Literature Review: the Sociology of Science

By David K. Levine

Background: Sociological analysis of science recognizes that scientists are individuals forming their own society. There is often a mainstream consensus enforced by social sanctions. Dissidents are ignored or sidelined although they are infrequently but occasionally correct. This is the “essential tension” of science between coherence and authority on the one hand, and individualism on the other. Research in this area focuses on case studies and interviews.

Collins, Harold Maurice, Bartlett, Andrew and Galindo, Luis Reyes 2017. Demarcating fringe science for policy. *Perspectives on Science* 25 (4) , pp. 411-438.

Physics is used as a case study with a particular emphasis on gravitational waves. The discipline's own definition of mainstream is adopted – in this case papers accepted for the “arXiv.” preprint server.

Concerning the social aspect of science: “The normal process of socialisation into a profession, of course, brings with it a tacit sense of what is to be taken seriously. When forced to reflect, gravitational wave scientists provided Collins (2014) with the following justifications for ignoring a published paper which questioned the basis of their work: tacit aspects of style; never heard of the journal; never heard of the author; never come across this article or similar by this author; author has little record of scientific accomplishment; journal and paper are incestuous in terms of author list and citation pattern; typical cranky anti-relativity paper and anti-relativity is past its sell-by date.”

Outside the mainstream is the “hinterlands” or fringe, including parapsychology, creationism and intelligent design, the tobacco and oil lobby, astrology, and to a certain extent fringe archaeology (space aliens).

The fringe has its own community with its own conferences and journals, and the typical age of fringe members is considerably higher than that of contributors to mainstream science. In the fringe there is a readiness to believe that the mainstream rejects fringe ideas as a consequence of conspiracies. Jewish conspiracies are a true but rare indicator of the fringe. Other ideas include the moon landing being faked or the corpses of aliens being stored at Roswell. Engineers, especially electrical engineers are common in the fringe.

Some fringe ideas are not intended to be absorbed into mainstream science. These are called “primarily oppositional.” The goal is not to advance science but to oppose certain findings of science. By contrast “pathological individualism” focuses on the notion of a

scientist in isolation: heterodox and brilliant without recognizing that there must be continuity and coherence in scientific thought. Results are often released independent of peer review or community assessment.

The term “norm-violation” refers to research such as “the so-called ‘research’ purchased by the tobacco and oil lobbies so as to fabricate doubt and create ‘counterfeit scientific controversies’ (Oreskes and Conway 2010; Collins and Weinel 2011). Jewish-conspiracy theories would also fit here but not in a policy-useful way.”

Actual revolutionary science operates differently than the fringe: “for something to be counted as science – say, Joe Weber’s defeated gravitational wave claims (Collins 2004) – the author of the claim should be aiming to preserve as much of existing science as possible. If the work is revolutionary its protagonists should be reluctant revolutionaries aiming to change as few concepts, empirical assumptions and experimental procedures as possible. This does not mean that anyone who wants to modify the institutions of science is consigned to the fringe since we know that some of the institutions, such as peer review, do not work very well.”

The notion of a “sell-by-date” is important: it refers to a topic that was once a subject “of hot debate in the mainstream [that] not been thoroughly defeated by logic or observation but making claims for so long without any breakthrough success that it has ceased to be a matter of concern to the mainstream.”

H.M. Collins and Robert Evans. The Third Wave of Science Studies: Studies of Expertise and Experience. *Social Studies of Science* 32/2(April 2002) 235–296.

This poses the following questions: How do you make decisions based on scientific knowledge before there is an absolute scientific consensus? How to you incorporate important expertise that is not formally accredited?

In many cases – the physics of gravitational waves would be one case – only “core scientists” can legitimately contribute and it is pretty apparent to a reasonably well educated person who they are. There are some interesting examples however. One is from 19th-century Edinburgh where scientists observing brain function were also important figures in Edinburgh politics and political considerations spilled over into the core science.

Consensus (for good or ill) is reached more quickly by the non-specialists in the scientific community. “Core-scientists are continually exposed, in case of dispute, to the counter-arguments of their fellows and, as a result, are slow to reach complete certainty about any conclusion.”

They develop a categorization scheme for types of expertise and levels of expertise. They indicate three levels:

1) No Expertise: That is the degree of expertise with which the fieldworker sets out; it is insufficient to conduct a sociological analysis or do quasi-participatory fieldwork.
2) Interactional Expertise: This means enough expertise to interact interestingly with participants and carry out a sociological analysis.
3) Contributory Expertise: This means enough expertise to contribute to the science of the field being analysed.

The case study of Cumbrian sheep farmers is quite interesting in illustrating many of the ideas.

> Brian Wynne's study of the relationship between scientists and sheep farmers after the radioactive fallout from the Chernobyl disaster contaminated the Cumbrian fells. Wynne found that the sheep farmers knew a great deal about the ecology of sheep, and about their behaviour (and that of rainwater) on the fells, that was relevant to the discussion of how the sheep (and the fells) should be treated so as to minimize the impact of the contamination. Since the Windscale-Sellafield plant was built soon after World War II, the farmers in the locality had long experience of the ecology of sheep exposed to (radioactive) waste. The farmers have all the characteristics of core-group experts in terms of experience in the ecology of hill sheep on (mildly radioactive) grassland, even though they had no formal qualifications. In our terms, the farmers had contributory expertise which in some respects exceeded that of scientists working for the relevant government department.
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> The scientists, however, were reluctant to take any advice from the farmers. Now, for the farmers to have contributed to the science they would not have had to engage in a symmetrical conversation with the scientific experts – all that would have been necessary was for the scientific experts to try to learn from the farmers. This seemingly trivial point helps us to understand what expertise is, but also points out where the social location of change needs to be. The normative point that follows is that the body of expertise that should have emerged in respect of Cumbrian sheep was a combination of the separate contributory expertise possessed by the scientists and the farmers. The scientists' expertise was not at risk of being displaced by that of the farmers; it was, or should have been, added to by that of the farmers. Should the situation have been symmetrical, it might have been an arbitrary matter whether the farmers' expertise was absorbed by the scientists or the scientists' expertise was absorbed by the farmers, but it was not symmetrical. To produce the optimum outcome, the scientists needed to have the interactional expertise to absorb the expertise of the farmers. Unfortunately, they seemed reluctant either to develop or to use such expertise.
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> ...the Cumbrian farmers might well have had more success in their dealings with the scientists from the UK Ministry of Agriculture, Fisheries and Food (MAFF) and from British Nuclear Fuels Ltd (BNFL), if their concerns were mediated by a

> Green- peace scientist, a Brian Wynne, or the like. Clearly such an individual would need to be briefed by the farmers about what the certified scientists were doing wrong, but such a person may have been able to phrase the problem in ways more familiar to the scientists, making it more credible (or less resistible). This problem was recognized by AIDS treatment activists in the USA, who found that they had to learn the language of science if they were to represent the interests of the wider community within the clinical trials process.

This raises the issue of what it takes to manage a scientific project. It does not require "contributory expertise in the sciences in question, but experience of contributory expertise in some related science. In other words, the managers must know, from their own experience, what it is to have contributory expertise; this puts them in a position to understand what is involved in making a contribution to the fields of the scientists they are leading at one remove." For a non-expert evaluating an expert:

> Does the author of a claim seem to have integrity? Is the author of a claim known to have made unreliable claims in the past? There are also secondary features of a claim itself that can be judged with only minimal scientific understanding: Is a claim internally consistent or inconsistent, or consistent with other claims made by the same person? Does the claim seem so self-serving as to give concern?
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> The crucial judgement is to "know" when the mainstream community of scientists has reached a level of social consensus that, for all practical purposes, cannot be gainsaid, in spite of the determined opposition of a group of experienced scientists who know far more about the science than the person making the judgement. This ability is gained through membership of what the Guardian newspaper calls the 'chattering classes'.

They also present a strong viewpoint about scientists speaking "out of school."

> The idea that scientists have special authority purely in virtue of their scientific qualifications and training has often been misleading and damaging. Scientists, as scientists, have nothing special to offer toward technical decision-making in the public domain where the specialisms are not their own.
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> one big mistake that has been made in the past is to exaggerate the importance of the referred expertise of the wider community of scientists. At the very outset...we noted that in the 1950s scientists were often attributed with authority to speak on subjects outside their narrow area of specialization. The Second Wave has shown how dangerous it is to take this kind of referred expertise at face value, since the pronouncements of the wider scientific community are nearly always based on simplified and retrospectively constructed accounts of the scientific process. Quite simply, scientists' supposed referred expertise about fields of science distant from their own is nearly always based on mythologies about science, rather than on science itself...Organizations such as the UK

> Committee on the Public Understanding of Science (COPUS), in its first incarnation, and many self-appointed scientific spokespersons, by making science as a whole the focus of their campaigns, have oversold it; it is the work of specialists, not generalists – not the whole scientific community – that should be the focus of campaigns to raise the status of science. Of course, the former type of campaign treats science as a world view – competing with religion and the like – and therefore is accompanied with the thrill of zealotry, or what might be called 'scientific fundamentalism'; the latter type of campaign would be a comparatively mundane enterprise, stressing experience and professionalism rather than priestly virtues.

They present several examples of misleading public demonstrations apparently showing one thing while experts saw the opposite. "What the public saw was that the flask did survive the spectacular crash with its integrity unscathed...according to other experts, the train crash could not be taken to imply the safety of the method of transport because of certain special features of the test whose significance was evident only to the expert eye. These included the absence of the railway lines beyond the point of impact, and the removal of the wheels of the wagon on which the flask was placed: the lines could have penetrated the flask had they been there, and the wheels could have dug into the ground, enhancing the impact."