science than story-telling. Furthermore, it is difficult to offer general advice about this aspect of the work, as the stories which can be told are heavily constrained by the details of the area of science and by the situation and knowledge of the author.

A second consideration which applies to the area as a whole, and is more specific to popular science, is the treatment of the nature of science. This is of interest for a number of reasons. Every narrative which relates something of what science has found, and how it was found, takes a view on the status of scientific knowledge, sometimes implicit, often explicit. Some understanding of the nature of science is also a component of most definitions of that elusive qualification for modern citizenship, scientific literacy. Finally, it is of interest because you do not have to delve very deep into the mass of popular science books to find that ideas about the nature of science are hotly contested.

This suggests that one aspect of our critical evaluation of any popular science book will be related to the way it treats the nature of science. Aside from whether we happen to agree with the particular version of the nature of science on offer, we will want to know if it is clear what the author wants to convey about this matter, and whether he or she is coherent or consistent about it. By the same token, would-be authors would do well to consider which views are in play in current popular discussion, and to reflect on where their own fit in. All of these reasons add up to a good case for making the nature of science the first topic to get closer attention below.

The second topic is explanation. If there is one thing you have to do as a science writer, it is to explain unfamiliar ideas and phenomena. But it is hard to find any systematic account of how this is done. Advice to authors usually boils down to avoiding equations, minimising jargon, striving for clarity, and using apt metaphors and analogies. It is certainly worth bearing all these in mind. Yet even when you do, it is still hard to define when the job has been done well for the intended audience.

The first of our topics obviously relates directly to academic science studies, just as the popular arguments about the nature of science are a variation on controversies about scientific knowledge which are alive in the academy. For the second, I shall turn to an area of research which science communicators are sometimes prone to ignore, on science teaching. We shall explore whether one set of terms for describing the explanatory performances of a teacher in a science classroom can be applied to the accounts science authors render of similar topics in print.

2. TRUTH, GAME, OR TRUTH GAME: VARIETIES OF SCIENTIFIC METHOD

To get a first perspective on the nature of science, consider the opening of a philosophical work which makes a historical point.

Once, in those dear dead days, almost, but not quite beyond recall, there was a view of science that commanded widespread popular and academic assent. That view deserves a name. I shall call it Legend.

Legend celebrated science. Depicting the sciences as directed at noble goals, it maintained that those goals have been ever more successfully realized. For explanations of the successes, we need look no further than the exemplary intellectual and moral qualities of the heroes of Legend, the great contributors of the great advances. Legend celebrated scientists, as well as science (Kitcher, 1993).

Philip Kitcher's point, of course, is that the legendary view is now widely disbelieved; that, in the thirty-odd years between the first edition of Kuhn's *Structure of Scientific Revolutions* and his own book, much historical, sociological and philosophical scholarship has called into question the picture of scientists as a band of heroes who, by their command of Scientific Method, wrest truth from Nature's grasp.

Kitcher's own intent is to evaluate the sources of this scepticism and, while acknowledging its force, nevertheless defend a version of the growth of science which provides for rational discussion of scientific progress. I am not going to comment on how well he succeeds. There are much more systematic evaluations of this widely available (Ziman, 2000). I simply want to use him to underline that what once seemed rather straightforward is now contested. In scholarly discussion, the legend is dead - what is at issue is what account of science to put in its place.

Kitcher suggests that the critique worth taking seriously is not that of what he calls 'science bashers' but of those who maintain that Legend offered 'an unreal account of a worthy enterprise'. He also maintains that Legend may still be found in 'textbooks and journalistic expositions'. But thirty years is long enough for news this important to filter out of the academy into the popular realm. And in recent

popular science, too, assumptions about the nature of science have become contested terrain

One could take this up by looking at contemporary examples but consider instead someone who has been dead for 100 years, Louis Pasteur. This has the advantage that there is no dispute about the status of the science. But, as we shall see, there is ample scope for disagreement about how Pasteur's claims were established.

For instance, biochemist Frank Ashall in his enthusiastically titled *Remarkable Discoveries!* tells the story of Pasteur's work refuting spontaneous generation, and concludes that;

Throughout Pasteur's life he encountered opposition to his theories, but he always triumphed over his antagonists. The main reasons for his success are probably his perseverance, conviction of the correctness of his ideas, the brilliance and simplicity of his experiments and the care with which they were performed. In the end, the results of his experiments were self-evident and nobody could argue with them, and they usually turned out to be correct. (Ashall, 1994, p.150)

Just the previous year, though, a pair of sociologists of science published a popular volume with the same publisher, Cambridge University Press, which relates the same episode, but comes to a very different conclusion:

Pasteur was a great scientist but what he did bore little resemblance to the ideal set out in modern texts of scientific method. It is hard to see how he would have brought about the changes in our ideas of the nature of germs if he had been constrained by the sterile model of behaviour which counts, for many, as the model of scientific method. (Collins and Pinch, 1993, p.9)

Not long after those two books appeared, science historian Gerald Geison published a new full-scale biography of Pasteur. This was generally well-received by the reviewers, with the notable exception of the Nobel prize-winning molecular biologist Max Perutz, who wrote an extended attack on Geison in the *New York Review of Books*. Perutz's intentions were admirably clear:

Pasteur led a simple family life and devoted all his time to research. To generations of Frenchmen, and to many others, Pasteur has been the image of the selfless seeker after the truth who has been intent on applying his science for the benefit of mankind. In *The Private Science of Louis Pasteur*, Gerald L. Geison, a historian of science, claims to have deconstructed Pasteur, and to have produced 'a fuller, deeper and quite different version of the currently dominant image of the great scientist'. I propose to deconstruct his deconstruction and restore the rightly dominant image. (Perutz, 1995)

He interprets Geison's painstaking historical treatment, drawing on new material from Pasteur's laboratory notebooks, as a salvo in the culture wars, the work of an arch-relativist out to do down a great scientific hero. So according to Perutz, Geison 'insinuates' that Pasteur cheated, 'implies that Pasteur acted dishonestly' and makes the 'accusation' that Pasteur was unethical. He denies that Pasteur could have been guilty of securing a verdict over his opponents in the spontaneous generation controversy at least partly by rhetorical means (Geison's interpretation) because, for Perutz, 'good research needs no rhetoric, only clarity'.

One could follow these arguments through, in Geison's reply to Perutz, or by looking at numerous other popular and scholarly accounts of Pasteur's life and work, but the basic polarity is clear. It is that between realism and constructivism, between seeing scientific knowledge as a true account of an underlying reality, justified by appeal to unequivocal facts, and regarding it as socially, culturally or linguistically constructed, with a much more problematic relation to the real phenomena.

If we want to explore this further, it is important to stress that, as well as being about much more than the image of Pasteur, the range of views about the nature of science is much more complex than this simple opposition suggests. We need to reduce that complexity to organise a discussion of popular science, but not quite as far as this. A useful simple inventory is offered in a British educational researchers' study of young people's images of science. (Driver, Leach, Miller and Scott, 1996). They also needed a way of classifying views of the nature of science, to help interpret students' discussions rather than popular texts, but their list will serve as a starting point.

In reviewing perspectives on the nature of science, they list five main widespread views:

- An *inductive* view of science, in which observations are paramount;
- A *Popperian* view, in which researchers try and falsify conjectures;
- A *Kuhnian* view, in which normal science is punctuated by revolutionary changes of paradigm;
- A *social constructivist* view, in which knowledge is seen as a creation of the relevant scientific community;
- An *instrumentalist* view, in which what 'works' is the principal test of which theories are accepted.

Just as their study applied these illuminatingly to the way school students think about scientific knowledge, I suggest they can help us interpret the epistemological assumptions of popular science texts. Let us try this out on a few examples.

Quantum physics is an area of science which inevitably raises questions about relations between observer and observed, causality and determinism, so books on the subject are likely to treat questions about the nature of the knowledge being described in some detail. Heinz Pagels' *The Cosmic Code - Quantum Physics as the Language of Nature* is a good example. The book was a relatively early contribution to the spate of 1980s volumes about the new particle physics. As the subtitle indicates, it takes an explicit position on the status of quantum mechanics. And it is an elaborate and subtle one. In the foreword, Pagels tells us that 'finally, there is a short third part, *The Cosmic Code*, which describes the nature of physical laws and how physicists find them' (p.12).

Turning to that section, we find a fairly lengthy discussion of the nature of science, which tells us that:

- Looking for natural laws is a creative game physicists play with nature. The obstacles in the game are the limitations of experimental technique and our ignorance, and the goal is finding the physical laws, the internal logic that governs the entire universe. (p. 299)

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