

See discussions, stats, and author profiles for this publication at:  
<https://www.researchgate.net/publication/261947867>

# The Mobilization of Scientists for Public Engagement

Article *in* Public Understanding of Science · February 2011

DOI: 10.1177/0963662510394457

---

CITATIONS

45

READS

747

2 authors, including:



[Martin W Bauer](#)

The London School of Economic...

**113** PUBLICATIONS **4,166** CITATIONS

[SEE PROFILE](#)

# Public Understanding of Science

<http://pus.sagepub.com/>

---

## **The mobilization of scientists for public engagement**

Martin W. Bauer and Pablo Jensen  
*Public Understanding of Science* 2011 20: 3  
DOI: 10.1177/0963662510394457

The online version of this article can be found at:  
<http://pus.sagepub.com/content/20/1/3>

---

Published by:



<http://www.sagepublications.com>

**Additional services and information for *Public Understanding of Science* can be found at:**

**Email Alerts:** <http://pus.sagepub.com/cgi/alerts>

**Subscriptions:** <http://pus.sagepub.com/subscriptions>

**Reprints:** <http://www.sagepub.com/journalsReprints.nav>

**Permissions:** <http://www.sagepub.com/journalsPermissions.nav>

**Citations:** <http://pus.sagepub.com/content/20/1/3.refs.html>

>> [Version of Record](#) - Feb 2, 2011

[What is This?](#)

# The mobilization of scientists for public engagement

Martin W. Bauer and Pablo Jensen

## 1. Introduction

The phrase “public understanding of science” carries a double meaning; the public’s understanding of science on one hand, and the mobilization of scientists and other resources to engage the public with science on the other. The two are linked, with the former providing context, outcome or observation, and the latter action, process, or social movement. The social movement aspect of mobilizing resources and public goodwill (see McCarthy and Zald, 1987) for science, otherwise known as public engagement activities (PE) has taken different formats and is played out in very different contexts across the globe.

Over the years *Public Understanding of Science*, and other journals for that matter, have published papers that describe and evaluate such activities. In recent years, the term public engagement has taken the specific meaning of communicative action, to establish a dialogue between science and various publics. Many research papers have justified this dialogical PE vis-à-vis other formats of science communication (see Bucchi and Neresini, 2008; Einsiedel, 2008), presented innovative formats and their organizational implications (e.g. Burgess et al., 2007), analyzed the constructions of “publics” that occur in these events (see Braun and Schulz, 2010; Lezaun and Soneryd, 2007), explored how to evaluate their impacts and consequences (see Rowe and Frewer, 2004), and increasingly reflect critically on this activism of public relations for science (e.g. Rödder, Franzen and Weingart, 2011). One could say that in many countries a new sector of the culture industry has developed whose specialty it is to engage the public with science: visible scientists, science communicators, science journalists, popular science writers, museum curators and interpreters, press office and public relations professionals, and others. Some of these activities are conducted by university and research institutes with dedicated functions, others are in the hands of an emergent sector of small businesses.

This special issue addresses these public engagement activities (PE) from a particular angle; we focus on the **mobilization of scientists**. We ask: to what extent are scientists involved in these PE activities? What proportion of the scientific person-power is mobilized in this manner? We investigate intensity, e.g. identifying occasions when active scientists take part, and the proportion of scientists that take part in any such events. The papers will compare intensities across contexts, and try to explain them by motives of scientists and by institutional factors. For this purpose, our definition of public engagement (PE) is broad and generic, and includes all forms of communication with non-scientific audiences (see below).

One of the purposes of the Royal Society’s internationally influential report of 1985, *The Public Understanding of Science*, has been to mobilize the scientific community to go out and

talk to the mass media and directly to a wider public about their research, and to elicit enthusiasm in the community for scientific research. The extent to which this mobilization of bench scientists has evolved over the last 25 years is the focus of this special edition of PUS and the five papers that follow.

## 2. What are public engagement activities?

PE activities include a wide range of activities such as lecturing in public or in schools, giving interviews to journalists for newspapers, radio or television, writing popular science books, writing the odd article for newspapers or magazines oneself, taking part in public debates, volunteering as an expert for a consensus conference or a “café scientifique,” collaborating with non-governmental organizations (NGOs) and associations as advisors or activists, and more.

Clearly, there is no entirely satisfactory definition of public engagement. As Stephen Hilgartner (1990) and others have argued, PE or “popularization” lies in fact on a continuum of communicative genres from arcane technical laboratory discussions on the one end, via conference presentations, and published literature, to lectures and writings for wider audiences outside the peer group on the other end, with no clear “cut” indicating where “science” ends and “popularization” or PE begins. Popularization activities are defined by scientists themselves who address and reach a wider and non-specialized public. This vague definition makes the categorical distinction a discursive resource for self-serving purposes: if the outreach activity serves the scientists it is just “good communication,” if it does not, or if it involves anti-scientific undertones, then it is called “popularization,” with a pejorative connotation. This ambivalence in the definition of PE activities allows scientists to police the boundaries of science/society flexibly and with their own interests in mind.

One might even argue that we are dealing not with a single continuum, but with a two-dimensional field, where one axis represents genres of science communication that mobilize support for science, while the other axis represents genres of popularization that mobilize resistance against particular developments (Bauer, 1994). This allows us to distinguish two streams of knowledge, one as the extension of science into society, the other a function of societal forces that challenge the authority of the science of the day, so-called social representations or “civic epistemologies.” One might be able to locate in this 2D plane the manifold activities of science education, classical outreach, vulgarization, popularization, public information and attention management, and more dialogue oriented public participation practices such as consensus conferences or public hearings. Each of these activities has its own history and contextual meaning, and it would sideline our present purpose if we were to try to clarify the differences in format, motives and attitudes towards the public that define these different activities. The above mentioned handbook entries help to shed light on these semantic and pragmatic differences.

For our present purpose, we do not privilege any of these PE activities, nor distinguish clearly between them in order to get an overall sense of the intensity of mobilization. Each of the papers that follow will operationalize PE in its own terms, but mainly leave it to scientists themselves to declare their doings in the context of accounting.

## 3. Previous research on levels of scientists’ public engagement

Everyone working in scientific research seems to have their own views of popularization practices. It is not uncommon to hear views such as “it’s always the same people that get down to

it” or “young researchers are more open to popularization” among the researchers in scientific laboratories. There have been very few studies that assess the level of PE activities among scientists. Among these is a statistical and qualitative analysis on the “Role of researchers in scientific popularisation” never published (Kunth, 1992), a study on popular science publishing in Norway (Kyvik, 1994) and a qualitative study on CNRS researchers (de Cheveigné, 2000). Recently, a survey study on “the factors affecting scientific communication by researchers and engineers” was conducted by the Royal Society on a sample of more than 1000 researchers and engineers in the UK (see below). For the United States, a report by the National Science Foundation “Science and Technology: Public Attitudes and Understanding” (NSF, 2004) merely states that “A recent poll of scientists found that 42 percent engaged in no public outreach. Asked why, 76 percent said they did not have time, 28 percent did not want to, and 17 percent did not care.” Another survey (Hartz and Chappell, 1997) on the relations between researchers and journalists questioned 670 US scientists, mostly physicists (59 per cent) and biologists (32 per cent). Twenty-six per cent declared they have never been interviewed nor have they written any articles for the general public, 45 per cent of them do so less than once a year, 14 per cent once a year, 16 per cent more than once a year.

A recent study investigated the factors that predict scientists’ intentions to participate in public engagement (Poliakoff and Webb, 2007). With a questionnaire distributed to academic staff and postgraduates, they found that many scientists avoid PE activities with the following reasons: they have never participated in the past (a result consistent with Jensen and Croissant, 2007), they display a negative attitude towards participation (it is seen as “pointless” or “no fun”), they feel a lack of skills, and they do not see colleagues participating which for them indicates the irrelevance of these activities. Notably, neither shortage of time nor career recognition is seen as an important determinant of participation.

In 2006, a consortium of Research Councils UK, the Wellcome Trust and the Royal Society of London sponsored a research project that tried to establish the intensity with which UK bench scientists are engaged in activities outside their immediate scientific community (see Bhattachary, 2006); 1485 research scientists in UK higher education institutions, about 40 per cent funded by public research councils, were interviewed on 39 questions. Among other things, they were asked (Q7) “Thinking about public engagement with, and communicating about, science, roughly how many times in the past 12 months have you done each of the following?” (none, once, 2–3, 4–5, more than 5 times). The responses in descending order of frequency of “once or more” were as follows: participated in open days (54 per cent), public lecturing (40 per cent), active in policy making (33 per cent), engaging primary and secondary school teachers (30 per cent), popular writing such as books (25 per cent), engaging with newspapers (23 per cent), NGO activity (23 per cent), taking part in a debate (20 per cent), working on science museum exhibitions (13 per cent), judging competitions (13 per cent), taking part in radio programmes (12 per cent).

We undertook a secondary analysis of these data, and find that these activities can be grouped in the following manner, supported by a hierarchical cluster analysis. Engaging with primary and secondary teachers goes together with public lecturing and participating in open days. Those who are active in policy making are also active with NGOs. Those who work on museum and science centre exhibitions are also likely to engage in public debates and serve as jury members on competitions. Who works with newspapers is also working with radio and in popular science book publishing.

Considering all these answers, the data allow us to conclude that 75 per cent of respondents have engaged in at least one of ten activities (disregarding reported involvement on “open days” as this would unduly inflate this ratio), and about 10 per cent can be regarded as “highly active” (i.e. 5 and more different activities). Scientists reported involvement on average in three different activities; the median is two activities on a maximum of 11.

Table 1 shows a reanalysis of these data with a statistical model predicting PE versus no PE (on the left hand side) and high versus low levels of PE activities among those scientists who declare such activities (on the right hand side). The predictor variables are seniority (comparing senior colleagues against less senior ones), biological age (comparing those above against those below 40 years of age), research assessment exercise (RAE) results (comparison units with 5\* against units with 5 or less), job age (comparing those with more against those with 15 or fewer years on the job), status (comparing researchers without against researchers with teaching responsibility), the support offered by the institution for doing public engagement (comparing no against yes), and the UK regions where the researchers work (comparison all regions against Wales).

The results are pretty clear cut. Three institutional factors determine the PE activities: senior researchers are three to four times more likely to engage with the public than their juniors; and those who do mainly research are 55 per cent less likely to engage the public than those who do research and also teach. In terms of regional differences, researchers in Wales report the highest level of engagement; in all other regions, particularly in the Midlands, researchers are less likely to engage with the public. The smaller than expected number of observations in the model arises from missing values.

Considering the factors that make a difference for being intensely active in public engagement, seniority again stands out. Sex, biological age, age on the job, support from colleagues, last RAE results or geographical region makes no difference. What appears to be higher level of engagement in London, the South and the North, is not statistically assured. Receiving research funding from different research councils also does not make any difference, except for those few natural scientists who are funded by the ESRC (Economic and Social Research Council) – they are 10 times more likely to do PE (not included in the model). As the survey did not include social scientists per se, this group most likely comprises those natural scientists who collaborate with social scientists on “PE projects.” We can assume that these scientists are engaged with interdisciplinary research on for example genomics or nanotechnology joint ventures between social and natural scientists. Within the survey these are the “leaders” in PE, far ahead in intensity than everybody else.

**Table 1.** Binary logistic model of PE activities in the UK 2006

Category (comparator)	PubEngage yes or no		PubEngage hi or lo	
	Exp(B)	%odds	Exp(B)	%odds
Grade (Junior)	4.761**	376	3.602**	260
Age (less than 40 yrs)	0.979	-2	0.699	-30
RAE (score 1-5)	0.802	-20	1.322	32
Job age (less than 15 yrs)	1.569	57	0.702	-30
Status (research+teach)	0.455**	-55	0.686	-31
Support (yes)	0.833	-17	0.967	-3
Regions (Wales)				
London	0.540	-46	1.087	9
South	0.401	-60	1.570	57
Midlands	0.288*	-71	0.627	-37
North	0.479	-52	1.322	32
Scotland	0.611	-39	0.696	-30
Constant	7.207**		0.109**	
N	785		578	
Nagelkerke	0.141		0.174	

Significance level: \* < 0.05; \*\* < 0.001.

#### 4. Hypotheses on scientists' public engagement

In the following, we will present five papers that ask these and other questions in very different contexts: in France, Spain, Argentina, comparatively for EU research institutions and across a global survey of scientists in different fields and countries. All papers investigate the intensity and type of scientists' PE activities. To introduce the five papers in this special edition we formulate nine hypotheses that are under investigation and open the field for further research on the mobilization of scientists for public engagement.

H1: Scientists live in a "golden cage" and see no need to engage publicly.

Torres-Albero et al (this issue) coined the term "trapped in a golden cage" to characterize the situation of scientists in Spain, who see no need for public engagement because there is little public demand for it. Data from 15 countries, however, show that a significant fraction of their scientists are involved in PE activities, but with large variations: for example about half of French CNRS scientists will probably never engage the wider public (Jensen, this issue).

H2: PE activities are different in kind and intensity for scientists working at the centre of the scientific world from those working in the periphery.

One would expect differences across national scientific cultures. Bentley and Kyvik's report on a global survey (this issue) will throw light on these differences. It seems reasonable to assume (Torres-Albero and colleagues, this issue) that differences in PE can relate to differences in the proportion of the population interested in reading about advances in science and technology, which varies among countries. However, Argentina is the most active in PE but amongst the lowest ranking countries in average science literacy amongst high school students (Bentley and Kyvik, this issue). Kreimer, Levin and Jensen (this issue) addresses the more specific question of centre and periphery of the scientific world by comparing the patterns of PE among scientists in Argentina with those in France. What he finds seems surprising: there are no major differences in the patterns of engagement, nor in the attitude of researchers. The argument leaves open whether both centre and periphery are well represented with these countries in the comparison. Argentina is probably better characterized as semi-periphery, where the exchange of culture with the centre is fairly intense and has always been. Future research on this hypothesis might focus on a sharper contrast, for example considering scientific communities in Africa or Asia.

H3: PE activities follow the institutional hierarchy. PE is the activity of senior members of scientific institutions.

This hierarchical expectation can be traced as far back as the French study conducted by Boltanski and Maldidier (1970) in the 1960s. They found that the intensity of PE activities of French scientists was directly related to the position in the institutional hierarchy: the more senior, the more active. This observation is confirmed by the above mentioned UK study forty years later: seniority is the most robust predictor of both PE and PE intensity. Jensen (this issue) will further explore this hypothesis on the data of CNRS researchers over several years, and similar observations are made by Kreimer, Levin and Jensen in Argentina and by Torres-Albero and colleagues in Spain (this issue).

H4: PE activities reflect a pattern that is specific to particular scientific disciplines.



Clearly, one would expect that PE activities are not equally distributed across scientific disciplines. We recognize easily that some disciplines, for example astronomy, have a long tradition of outreach and “citizen science” through popular astronomy clubs. The studies on Argentina and France suggest that social scientists and astrophysicists may be the most active in PE, while chemists and biologists rank last. It is still an open question for further research, whether public controversy over contested areas of development such as nuclear power, genetically modified crops, or embryonic stem cell research, encourages or discourages scientists to get involved in PE activities.

H5: PE activities have generally increased in the world of science.

There are very few if any longitudinal data on PE intensity anywhere. The exception is France, where the CNRS annual reporting procedures allow us to establish a time series of PE activities. Jensen (this issue) will report on how things have and have not changed in France over the last 20 or more years.

H6: PE activities mark more apparent than real change in the culture of scientific research institutions.

Since the rallying call of institutions like the Royal Society of London (1985) to engage the mass media and again the House of Lords (2000) to engage the wider public to pre-empt or overcome any crisis of confidence that might emerge in society vis-à-vis science, to pronounce in support of PE activities is seen as virtuous, and not only in the UK. And many young and older scientists are trained or offered training to engage with the mass media, and invited to take part in consensus conferences and other PE events. However, it remains unclear to what extent PE remains a personal choice, or has become a normative part of the organizational culture of research institutes and laboratories across Europe. Neresini and Bucchi (this issue) set out to investigate. They developed an instrument with which they can rate the PE culture of a scientific laboratory from their web appearance and interviews with members of staff. The preliminary result is disappointing: there is little evidence for a widespread PE culture in European research institutions. Public engagement remains a marginal call. However, the instrument and data stream that warrants this claim is still under construction.

H7: There is a trade-off between doing research and doing PE; scientists that do the one, do less of the other.

Bentley and Kyvik (this issue) presents a 13 country comparative study which shows that, while popular publishing is an elite activity correlated with rank, it is also related to productivity in peer-reviewed scientific publishing. The positive correlation between PE and academic publishing is confirmed by the study on several thousand CNRS scientists (Jensen, this issue). There seems to be no trade-off between PE and scientific publishing across all these countries.

H8: There is a trade-off between PE activities and career prospects: PE is not conducive to a scientific career.

Weingart (1991) argued that a distance between science and society is a prerequisite of trusted knowledge production in society. Scientific knowledge is certified by reputation among peers, while popularization helps to acquire media prominence through public attention. It



can be considered systemically functional, that the scientific community does not look favourably on any substitution of peer reputation by media prominence on the career path. Public attention does not seem to be equivalent to peer reputation. Many writers concerned with the level of PE of scientists wonder about institutional and normative barriers that might discourage such activities. A key variable is the recognition that PE activities might or might not get for the career development of young scientists; or any indication that scientists with PE activities are punished in their career aspirations. Jensen (this issue) demonstrates on the example of France's CNRS that PE activities remain an elite occupation that is largely neutral with regard to career prospects.

H9: The structure of PE has shifted from predominantly outreach to predominantly dialogical formats.

Clearly PE activities are not only a matter of intensity, but it is also important to see whether the distribution of formats that are undertaken by scientists is shifting over time. The papers that follow have little to say about this issue, because as we will see longitudinal data are hard to come by, and because the classification of activities is not well defined as yet. The shift from outreach to dialogical formats is a common opening trope in research papers: "... in recent years we have seen a shift from deficit oriented to more dialogical formats ..."; it remains, however, a claim that is never really demonstrated. This is clearly an open question for future research. Reading the five papers will leave many questions open but more clearly defined, which is the very purpose of such a special issue on a novel topic.

## 5. Infrastructure issues for future research

To end our introduction we now want to raise three focal issues. Resolving these issues constitutes an intra-structure investment for research in this area. Future research on the comparative levels of PE activities has to address these issues to make significant progress.

### *a) The need for robust comparable data on PE activities*

It would be interesting to compare CNRS statistics with those of the other studies. But this is not straightforward because of differences in data collection, the questions asked and definition of the populations. CNRS's PE data are documented in the annual activity reports of each individual researcher, which is actuarial statistics; while most other studies are questionnaire and interview studies. It is likely that for example mail surveys of PE activities produce a sampling bias, because those who respond pay attention and are more likely to be engaged scientists. Also, one must expect that in a climate where PE activities are seen as virtuous in the research culture, questionnaire data can overestimate the level of activity owing to a social desirability bias.

Another difficulty of comparison arises from defining the sampling populations and sampling frames used. What kinds of scientists are included or excluded? Some studies include social sciences and humanities, others do not; some include clinical researchers in biomedicine, others do not.

Lastly, studies use different techniques to measure PE activities, rating scales such as "no activity, some activity and much activity," or lists of activities engaged in over the last 12 months (Royal Society; Spain; Argentina), or open questions with regard to such activities

(CNRS). Strictly speaking these different data elicitation techniques are difficult to compare directly. For example a universally defined, or at least locally consistent, list of PE activities is necessary in order to demonstrate trends in the structure of PE activities such as the shift from outreach to dialogical formats which is so often claimed but not supported by any evidence.

Clearly, it is desirable to co-ordinate future studies on the mobilization of scientists to be comparable on all of these elements: definition of the population, sampling procedure, lists of PE activities considered, and formats of intensity indicators. As a first step in that direction, and adopting the example of CNRS, Argentina's CONICET has recently decided to include a section on popularization and PE activities on its scientists' annual report.

#### *b) Surveying individuals as well as institutions*

PE activities must be assessed at the level of individuals and at the level of institutions (see Neresini and Bucchi, this issue). Although relying on the enthusiasm of individual scientists, PE activity is a feature of the organizational culture of a laboratory or a research institute. And this developing culture can either encourage or discourage PE activities through the allocation of resources and the recognition and celebration of outreach efforts, or through the undermining of individual motivation for PE activities. To understand and monitor the effects of institutional learning on individual behaviour, data on both levels should be available.

#### *c) Routine monitoring of PE activities*

From the point of view of the present purpose of comparing the levels of mobilization of different sciences, and asking whether these have changed over time, the lack of comparable data is frustrating. Hence, a regular, bi-annual or tri-annual audit of PE activities of the scientific community is clearly desirable, and efforts to that effect should be encouraged on a global scale. Such a commitment to monitoring would allow us to systematically measure the resource inputs that go into PE activities and relate such inputs to outcomes that still need to be defined. It is quite possible that research evaluation exercises like the one planned in the UK for 2013, which includes an "impact assessment" as one of its criteria, will bring about an institutional audit of PE activities.

However, what is desirable from the researcher's point of view of having good and regular data, will be balanced against its direct and indirect costs. It is quite likely that a drive to demonstrate high levels of PE activities changes the nature of the game of PE from a voluntary activity to a normative feature of the job, and this might change the quality of the PE activity. A psychologically well-known phenomenon might occur: the intrinsic motivation to engage the public because it is fun or part of a personal ethos is crowded-out by institutional incentives and defined duties that are set by institutional commitments. This might lead to unintended consequences, for example in the proliferation of pseudo-PE activities where the public is not informed, nor educated nor involved in dialogue, but the subject of tick-box pro-forma activities or purely symbolic PE rituals without any consequences. Here various types of research will be needed to identify the unintended consequences of what otherwise might have been good intentions.

Beyond quantitative monitoring, it will be important to foster a reflexive attitude on PE, and PUS research has its role to play in this, pushing scientists to think about their activities, their implicit vision of the public and the interactions between science and society.

## References

- Bauer, M. (1994) "Popular Science as 'Cultural Immunisation': The Resistance Function of Social Representations," in P. Guareschi and S. Jovchelovitch (eds) *Textos en Representacoes Sociais*, pp. 229–59. Petropolis, Brazil: VOZES. (12th edn 2010.)
- Bhattachary, D. (2006) *Science Communication Excellence: Survey of Factors Affecting Science Communication by Scientists and Engineers*. London: Royal Society, RCUK, & Wellcome Trust.
- Boltanski, L. and Maldidier, P. (1970) "Carrière scientifique, morale scientifique et vulgarisation," *Information sur les sciences sociales* IX(3): 99–118.
- Braun, K. and Schultz, S. (2010) "'A Certain Amount of Engineering Involved': Constructing the Public in Participatory Governance Arrangements," *Public Understanding of Science* 19(4): 403–19.
- Bucchi, M. and Neresini, F. (2008) "Science and Public Participation," in E.J. Hackett, O. Amsterdamska, M. Lynch and J. Wajcman (eds) *The Handbook of Science and Technology Studies*, pp. 449–72. Cambridge, MA: MIT Press.
- Burgess, J., Stirling, A., Clark, J., Davies, G., Eames, M., Staley, K. and Williamson, S. (2007) "Deliberative Mapping: A Novel Analytic-Deliberative Methodology to Support Contested Science-policy Decisions," *Public Understanding of Science* 16(3): 299–322.
- de Cheveigné, S. (2000) Report on CNRS scientists' popularization activities, unpublished, private communication.
- Einsiedel, E. (2008) "Public Participation and Dialogue," in M. Bucchi and B. Trench (eds) *Handbook of Public Communication of Science and Technology*, pp. 173–84. London: Routledge.
- Hartz, J. and Chappell, R. (1997) "Worlds Apart: How the Distance between Science and Journalism Threatens America's Future," URL (accessed 30 October 2010): <http://www.freedomforum.org/publications/first/worldsapart/worldsapart.pdf>
- Hilgartner, S. (1990) "The Dominant View of Popularization: Conceptual Problems, Political Uses," *Social Studies of Science* 20: 519–39.
- House of Lords Select Committee on Science and Technology (2000) *Science in Society: 3rd Report of Session 1999–2000*. London: HM Stationery Office.
- Jensen, P. and Croissant, Y. (2007) "CNRS Researchers' Popularisation Activities: A Progress Report," *Journal of Science Communication* 6(3), URL: <http://jcom.sissa.it>
- Kunth, D. (1992) "La place du chercheur dans la vulgarisation scientifique," Rapport CNRS. URL: [http://sciences-medias.ens-lsh.fr/scs/article.php?id\\_article=276](http://sciences-medias.ens-lsh.fr/scs/article.php?id_article=276)
- Kyvik, S. (1994) "Popular Science Publishing," *Scientometrics* 31(2): 143–53.
- Lezaun, J. and Soneryd, L. (2007) "Consulting Citizens: Technologies of Elicitation and the Mobility of Publics," *Public Understanding of Science* 16(3): 279–97.
- McCarthy, J.D. and Zald, M.N. (1987) "Resource Mobilization and Social Movements: A Partial Theory," in M.N. Zald and J.D. McCarthy (eds) *Social Movements in an Organizational Society: Collected Essays*, pp. 15–48. New Brunswick, NJ: Transaction Books.
- NSF (2004) "National Science Board: Science and Engineering Indicators," URL (accessed 30 October 2010): <http://www.nsf.gov/statistics/seind04/pdf/c07.pdf>
- Poliakoff, E. and Webb, T.L. (2007) "What Factors Predict Scientists' Intentions to Participate in Public Engagement of Science Activities?," *Science Communication* 29: 242–63.
- Rödder, S., Franzen, M. and Weingart, P. (eds) (2011) *The Sciences' Media Connection: Communication to the Public and its Repercussions*. Sociology of the Sciences Yearbook. Dordrecht: Springer.
- Rowe, G. and Frewer, L. (2004) "Evaluating Public Participation Exercises: A Research Agenda," *Science, Technology and Human Values* 29: 512–56.
- Royal Society (1985) *The Public Understanding of Science*. London: Royal Society.
- Weingart, P. (1991) "The Loss of Distance in Transition," in G.E. Allen and R.M. MacLeod (eds) *Science, History and Social Activism: A Tribute to Everett Mendelsohn*, pp. 167–84. Amsterdam: Kluwer Academic Publishers.