Ten Big Questions on Public Engagement on Science and Technology: Observations from a Rocky Boat in the Upstream and Downstream of Engagement

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Ten Big Questions on Public Engagement on Science and Technology: Observations from a Rocky Boat in the Upstream and Downstream of Engagement

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Abstract

That good public engagement on contentious science and technology applications leads to better product and policy outcomes is fairly easy to get an agreement on. But as to what good engagement in this area actually looks like in practice – that isn't so clear. This paper offers an overview of observations that raise some question about science and technology engagements that need to be better addressed in both theories and practices.

Keywords: Public Engagement, contentious science and technology, best practice

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Public engagement can be undertaken for many reasons, varying from seeking better market intelligence, obtaining better inputs to policy, gaining a better understanding of public concerns and aspirations, seeking information from the public rather than those who seek to represent the public, or for simply seeking guidance on technology futures for research and development that are most likely to be accepted by the public.

Also, as many enabling technologies (nanotechnologies, stem cells, genetic modification etc) are increasingly becoming the focus of public concerns, unless the causes of these concerns and the factors driving them are better understood, new and contentious technologies may well face public rejection. This can be diminished by good public engagement processes that can lead to improved public input to policy, research and product development, as well as to diminishing concerns about products and processes using new technologies, when those products and processes meet community needs.

Underpinning most engagement is, or should be, the belief that in a democracy, citizens should have a say in decisions about technological developments that will significantly affect their lives (Powell & Collin, 2008). But with this as the goal, do we sometimes get lost in the methodologies, forgetting that citizens – all citizens – should also have a say in how they want to be engaged with?

That is our first big questions about public engagement – what do the public make of it all – or more specifically, are the ways we test and measure public responses to new technologies an accurate reflection of how the public actually consider them?

Any discussion of public engagement with new and contentious technologies sooner or later comes back to the poster child of GM crops and foods. It is invariably seen as a case of too little too late. GM foods can be typified as a technology that was developed before being presented to the public – who it turned out didn't especially want that technology. The reasons for this are many, and often more complex than the descriptions given, but can be summed up as: the public were being given a technological solution to a problem that they did not really see as being their problem. In addition, they were being asked to take whatever risks might be related to GM foods, but all the benefits were

going to others – predominantly the crop companies and farmers.

Imagine how different the GM debate might have played out, and the types of GM crops we would have seen developed, if researchers had held early discussions with members of the public over what might be their preferred applications of gene technology. It is highly likely that we would have seen small niche crops with high value-add, such as pharmaceuticals being grown in non-food plants in greenhouses, rather than GM broad acre crops with herbicide resistance.

We could hold those debates now, but we will never really know how it might have played out in actuality, as any discussions of GM foods will be forever framed around the way that GM foods were introduced into society. And this raises our second big question – how many of our engagements are too much after (or too much before) the fact – obtaining interesting results that might not bear enough similarity to the way that public conversation might be held?

For nanotechnology, which is the current star of S&T public engagement – attracting significant funding and therefore significant research – there is still time to get it right. Nanotechnologies are still emerging, as are public attitudes, which will continue to form as more sections of the public become more aware of nanotechnology and its risks and potentials, and are then able to articulate their thoughts and feelings about the impacts of nanotechnology (both good and bad).

There is a risk, however, of too much too early, as awareness of nanotechnologies and its impacts are still relatively low (though rising), and many engagement activities have to either force a construct of the issue, or recruit from the small sections of the public with high awareness and interest.

Ideally, good engagement would go something like this, in a simplified model: a scientist develops a new process or innovation, and before applying it he or she has a discussion with the community that will be most affected by it, as to how they would like the technology to be developed and used. They discuss, in clear and reasoned ways, what types of applications should have resources put into them, and what types of products should be developed. Then, with a firm understanding of public support or rejection, or preferred direction of further research, capital for development is easier to acquire, and products are developed,

and the public, the scientists, and developers are all happy with the outcomes.

In reality, it tends to go a little like this though: a scientist develops a good idea and then hunts around for a use for that idea, focusing on areas most likely to attract development and commercialization funding. When the idea is eventually developed into an application it is taken to the market – where it succeeds or fails, for a variety of reasons. If there is community backlash at that point, then engagement is undertaken to try and sell the benefits of the product and process, and minimize the risks, and/or better determine how the members of the public managed to become so misguided as to reject the product or process.

There are not many examples of the first model that spring to mind – and too many of the second, mostly based on the assumption that if an idea gets capital funding then it must be a good idea. This comes from the traditional triple-helix model of technology development, where the key players are Government – Researchers – Industry. With some technologies, such as mobile phones or ipads, it works well. But with many other technologies, particularly those are socially disruptive in any way, such as biotechnologies and nanotechnologies, it is not such a suitable model, and a 'quintuple helix' (Government – Researchers – Industry – NGOs/Community Groups – the Public/s) potentially provides a more inclusive approach.

An attempt at this was made by the Australian Government's Office of Nanotechnology in 2008, bringing all five stakeholder groups together for a single-day's workshop, but one of the outcomes was that the different interest groups tended to lead to competition rather than cooperation, with each becoming more entrenched in its view of what was necessary for good public engagement (Cormick, 2012).

Historically, public engagement on science and technology (S&T) has moved from awareness raising, to education, to participative engagement – with some agencies working in all three spaces, and there is now movement towards new and more effective multiple models. This mirrors the evolution of the closely-related field of technology assessment. The first generation of technology assessment was typified by the US Office of Technology Assessment in the 1970s. It was characterized by being expert-based, led by government agencies, and

sought to provide strategic analysis of developing technologies.

The second generation of technology assessment was typified by the Danish Board of Technology in the 1990s, which was established by Government, but not operating within Government. The second generation models involved selected citizens and key stakeholders making deliberative assessments on the impacts of new technologies, such as occurs in citizens juries.

The third generation is still evolving, but is based around using multiple models and methods, by involving a diversity of interest groups. In practice it involves a lot of trials (and errors), that might even combine different methodologies. It is also typified by distributed governance of management, knowledge and participation. It also has a tendency to blur the boundaries between participating interest groups and individuals. Professor Arie Rip (2010), one of the key proponents of the third generation of technology assessment, defines it as having multiple technology assessment models that exist at different places or on different paths.

So the third big question we need to ask is whether public engagements that being planned or studied, are still operating in the earlier generations and need to be moved into third generation activities and outcomes?

So what does good engagement look like? This is the fourth big question, as a key problem when trying to discuss and define good public engagement with interest groups is that it can look very different to different interest groups. It may be more instructive to look at what good engagement doesn't look like, and unfortunately many public engagements, while not necessarily bad, are only "almost good", which can be like having a bridge that is 80% or 90% the width of a wide chasm – it will almost get you across, but will inevitably dump you into the turbulent river of public and professional criticism flowing rapidly beneath you.

Some of the key factors in poor engagement can include: It is more about proselytizing or converting a stakeholder group to another's way of thinking, it is developed in isolation from all the stakeholders needing to be engaged with, it makes no impact on policy or technology development.

This final point is a problem with some otherwise very good engagement exercises, such as the UK's 2005 Nanojury and the 2009-11 Dutch Societal Dialogues on Nanotechnology, that ultimately had little impact upon policy formulation (Singh, 2006; Toumey, 2010).

Also, as many models of engagement only include two key groups, such as researchers and the public, or government and the public, they fail to be inclusive of key participants who are integral to any outcomes being widely adopted. Another obstacle to good engagement can be the problem that some principles of good engagement have a habit of working against each other, such as how to include all key stakeholders into a process while accommodating the very different and competing perspectives and needs of different stakeholders, or the need to educate members of the general public to understand the complex issues needing to be discussed while respecting lay knowledge.

Also, different stakeholder groups have a preference for using public engagement activities to suit their own purposes. Carolyn M Hendriks (2006, p.594) has observed:

> "When we take this phenomenon seriously, we see how easily discursive models of public deliberation might collapse into the very kind of interest group pluralism that deliberative democracy has sought to reject. The fact that many actors approach public deliberation strategically reinforces the importance of designing moments of collective reasoning that encourage 'we' rather than 'I' thinking."

The traditional scientific/industrial view point – that if the public only understood the science better they'd accept it better – has tended to dominate much early engagement on science and technologies. This now discredited `Deficit Model´ still emerges in discussions on the impact of science on society, however, though with decreasing frequency.

Many engagement processes undertaken using this model tend to see awareness raising as the end game. An interesting study by Druckman and Bolsen (2010), however, found that factual information was actually of limited value in influencing opinions, as it did not have any greater impact than information that lacked factual basis. One of the key finding

of this study was that an individual's pre-existing opinions bias what information they are willing to accept, and providing people with different points of view tends to make them become more polarised or extreme towards the position they already held. This effect has been summarised by Lakoff (et al. 2004, p.17) as: "People think in frames… to be accepted, the truth must fit people's frames. If the facts do not fit a frame, the frame stays and the facts bounce off."

Added to this is the finding of Binder (2010) that when people talk about risks associated with unfamiliar science and technologies, such discussions can act as an amplifier of risk, strongly influenced by an individual's existing attitudes. In practice this can mean that the more people talk about their existing position towards a new technology the less likely they are willing to accept different perspectives to their own. The significance of such findings is quite important to understand for public engagement of science and technology, as they indicate that engagement activities that are based on informing and educating an audience with strong existing views may have very little impact.

Deficit 2.0

The Deficit model of communication or engagement has been widely discussed over the years, yet leads to our next big question: In concentrating on policing the traditional deficit model of science and technology information, have we been missing the ways it has been evolving? With some awareness of the need to go beyond stating that the public are concerned about new technologies only because they don't understand them enough, it is becoming increasingly common to hear arguments such as: if only the public had a more science-centric view of the world they would understand things as well as scientists do. This perspective, of course, fails to accept that there is a public view of issues such as risk, that while different to a scientific view of risk, is no less valid to the public.

By contrast, an industry, or private sector view of the public is one whereby they are often described as being primarily consumers, and needing to be engaged through traditional consumer models (Wickson, Delgado & Kjølberg, 2010). They are the 'market' that can be influenced by sophisticated advertising and marketing.

Government agencies tend to define the public increasingly as stakeholders, which has a connotation of being shareholders, or having a vested interest. But this doesn't hold up well to scrutiny of the different motives and different levels of engagement amongst the public. Something that is not often acknowledged amongst those involved in discussions on community engagement with new technologies, is that many members of the public really don't really give a damn about science and technology issues. In fact, according to figures from the Victorian Department of Innovation, Industry, and Regional Development (2007), or the Research Councils UK (2008), it might be as high as 35 per cent.

Turning to NGOs and civil society groups, many view the publics as their members, concentrating on those who align with their perspectives or ideologies or are actively engaged in social issues. Europeans have a preference for calling these active members of the public 'citizens', as articulated by Wickson (et al. 2010) who examine how the public are categorised as laity, consumers or stakeholders. Citizens, however, tend to have a strong relationship with the `state´, and are actively engaged in inputs to policy formation. Unfortunately this doesn't account very well for those who do not know they are citizens or couldn't care if they were.

For the public are consumers and citizens and public/s and stakeholders and the unengaged and engaged, and need to be represented by ways of thinking that understands this huge diversity, not just to better understand the public, but also to better understand all the interest groups and stakeholders who are seeking to engage with the public on new technologies.

A more recent attempt to bridge the diversity of perspectives and views of different stakeholders undertaken by the Australian National Enabling Technologies Strategy's Public Awareness and Community Engagement Program (NETS-PACE, the successor the Australian Office of Nanotechnology) was to undertake a two-step multistakeholder process, that sought to have interest groups firstly more clearly articulate and examine their own positions, and then, after being exposed to the different views of other stakeholders, all come together to work out a set of common principles for best-practice engagement. The success factors behind this process, known as the Science and

Technology Engagement Pathways (STEP), were based on strong participation by all parties, a focus on an actual outcomes and the presence of members of the public as a stakeholder group who were able to provide feedback on what actually would be acceptable or preferable to them (Cormick, 2012).

The seven key principles for good engagement that were agreed to, are:

1. Commitment and Integrity
2. Clarity of objectives and scope
3. Inclusiveness
4. Good process
5. Quality information/ Knowledge sharing
6. Dialogue and open discussion
7. Impact on decision making.

And new engagement activities undertaken under the STEP framework by NETS-PACE will be based on the model that developed the principles, including involving key stakeholders on project working groups to develop the engagement activities, and then test them on the public for their relevance (DIISRTE, 2012). As a model for good engagement it provides great promise, but will now need to be tested in practice.

How to engage with the unengaged?

This is our sixth big question. How do we best engage with the unengaged publics, who don't as yet care too much about emerging technologies nor their impacts, and don't show up to engagement activities? In an effort to better understand these members of the public, the Australian Government held a series of 'nanodialogues' on different topics such as water, bionics and new materials, recruiting members of the public who were generally disinterested in science and technology. Participants were recruited by a market research company and were paid for taking part.

The parameters of the dialogues were that the participants led the discussions more than would happen in a focus group, that technologies were framed in terms of applications, and that the discussions should lead to what type of a world we want to live in. The key finding was that disengaged and unengaged members of the public have different values, interests and levels of awareness in science and technology issues to those sections of the public who tend to self-select to attend most information or engagement activities (Cormick, 2012).

The unengaged also tend to have had poor experiences with science at school that has turned them off science. They also tend to seek information on science and technology issues primarily from friends and family, and they respond to S&T discussions overwhelmingly in terms of their applications only, and as such need to be engaged in different ways to the highly-engaged or affected members of the public (Cormick, 2010).

When to engage?

Our seventh big question is when is the best time to engage with the public? Most advocates of public engagement would argue that 'upstream' or early engagement is ideal, but with some technologies this may need to be reconsidered. Certainly, involving the public too late in the development of any technology is unlikely to result in trust or mutual learnings, as was seen with the release of GM foods, but there might be an argument for more 'midstream engagement' on nanotechnology, as Kyle and Dodds (2009) argue that at the early development stages there may not be enough information or clarity of applications to draw upon to expect sensible decisions.

There are also some competing communication paradigms that impact upon the best point for successful engagement, that include:

f the public are to be more involved in decision making, they need some levels of knowledge.

- Lay knowledge should be valued, but is only one level of knowledge.
- Scientific information is often too complicated for the general public to understand, and misinformation and emotional information leads to a distorted understanding (Kuroda, 2010).

Examples of engagement

Rowe and Frewer (2000) have listed over 100 examples of engagement in practice, ranging from Action Planning to Citizens' Juries, to Community dinners to Computer-Based techniques, to Hotlines and Open Houses and Study Circles, and it can make a significant difference to the outcomes as to which example is chosen. Yet observation shows they tend to be chosen to best suit the organisers' preferred outcomes, rather than for the participants' outcomes.

Another analysis of models of engagement, by Abels (2005), defined seven different types of models and looked at how representative they were and who they favoured. He found that under most models, one group or another holds a key position. In the consensus conference, it is the lay persons. In the public hearing it is the administrator. In participatory technology assessment models it is often the scientific experts. However, in two models all participating groups enjoy equal rights. He cites these as the voting conference and scenario workshop, which he deems 'balanced'.

The eighth big question we really need to ask ourselves, is how often is the power-holder the social scientist, seeking a good publication outcome? There is, after all, little reward for not finding anything publishable from engagement activities. A large amount of engagement activities involve bringing a range of experts and the public together in some manner, or bringing lay publics together, to discuss S&T issues, with research being conducted into what and how and why the public react to the engagement activity. That's all good, and activities are getting better and better at developing two-way learnings, but there are publics and there are publics, and most engagement activities recruit people who self-select to attend, and as a result are more likely to represent those with some interest in the technology or its impacts already.

So if a lot of activities are engaging with those people who least need to be engaged with, we need to ask another big question, who is really benefiting from engagement activities and how well do they impact upon the wider community?

A useful GM analogy to use here is the difference between laboratory trials, greenhouse trials and field trials. Many technology engagements

are the equivalent of laboratory trials – being conducted in artificial environments (focus groups, deliberative dialogues and citizens juries) that, while providing useful data, might not be easily transferable to the real world.

There are other engagements that we might consider greenhouse trials, such as online forums, café scientifics and so on, that are much closer to the real world that most people live in, but still aren't quite it, such as online discussion forums.

Then there are some good examples of engagements that are what we might call field trials (community group meetings and shopping center interviews), but not many.

Which brings us to our ninth big question: how do we create engagements that replicate real world experiences, and provide modelling so that people might be able to transfer the learnings and outcome to their homes and work places?

There is generally an expectation that people who take part in engagement activities – whether they be laboratory experiments, greenhouse trials or field trials – they will take their new knowledge or attitudes and go forth and multiply it within the broader community. But unfortunately there is very little data to demonstrate whether this actually happens or not. A study by Cobb (2011) into a month-long online national citizens' technology forum about nanotechnologies for human enhancement, found that there was significant engagement fade from those who took part after the activity was concluded.

Analysis of the impacts of Science Cafes by Powell (2009), for example, has also led to questions such as, can academics and others who work within institutions really initiate meaningful engagement with members of the public in a predominantly top-down approach? Clearly every engagement activity is going to have strengths and weaknesses, and the search for a dream model to base engagement activities on is likely to prove elusive.

Online communities and online community engagement

In an era of web 2.0 that is rapidly moving towards web 3.0, online engagement deserves a separate mention. The rapid growth of the internet and the ability to engage people through popular social network

sites may drastically change the way it is possible to engage with members of the community – but many of the fundamental problems and barriers to good engagement are likely to remain. If 100 people sign up to an online discussion board relating to an aspect of nanotechnology, it is important to know if they represent only an 'engaged' public, or other segments of the public too.

The development of e-communities may provide new ways to easily reach a target audience, especially with the ability to recruit and develop e-community profiles to match either particular stakeholder or audience segments to reflect the wider community. It is not a given though that the e-environment will be provide easy ways to reach new publics as there is enormous amount of 'competing noise' that will need to be overcome.

One benefit of internet-based methods of engagement however, is that they allow for a breaking down of the boundaries between experts and non-experts, best typified by web 3.0 practices of citizen-generated content. This may also have a down-side though, as the internet is a devil's playground for confirmation bias, and the trend for all opinions to having equal weighting, giving pseudoscience as much credibility as traditional science can work against good engagement.

For the moment though, the potential for new and better ways to engage with the public in online spaces is great, and the uptake is proving rapid and new models and experiments in this space are to be encouraged.

So what does it all mean?

Our final big question is a difficult one to answer, as it is not easy to try and find a clear way forward after asking all these big questions, and as Toumey (2011) has argued, there is no easy model for democratising science. He has also stated that good engagement needs to tread the fine line between science policy being determined by political values that disregard scientific knowledge, while avoiding forcing science policy onto a populace that resents it, even if it is grounded in good science. For that is the ultimate outcome of good engagement – good policy.

It almost doesn't need repeating that new technologies are going to have complex impacts upon our societies, and that not all of them will

be foreseeable. But in order to do justice to the complexity of ways in which the public relate to new technologies we must embrace more complex ways of viewing the public, as we embrace more complex ways of viewing new technologies – as well as embracing more complex ways of viewing the relationships between them. All of which will need to be driven by asking the hard questions that need to be asked to underpin more complex and diverse engagement practices.

To quote Jose Manuel de Cozar-Escalante (2006):

> "In short, we should seek a broader conception of representation for the politics of science and technology, a representation that is better suited to the intricacies of our increasingly technological and globalised world."

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