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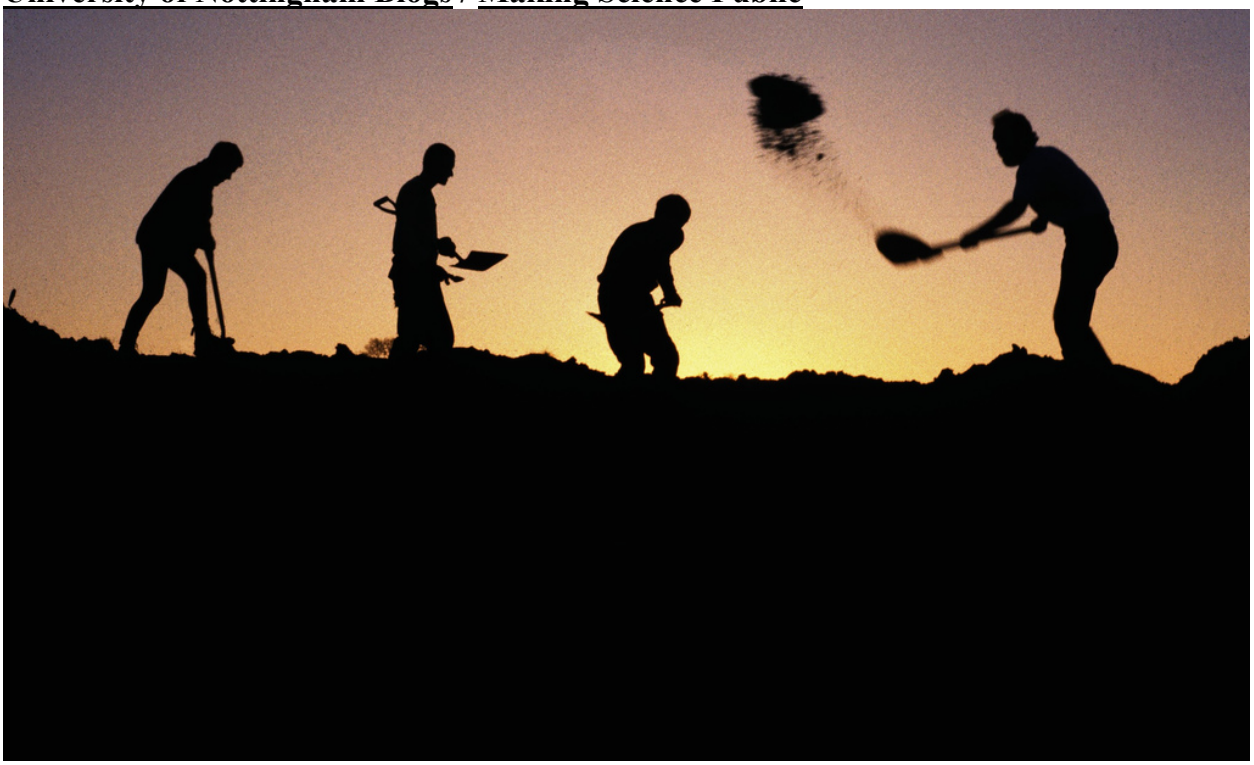

February 25, 2017, by Brigitte Nerlich

# Digging for the roots of the deficit model

According to my twitter feed, the deficit model (also known as the knowledge or information deficit model of science communication or of public understanding of science) has been discussed yet again, this time during the 2017 meeting of the *American Association for the Advancement of Science*, in the midst of current soul searching about facts, knowledge, expertise and communication.
Here is an example: "That notion, referred to as the 'knowledge deficit hypothesis' in academic circles, is problematic, Dr. Scheufele said. It bestows a sort of responsibility and expertise on those in the know to impart knowledge on those who are not, and ignores the fact that the lay public has anything to contribute to the conversation." This covers one basic tenet of the deficit model; that focusing on imparting knowledge from A to B overlooks the fact that B may have some knowledge too.
Another tenet of the deficit model was summarised by "Asheley Landrum, a cognitive scientist at the Annenberg Public Policy Center at the University of Pennsylvania". She "explained in a talk at the AAAS meeting… that 'any public skepticism or negative attitudes toward science is due to the fact that people just don't know enough and that if they only knew more, that they would accept it.'" This is the second tenet: that scientists assume that giving people knowledge makes them accept or support science and that providing more facts about science creates more positive attitudes to science.

This echoes an older, slightly more harshly worded definition (one of many I could quote since the model first appeared on the social science scene in the 1980s): "This model has emphasized the public's inability to understand and appreciate the achievements of science—owing to prejudicial public hostility as well as to misrepresentation by the mass media—and adopted a linear, pedagogical and paternalistic view of communication to argue that the quantity and quality of the public communication of science should be improved." (2008, Handbook of Science and Technology Studies)

# A question of evidence

Since entering the field of Science and Technology Studies (STS) in around 2001, I have often heard about the deficit model and, in a sense, taken its tenets for granted. However, when reading yet again about it, I suddenly asked myself: Where does this 'model' actually come from? On what empirical basis was it 'built'? Who is supposed to have held the views summarised by the model? How was this attribution made? There are now some empirical studies that seem to show that such views can be attributed to some scientists, but where are the studies on which the original deficit model was based 40 years ago?

When I first heard about the model, I remember a lot of finger-pointing and finger-wagging at the 1985 Royal Society Bodmer report and the year 2000 House of Lords report on public understanding of science and on science communication. So I assumed that somebody might have done an analysis of such reports and found that they contained or implied the main tenets of the deficit model, including 'the public's inability to understand and appreciate the achievements of science', for example.

# The Bodmer report

For this blog I have not done a comprehensive textual analysis of reports advocating that scientists talk more about what they do, but I had a quick look at the Bodmer report, as it appeared to be the 'original sin' of public understanding of science. To my surprise I couldn't really find any explicit or implicit endorsement of the deficit model. Here are some quotes:

"More than ever, people need some understanding of science, whether they are involved in decision-making at a national or local level, in managing industrial companies, in skilled or semi-skilled employment, in voting as private citizens or in making a wide range of personal decisions. In publishing this report the Council hopes that it will highlight this need for an overall awareness of *the nature of science* and, more particularly, of the way that science and technology pervade modern life, and that it will generate both debate and decisions on how best they can be fostered." (Italics added; it doesn't say 'content' of science)

"Many personal decisions, for example about diet, vaccination, personal hygiene or safety at home and at work, would be helped by some understanding of the underlying science. Understanding includes *not just the facts of science*, but also *the method and its limitations as well as an appreciation of the practical and social implications*. A basic understanding of statistics including the nature of risks, uncertainty and variability, and an ability to assimilate numerical data are also an essential part of understanding science." (italics added)

Importantly: "Better overall understanding of science would, in our view, significantly improve the quality of public decision-making, ***not*** because the 'right' decisions would then be made, but because decisions made in the light of an adequate understanding of the issues are likely to be better than decisions made in the absence of such understanding." (bold in original)

What does that mean for scientists? The main gist of the report was that scientists have a moral (or civic) duty to communicate: "Given the importance of public understanding of science… scientists as a whole must recognize that they have a serious responsibility to speak to the lay public. Scientists are also democratically accountable to those who support scientific training and research through public taxation. If the public is not told about the scientific research it supports, it is unlikely to worry if the level of support is reduced. It is clearly a part of each scientist's professional responsibility to promote the public understanding of science."

So, one could say that engaging with people and enhancing people's understanding of the nature and the methods of science is part of responsible research (and innovation) and integral to a functioning democracy. So where is the deficit model? As far as I can make out, there was no talk yet in 1985 of dialogue and engagement, but there was also no denigration of 'the public'.

# Postulating the deficit model

This made me curious and I started to read some of the old social science articles (again), in which the deficit model was discussed (some of which I couldn't access, so I am grateful to twitter friends for sending them to me).

Let's start with one of the earliest articles on the matter from 1988. It's by Robin Millar and Brian Wynne and entitled *Public understanding of science: From contents to processes*. The authors briefly refer to the Bodmer

report, but nothing is quoted from the report. Instead a passage from an unrelated book is quoted which provides a convenient bridge to then postulating a 'deficit model'. The book is by J. H. Fremlin: *Power Production: What are the Risks?* (1985).
This is what Millar and Wynne say at the start of their article: "A conventional approach to the 'public understanding' problem (reflected, for example, in the Royal Society's Report on The Public Understanding of Science (1985), and in much of the literature of risk perception) is that it is a problem of getting the public to understand the *contents* of science." (italics added) As we have seen, this is not quite right.
The authors go on to say: "Fremlin (1985), for example, has lamented that: 'It is an extraordinary feature of the long and healthy lives that we now enjoy, that we are worrying more about the dangers of the abundant energy supplies that have made their advantages possible, than we do about the enormously greater and potentially controllable hazards such as those arising from the ordinary things that we eat and drink and breathe. This is not due to public stupidity, but to ignorance fed with well-meant misinformation by ill-informed media avid for the frightening and the horrible. (Preface, p. x)'." Interestingly, the Bodmer report had pointed out that scientists should interact more with the media in order to counteract such hype and that a change in culture was needed within the media.

Following on from this strategically chosen quote taken from Fremlin, the authors then posit the 'deficit model': "Thus, if only the public was properly informed and 'understood' science better people would have a more positive view of what scientists say and do, and this would be reflected in wider popular support (and more generous public funding)." I still hadn't found the empirical foundations of the model though. Then I stumbled across some footnotes…

# PUS meets STS

There is a footnote in a 1993 article by Wynne in which he points out that "[t]he deficit model was a name first given to the conventional approach by Wynne in a draft paper criticizing it, for a workshop in Lancaster in May 1988 of the Economic and Social Research Council- Science Policy Support Group research groups under the phase I Public Understanding of Science Research Initiative." This was the origin of the STS movement, which saw as its main task the critical evaluation of the meaning and purpose of science communication and the public understanding of science (PUS) movement. Still I had not found the empirical foundations for this critique based on rejecting the 'deficit model'.
This is when I saw a footnote in a 2008 chapter by Martin Bauer in which he said: "In the UK, the ESRC funded a research programme 'public understanding of science' from 1987-1990 … with 11 different projects. … I … recall how some members of the research programme were hardly on speaking terms. Curiously, the fault line fell on whether a team would use a numerical or a qualitative protocol for their observations. The later publication (Irwin & Wynne, 1996), that became the summary of this programme, 'excluded' the three projects with numerical data: the survey of the British adult population …, the survey of British children …, and the analysis of mass media reportage of science …". Surprisingly, an overview of the quantitative survey research published in *Nature* in 1989 stated (tentatively) that informants who were better informed about science tended to have more positive attitudes.
John Ziman (physicist and humanist) spoke about the ESRC research programme at the launch of a new journal called *Public Understanding of Science* in 1990 – a journal that became the major outlet for social science research into public understanding of science and science communication. The article was published in 1991.
Ziman talks fondly of the Bodmer report, but then goes on to say that "it was surprising to us how very little serious research had been done on the subject. We did not even have reliable estimates of scale factors, such as what proportion of the public know how much about what sort of science, let alone an understanding of personal factors such as attitudes or of social influences such as education or the media. Thus the plan for a major program of research to follow upon the Bodmer Report was widely welcomed."

He echoes the Bodmer report when he says: "It is quite clearly the responsibility of every scientifically literate person to combat the extreme ignorance of the most elementary scientific facts and theories that we find even among the best educated of our friends and colleagues. Every possible means should be taken to improve the transfer process in the science museum, in the schools, in the media, or wherever." That sounds a bit 'deficit model' to me!

However, he meets up with STS concerns when he points out that "a simple deficit model, which tries to interpret the situation solely in terms of public ignorance or scientific illiteracy, does not provide an adequate analytical framework for many of the results of our research." This probably means that in all that qualitative and quantitative research undertaken between 1987 and 1990, some results indicated that people have rather complex attitudes to science, or as Ziman said: "scientific knowledge is not received impersonally, as the product of disembodied expertise, but comes as part of life, among real people, with real interests, in a real world." Still, I wondered where the deficit model fits into this, as it is not about people per se but only about particular people, namely scientists having rather paternalistic attitudes to people and to communication.

Nevertheless, members of the STS community set out to devise new analytical frameworks that challenged the postulated deficit model (here is some history and reflection by Alan Irwin). As pointed out by Maureen McNeill in 2013: "STS dissatisfactions with the PUS movement consolidated around the characterisation and critique of the deficit model of public understanding of science … [I]nformed by a few celebrated empirical studies, STS scholars articulated their dissatisfactions with the PUS movement by identifying the deficit model of public understanding of science as its conceptual/political core."
One of the celebrated empirical studies was research carried out by Wynne with Cumbrian sheep farmers after the Chernobyl incident in 1986 and published in 1996. And yet, this still did not provide me with any indication of the empirical foundations for postulating the basic tenets of the deficit model at the end of the 1980s. So the search goes on! I might of course have overlooked something. So I would be grateful for guidance, advice and information by people who know much more about this than I do!

# Bodmer revisited

I always believed that the Bodmer report was the trigger for people postulating the deficit model. As we have seen, this might not be the case. While I don't doubt that an increasingly small number of scientists might see providing information from A to B as all there is to discharging what Bodmer called their public duty to communicate science, and while some might still believe that providing facts might lead to public acceptance of science, these two tenets of the deficit model were, as far as I can make out, not integral to the original reports on public understanding of science and science communication. And while I don't doubt that a critique of the postulated deficit model has brought about a useful rethinking of what public engagement with science and public communication about science are and should be, it should not be forgotten that some of this thinking is already contained in the original but often belittled reports.

It should also not be overlooked that, as Bodmer himself pointed out in a 2010 article defending his 1985 report, the social science research funded by the ESRC would never have got off the ground, if it hadn't been for the Bodmer report calling for more engagement with the public on the part of scientists.
And finally, while overcoming the deficit model, wherever it came from, has led to new thinking about science communication and public understanding of science, it has also side-lined one (currently very) important function of science writing, science journalism and science communication, namely to provide access to information, knowledge, expertise and facts. As David Dickson has so memorably pointed out in his defence of the deficit model: "When engaging in an issue of science-related public controversy, both the science communicator and the science journalist in particular have a responsibility to ensure that any publicly-stated position is well grounded in the current state of scientific knowledge." We should not forget that.
Image: Digging in the Dark, Wessex archaeology, Flickr

**Epilogue**

There were some interesting hints on twitter about various possible roots for the deficit model. Jean Goodwin linked it to other mental models of communication; Roger Pielke linked it back to the health belief model and Tim Johnson linked it back to Spinoza.
Roger also points to a passage in the Bodmer report which seems to indicate that there was implicitly talk of a deficit model. I leave it to you readers to interpret this passage in view of the popular renderings of the deficit model I quoted at the beginning of the article: "The public attitudes to science revealed by surveys may be a valuable guide

to the improvement of understanding. Areas of concern and interest, as well as deficiencies in knowledge and understanding, are identified. The contrast between, for example, the support for basic research given by those with more, as compared with less, knowledge of the science, emphasizes the need to explain the extent to which basic research underlies the technological advances of the future. The obvious interest in issues such as energy supply and pollution emphasizes the value of relating the teaching of, and the provision of information about, science to these issues. We recommend, therefore, that the Economic and Social Research Council and other appropriate bodies devise methods of monitoring attitudes to science in the United Kingdom along the lines of the USA National Science Board's Science indicators."