

Physics for the Masses

Oliver Pike

Although science has always been performed by a very small subsection of the public, science communication with the ‘educated layman’ has a well-established history [1]. Its importance is outlined by Thomas and Durant in nine key benefits [2]. These include; benefits to science, as the taxpayer often funds scientific research; benefits to democratic governments and national economies; and benefits to the individual, as some sense of scientific process is necessary in the modern technological world. Indeed, physics education benefits “all sections of society... the specialist... the skilled worker... the citizen ... [and] the individual” [3].

“Physics education benefits all sections of society.”

Science communication takes many different forms. The formal education of science is a mandatory part of the National Curriculum in the UK until the age of 16. Television has proven itself a powerful vehicle for presenting the public with science in an intriguing, sensationalist fashion, whilst scientific journals present cutting edge research more formally and ‘popular science’ books and magazines seek to make scientific theories technically accessible and interesting to all. Many of these have been written on topics such as Einstein, specifically his work in relativity, and more recent theories like string theory. Famous scientists, notably Feynman and Hawking, have themselves written books for the layman. There have been best-selling books targeted at a wider audience, which aim to install a basic scientific literacy in the reader. These include *A Brief History of Time*, *A Short History of Nearly Everything*, and recently, *The Trouble with Physics*. Hawking’s *A Brief History of Time*, which explains a range of cosmological subjects, including the Big Bang, black holes and superstring theory to the non-scientist, holds the record for the longest time spent on the Sunday Times best-seller list; 237 weeks. The book’s sales suggest the public’s appreciation for basic scientific literacy, but Robert Pollock argues in the *Wall Street Journal* that “publishing

watchers cite Stephen Hawking’s *A Brief History of Time* [as an example of] the unread bestseller” [4], implying that it was either uninteresting or inaccessible to the reader.

Scientific writing is objective and factual; it is methodically structured, cross-referenced and clearly defined. ‘Popular science’ writing on the other hand is engaging and seductive, its “main purpose is to celebrate rather than validate” [5]. Particular emphasis is placed on the incredibility or apparent implausibility of results; in one *Atom* episode alone, the words “phenomenal”, “astonishing”, “revolutionary”, “jaw-dropping”, “amazing”, “magnificent” and “awesome” were all used. The effect this has is to exaggerate the science and make the results more impacting. Popular science will also often try and invoke an emotional response in the reader; perhaps the most famous example of this is in *The Ascent of Man*, Bronowski standing in the pools of water at Auschwitz, imploring that we “must cure ourselves of the itch for absolute knowledge and power”. The audience is no longer objective about the subject and its implications.

Television also often adopts a sensationalist approach to science communication. As the number of television sets in the UK has risen to over 60 million today, with the average daily viewing time of 3:36 hours, inaccessibility has become

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less of a problem for this powerful vehicle for dissemination of scientific ideas [6].

In fact, science documentaries have a long-standing history on television. In 1952, *Science Review* became the first of this kind and was watched by over 10% of the population. *The Sky at Night* was first presented in 1957 by Patrick Moore and still takes the same format today. It is now Britain’s longest running programme and appears to have conquered one of the main issues facing the science communicator: the interest of the audience. Not only does popular science need to be at a technical level that is accessible to the public, it also needs to excite their curiosity. Moore attributes the success of *The Sky at Night* to the fact that “astronomy is a fascinating subject. You look up... you can’t help getting interested and it’s there” [7]. Given also the amount of competition in the television industry, it comes as no surprise that of primary importance for modern scientific documentaries is the entertainment value. Colourful computer-generated particles, battlefields, drum-rolls and emotive story lines are all for the audience’s enjoyment.

Other documentaries have been less successful than *The Sky at Night* in keeping with their original format. After several attempts to modernise its format, *Tomorrow’s World* was cancelled in 2003 due to falling ratings; the number of



Nanolasers: will futuristic technology keep audiences interested in physics? Reproduced from [13]



The wonder of the Universe. Reproduced from [14]

viewers had dropped from 10 million at its peak of popularity in 1980's to 3 million by 2002. The programme's original presenter, Raymond Baxter, responded to the show's cancellation, "There's a thing in broadcasting... where you have to change things. If it ain't broke, don't fix it" [8]. The format of *Horizon* also changed in the early 90's to adopt a narrative format, much like many other modern documentaries. A problem is posed at the start, and solved within the hour. The scientist becomes idolised as the "genius in our story" [9]; the narrator takes the audience on a journey in which ultimately the mystery is always solved. Gregory and Miller argue in *Science in Public* that "the overriding social message of science on television is that scientists always solve the problem" [10]. This is completely incompatible with the actual scientific process, which involves high-powered theory and slow, precise experiments. Hypotheses are tried, tested, disproved and another one conjured. Results are even stumbled upon in the search of something completely different. Indeed, many scientists believe there is no reason we should be able to answer every question about the universe. This has little impact on accurately conveying scientific theories, but severely limits the layman's understanding of the scientific process.

New Scientist came under criticism from readers over an article, featuring Roger Sawyer's controversial "emdrive", an engine with no moving parts, which generates "thrust purely from electromagnetic radiation". Many readers wrote in to argue that this engine as described contravenes one of physics most fundamental theories, the conservation of momentum. Sawyer replied, "the emdrive concept is clearly difficult to comprehend without a rigorous study or the theory paper." This clearly exemplifies the conflict between making scientific writing both accessible and accurate. These problems are not limited to the written media. The *Horizon*

'Parallel Universes' documentary begins with the narrator stating, "everything you are about to hear is true. At least, in this universe it is." Although this assertion immediately engages the audience, it is rather inconsistent with the scientific process of doubt.

To combat the problems facing science communication, organisations exist to encourage scientists themselves to get involved in public engagement. The Engineering & Physical Sciences Research Council (EPSRC) offer "Partnership for Public Engagement (PPE) Awards" to help fund scientists who communicate research to the public. The Royal Society provides courses in communication skills and media training, and also offer prizes for popular science books.

In a 2006 survey [11], which examined the views of scientists with regard to public engagement, 74% had taken part in at least one science communication activity within the past year, a 18% rise since 2000. Of the "no activity" subgroup, 53% stated they would like to spend more time with the public and only 6% "just did not want to" get involved in any public engagement. These are very positive statistics and show scientists' appreciation for the importance of communication. However, 64% said the need for time researching was stopping them getting more involved. This is an unfortunate conflict with no simple solution. Yet, "researchers are the best people to promote research" [12] and should therefore spend as much time as possible in public engagement.

“The consequences of science can be incredible.”

One of the benefits to science communication is that many research projects receive their funding from the public. It is therefore very much in the direct interest of the scientist to let his/her work and its importance be known to as many people as possible. However, the scientist must also appreciate the wider benefits of science communication. Indeed, they must be trusted members of society as the consequences of science can be incredible; the atomic bomb, climate change and nuclear energy. It is important that these areas are particularly well understood so that informed democratic decisions can be made collaboratively, between scientists and the public. ■

Oliver Pike was a fourth year studying Physics, and has now graduated.

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