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Six Ideal Types of Public Engagement with Science and Technology: Reflections on Capital, Legitimacy and Models of Democracy

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Six Ideal Types of Public Engagement with Science and Technology: Reflections on Capital, Legitimacy and Models of Democracy

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Abstract

A number of researchers have been analysing apparent shifts from top-down approaches to public engagement with science and technology towards more participatory ones. Some have revealed the existence of often unacknowledged assumptions about how science and public should interact. These normative visions shape public engagement and may go against any shift towards inclusiveness. To further probe this, interviews with 41 stem cell scientists were carried out. They reveal diverse normative visions of publics, scientists, dialogue, relevant technical and political capital, and scientific citizenship. From this, six ideal types of public engagement with science and technology are constructed and connected to models of democracy. This typology, built on an analytical framework that draws on Science & Technology Studies, Sociology and Political Theory, can be used as a heuristic device to examine particular instances of (and discourses about) engagement. This enables reflections on their legitimacy and opens up for potential transformation the norms that underlie them.

Keywords: Science & Technology Studies, public engagement, stem cell research, scientific citizenship, lay political science, Bourdieu and capital

Seis Tipos Ideales de Vinculación Pública con la Tecnociencia: Reflexiones sobre Capital, Legitimidad y Modelos de Democracia

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Resumen

En los últimos años, se ha podido comprobar un aparente cambio de rumbo hacia una vinculación mayor del público con la ciencia. Estudios sobre ese cambio han revelado también la existencia de supuestos básicos no examinados con anterioridad sobre cómo la ciencia interactúa con el público, que tienen influencia y pueden dificultar una mayor inclusión en la toma de decisiones. Este artículo examina los discursos de personas científicas, vinculadas con el estudio de células madre, explorando (mediante 41 entrevistas) sus visiones normativas sobre los públicos, la comunidad científica, el dialogo, el capital técnico y político, y la ciudadanía científica. A raíz de ahí, elaboro seis tipos ideales de vinculación pública con la ciencia y los conecto con modelos de democracia basados en disciplinas como los estudios sobre la ciencia y la tecnología, la sociología y la teoría política. Mi argumento es que esta tipología puede ser usada como aparato heurístico para examinar ejemplos concretos de (y discursos sobre) vinculación pública con la ciencia. Además, puede reflejar aspectos sobre su legitimidad y abrir un espacio para la potencial transformación normativa de estas actividades.

Palabras clave: Science & Technology Studies (STS), vinculación pública, investigación con células madre, ciudadanía cientifica, ciencias políticas no profesionales, Bourdieu y capital

R esearchers from Science & Technology Studies (STS) and other disciplines have examined apparent changes in public engagement with science and technology[1] (e.g. see reviews in Burgess & Chilvers, 2006; Lengwiler, 2008). Some argue that elements of practice and discourse in this area have shifted away from the "deficit model" of public understanding of science (Wynne, 1995) - where public ignorance needs to be fixed by education - towards encouraging public participation in science. However, these shifts may be limited and many attempts at improving public participation in practice have failed (e.g. Goven, 2006; Stirling, 2008; Kurath & Gisler, 2009; Kurian & Wright, 2012).

One reason for these limited changes is that those who organise, advocate or take part in public engagement bring with them unacknowledged assumptions about science and publics, and about how these should come together during public engagement. These normative visions may work against any participatory ideal that is meant to guide the particular instance of public engagement (see Wynne, 2006). These visions have been studied in key policy documents and reports made by scientific institutions[2]; in publications by social scientists and others who advocate public participation[3]; and in data from interviews and focus groups with publics and scientists[4]. Multiple normative visions of public engagement are revealed, ranging from educating members of the public in order to prevent anti-science sentiments, all the way to empowering them to change science governance. Depending on whose normative visions frame particular instances of science-public interactions, different kinds of engagement will be facilitated (Bickerstaff, et al., 2010).

Of specific interest here, Michael and Brown (2000) analyse these often unacknowledged norms by examining discourses which touch on political theory and processes, and on ideals of democracy, dialogue and representation. They call these discourses "performances of lay political science". Different discourses of this kind put forward different types of dialogue as preferable. For instance, some scientists portray themselves as separate from the public and recommend dialogue with some "publics-in-particular" (such as moderate animal activists); these scientists thus deploy what Brown and Michael call "external" model of dialogue. Others deploy an "internal" model of dialogue where

discussions around science should be conducted only within the scientific community; these scientists see themselves as part of "publics-in-general" and, therefore, as holding the same fears, concerns and "commonsensical stories" as publics. These performances of lay political science can therefore put forward different people as appropriate participants in discussions and/or decision-making about science. In other words, they articulate different normative visions of the "scientific citizen" (Irwin, 2001).

   For instance, calls for public education, epitomised by the Bodmer Report in the UK, bestow scientific citizenship only upon those who can be educated to make appropriate and reasoned decisions about science. These citizens can participate in a "consumer democracy" where they can be educated to consume the products of science (Elam & Bertilsson, 2003, pp. 238-240), or in a "competitive elitist democracy" where educated elites speak on behalf of others (Michael & Brown, 2000, p. 7; Held, 2006, pp. 125-157). On this view, the public cannot legitimately shape the direction of scientific research. By contrast, calls for more participatory forms of engagement bestow scientific citizenship upon anyone able to enter into rational and reasoned debates. This aligns with the principles of deliberative democracy (Elam & Bertilsson, 2003, pp. 240-243; Papadopoulos, 2011; Lövbrand, et al., 2011) which can accommodate a wider range of opinions and may offer different kinds of citizens the opportunity to shape scientific research.

  It is clear then that there are multiple normative visions of public engagement with science and technology which can be mutually exclusive. According to Bourdieu, a key role for social scientists is to reveal the arbitrariness of how social relations happen to be organised - what he calls the arbitrariness of the structure of the "field"[5] (1980, 1975). He argues that if the unacknowledged norms that shape the structure of a particular field (say that of public engagement with stem cell research) map onto the unacknowledged and embodied norms that guide our ways of thinking and doing (our "habitus"), the structure of this field seems given by nature (1980, pp. 229-230). For instance it may seem natural that only scientists have a say in scientific matters. If social scientists highlight the normative visions at play and suggest alternative ways of structuring the field (for instance by suggesting

other scientific citizens whose participation can be legitimate), they can offer opportunities for transformation, or at least encourage the status quo to be justified.

 In this paper, I do two main things. I contribute to the STS body of knowledge about public engagement with science and technology by examining the normative visions embedded in the discourses of key players in engagement: I focus on scientists and their various normative visions of publics, scientists, dialogue, relevant technical and political "capital" (Bourdieu, 1986, see below) and scientific citizenship. In parallel, following calls to refine STS reflections on engagement by connecting them with the political theory literature (Michael & Brown, 2000; Wynne, 2007; Papadopoulos, 2011; Durant, 2011), I organise these normative visions into six "ideal types" (Weber, 1949, see below) of public engagement and sketch connections to different models of democracy with which they share similarities. The ideal types and models of democracy do not map exactly onto each other; rather the hope here is that by highlighting some resonances between theory and empirical data, we can reflect on both. This may facilitate critical reflections on different approaches to public engagement and open up for potential transformation the unacknowledged norms that shape these approaches.

 In what follows, I explain the derivation of my typology from empirical findings and argue that it is a useful addition to existing typologies. I then describe my six ideal types of public engagement with science and technology: Type I - internal dialogue with scientists as publics; Type II - recruiting publics/patients to support science or lobby; Type III - educating scientific consumers/citizens; Type IV - public relations exercise; Type V - mixing elite expertises; and Type VI - upstream mixing of situated knowledges. In the discussion, I argue that social scientists can use this typology to examine organisers' or participants' unacknowledged normative visions of public engagement. They can then move beyond simple endorsement and/or critiques of engagement: these ideal types can be used to reflect on the legitimacy of different normative visions of public engagement with science and technology because they connect STS with political theory which has for decades discussed these issues. In the conclusion, I suggest that this typology is

a useful heuristic device which I hope will be further developed and refined.

Not another typology! Connecting empirically-derived normative visions of engagement with models of democracy

A number of typologies of public engagement (with science and with civic life more generally) have been developed. A classic is Arnstein's (1969) "ladder of citizen participation", ranking participation according to how much power is devolved to citizens. Rowe and Frewer (2005, p. 260) criticise it for only focussing on one dimension (power). Instead, they put forward a well-researched and oft-cited typology to evaluate engagement activities according to diverse measures of acceptability and effectiveness (2005; see also 2000). This typology is also limited: according to Burgess and Chilvers (2006), it is based on the researchers' normative views and does not take sufficient account of broader institutional contexts which can shape engagement. Burgess and Chilvers argue that most engagement evaluations and typologies are based on one of three criteria: "the opinion of research practitioners"; "theory-based criteria" derived from specific models of democracy; or "the views of process participants" (2006, pp. 722-723). In parallel, STS' championing of "democratic" forms of engagement has been criticised for not paying enough attention to what is meant by "democratic" (see especially Durant, 2011). I here discuss how the present typology addresses some of these concerns.

Drawing inspiration from Weber (1949), I establish six ideal types of public engagement with science and technology (henceforth PE) that I hope can serve as useful heuristics. To construct these ideal types, I start with empirical "reality" (in all its infiniteness and complexity, Weber, 1949, p. 72): I draw on data from in-depth semi-structured interviews with 41 researchers of different levels of seniority, working in the UK and Australia on different types of stem cells, and with varying experience of PE. Data collection took place in 2004-5 and most interviews lasted one hour. I analyse scientists' discourses about PE because these have the potential to shape engagement practices (see Marks, forthcoming). In this mess of everyday language (1949, pp. 108-109), I focus on discourses that express normative visions of members

of the public, scientists, dialogue, relevant technical and political capital (discussed below), and scientific citizenship. I distil these multiple normative visions into ideal types of PE[6]. These are not ideal in the sense that they reflect my personal preference, or some theoretical ideal drawn from the literature, rather they represent "logical" ideals: they are a synthesis of the complexities of the empirical world (1949, pp. 90, 92). They are not an "average" of what is in the empirical world, they might not exist there at all (1949, p. 91). Their construction is guided by my analytical interest in what different visions of PE are expressed, and on what bases they might claim their legitimacy. The usefulness of these ideal types is as a means not an end (1949, p. 92): they should be compared back to the empirical world (e.g. practices and discourse of public engagement), and used to analyse it.

   To enable this typology to guide reflections on legitimacy, these empirically-derived ideal types firstly highlight the kinds of "capital" that are recognised as relevant and legitimate, and secondly are connected to the political science literature and its reflections on legitimacy. Regarding the second way of reflecting on legitimacy, I argue that the six ideal types of PE share features with different models[7] of democracy. I discuss how these models claim legitimacy in different ways. For instance, legitimacy according to deliberative democrats might rest on "free and unconstrained public deliberation of all about matters of common concern" (Benhabib, 1996, p. 68), whilst competitive elitist democrats see legitimacy in situations where those in power are the ones with the best technical skills (Held, 2006, pp. 149-150). Connecting ideal types of PE with models of democracy enables STS to connect with political theory's analyses and critiques of different sources of legitimacy.

   Regarding the first way of reflecting on legitimacy, I draw on Bourdieu's notion of capital (especially 1986). It goes beyond economic capital to include "social capital" - connected with group membership - and "cultural capital" - connected with education and social status. Importantly, these different kinds of capital can be converted into each other. Of relevance here, scientific authority, which is a mixture of technical capability and social power (1975, pp. 91-92), is a type of social capital. It can be accumulated and converted into capital relevant

outside the scientific field (1975, p. 97). Accumulation of capital enables (and is enabled by) "symbolic power", which is acceptance of the legitimacy of someone and what they say or do (Bourdieu & Wacquant, 1992, p. 148). For example, large numbers of quality publications in physics can give someone high levels of scientific authority within the scientific field, since publications reflect technical capability. This can also give the author symbolic power in policy settings, potentially enabling them to legitimately advocate for the importance of physics (and other sciences) in society.

  In this paper, I draw on the notions of convertibility of capital and the importance of socially- and culturally-dependent legitimacy. I also distinguish several types of capital. Technical capital includes technical knowledges; that is those painted as rational, objective and universal. It also includes forms of authority typically recognised by scientists, such as publications. This is contrasted to political and consumer capital which include the ability to shape the direction of science by voting, consuming, funding, criticising etc. PE ideal type VI (detailed below) fits into a slightly different framework: the technical and the political are no longer separated. Rather, in a manner more consistent with the common STS view that knowledge is contingent, capital encompasses a range of socially situated knowledges, as well as the ability to contribute to decision-making.

  To summarise, this typology complements and further develops others: it considers multiple dimensions, not just power (it does not consider practicalities such as effectiveness); it is derived from the views expressed by potential process participants, but does not uncritically use these to assess quality; and it draws out a set of theory-based criteria to reflect on legitimacy, based on multiple models of democracy, not just the one(s) I favour. So rather than calling for more democratic PE as many STS scholars do, I here offer a typology that, if used as a heuristic to examine particular instances of engagement, can highlight the different meanings of "democratic" forms of engagement, and drawing on decades, if not centuries, of work in political theory, enable reflections on their legitimacy.

Six Ideal Types of Public Engagement with Science and Technology

Ideal Type I – PE as internal Dialogue with Scientists as Publics

In this ideal type of PE, scientists self-regulate because they have the necessary technical and political capital to do so. This ideal type was constructed from interviews with five PhD students and three group leaders (from the UK and Australia)[8].

During interviews, a number of scientists describe themselves and their colleagues as the only ones holding relevant knowledge for decision-making around science. They deploy an "internal" model of dialogue where they describe themselves as part of "publics-in-general" (Michael & Brown, 2000): they consider themselves to have all the necessary capital to make decisions around science. They have the technical capital to judge the promises and risks of research and its application and to know what concerns publics may raise. They also have all the necessary political capital to vote or make decisions in their field. These scientists locate themselves apart from outside influences and, if they have any concerns about their work, they turn to their peers. Here, technical capital is automatically converted into political capital.

Publics are depicted as emotional and are not seen to hold experience-based expertise, such as different understandings of disease. There is no role for publics as scientific citizens, beyond the provision of biological material when needed:

> As scientists, we know there's a chronic need for better therapy, and we're all extremely motivated, so I don't see what [people with diseases] could particularly tell us that would make us do anything differently.

However, some publics are described as sharing "commonsensical stories" (Michael & Brown, 2000) with scientists such as: if you accept abortion, you cannot reject embryonic stem cell research. Other publics are too irrational to share these stories (for example extreme anti-abortion groups, similar to Michael and Brown's extreme animal activists) and their views must not shape research.

PE involves the incorporation of commonsensical stories into rational discussions between scientists. It also includes a small measure of

talking to the public and "letting them know what we're doing". Informants that have experience of PE at the parliamentary level discuss an exceptional role for politicians in setting legal frameworks (such as banning reproductive cloning or legalising research on embryos) but do not accept a role for the public shaping of research any more routinely. Scientific citizenship is only held by scientists.

The features of this ideal type echo some versions of republicanism, which involves a community with shared values, whose members handle common concerns through discussions within that community (e.g. Cunningham, 2002, pp. 55-6). My ideal type most closely resembles Polanyi's concept of Republicanism, where the "republic of science" is a "society of explorers" who "strive towards a hidden reality" (1962, p. 67) and are independent of external pressures. Legitimacy in the Republic comes from being accountable to members of the community but not slave to rule by ignorant mobs (Held, 2006, pp. 32-3); it also rests on the assumptions that those in the community of decision-makers are trustworthy "club members" willing to engage in a restricted form of "direct democracy" (Held, 2006, p. 39).

Ideal type II – PE as recruiting Supporters

PE here involves educating publics about science in order to recruit them into supporting it and perhaps lobbying politicians and other decision-makers on behalf of scientists. The notion that education automatically leads to support was drawn upon by many informants in both countries (explicitly by twelve) and the strategic use of patients or public groups to convince politicians or other decision makers was explicitly made by four of these informants (all senior).

Scientists here see themselves as objective and with the necessary technical capital to predict the best future for science and society. However, they view themselves as lacking the necessary political capital to make decisions around science; these are made by funders and politicians. Scientists cannot easily convert their technical capital into political capital; in particular scientists seen as promoting their interests can lose their image of neutrality: "it's seen as self-serving". In turn, this may diminish their technical capital as well as their political capital.

As in the first two ideal types, publics are portrayed as ignorant and emotional but some, especially patients, have the political capital to convince politicians and others about the promises of science. The notion that patients have more political capital than scientists was specifically expressed by group leaders with engagement experience. Thus, experience of engagement can lead to scientists becoming more aware of strategies to improve their position – here, by using patients who support their cause.

Knowledge is depicted as objective, and it is assumed that knowing more increases support for science - echoing the traditional deficit model of public understanding. Patients initially are usually "not informed" and perhaps sceptical. However, once they know what is happening, they will be more supportive: "the more education that people receive, the more liberal they're prepared to be, because they understand the issues better".

When informants made statements in which deficit model assumptions were apparent, I raised research challenging these. Some respondents went on to delineate two types of publics: a majority public that can be educated to see the promise of science, and that holds a worldview compatible with science as a vehicle of progress; and a minority public, such as religious groups, that will not be convinced by education and whose worldviews contrast with those of scientists (similar to Michael and Brown's extreme animal activists mentioned above). The respondents who stayed within this ideal type did not go on to suggest that engagement should be abandoned or modified (unlike others, see type IV below); nor did they suggest that these minority views should be listened to in a democracy (unlike type III below). Instead, they suggested that these views were not legitimate as they were not founded on good reasoning, and could therefore be set aside and ignored. Thus, legitimate citizens will use their political capital to support science. In a circular manner, if they do not support science, they are not legitimate citizens.

Some elements of this ideal type echo liberal democracy, in particular what Held calls "developmental democracy" (2006, pp. 81-93). According to liberal democrats, the State does not automatically know what is best for its citizens, and therefore needs guidance from these

(see also Habermas, 1996, p. 21) - e.g. here through powerful appeals by ill patients. There is an assumption amongst theorists such as John Stuart Mill that education is key and that the most educated people will be able to make the best decisions (here, to support science). Mill even suggests a voting system whereby intellectuals hold more votes than working people - Held calls this "education elitism" (2006, p. 92). Whilst liberal democratic theory can be seen as laying the seeds for social equality, there remains a concern about some people - the working classes - "spoiling the political order" (Held, 2006, p. 85). This connects with the above exclusion of some people from scientific citizenship: those who cannot see reason and support science. Legitimacy comes from not imposing a political order through strength, but by gaining consent from citizens (Held, 2006, p. 89) - here education would be assumed to lead to increased knowledge and therefore consent.

Ideal type III – PE as educating scientific Consumers/Citizens

In this ideal type, PE is aimed at providing a variety of publics with neutral information. Individuals can then choose between the different options on offer, either by exercising their rights as consumers (by choosing or not to buy a product) or as citizens (by voting). Elements of this ideal type are drawn from interviews with five PhD students, one post-doc and six group leaders in the UK and Australia.

  As in ideal type I, scientists hold all the relevant technical capital. They do not have the right to make all the decisions about science however; they lack political capital. Their role is to give impartial advice about technical issues: "I'm not really competent to get into religious/philosophical discussion with these individuals about their beliefs, not my job, not my role." Scientists are objective providers of neutral information (cf. Kerr, Cunningham-Burley, & Amos, 1997). The purpose of PE is to inform publics about options made possible by scientists, such as donating or not, participating in a trial or not. Publics are seen as temporarily ignorant but can be enabled, through education, to make informed decisions. Although education is essential, it is recognised that some publics will never be swayed towards the

scientists' point of view; unlike ideal types I and II, this does not mean that their views should be dismissed: "we have to make a democratic decision and either move forward or not". However, publics in this ideal type are not only potential voters, they are also potential consumers. Patients for example are labelled "the number one consumers" and their "opinions" are legitimate: they have citizen rights through their consumption. Michael and Brown similarly note a "blurring of the boundaries between 'citizen' and 'consumer'" (2000, p. 16). This can be connected to the rise of the "New Right" where it "seems to be becoming increasingly problematic to separate out – to keep distinct – the practices of citizenship from those of consumption" (Michael, 1998, p. 320).

  Science is not an independent republic as above, with scientists as the only citizens. Rather, scientific citizens are all sorts of publics who vote and consume, and scientists who educate. I see them as belonging to what Elam and Bertilsson call an "advanced consumer society" (2003, pp. 239-40). This society is a "market structured network of interactions among private persons" who are trying to advance their "private interests" (Habermas, 1996, p. 21). This indicates a liberal version of democracy that highlights the importance of individual freedoms (Cunningham, 2002, p.30). More specifically, this engagement ideal type reflects a notion of "advanced consumer democracy" or "competitive elitist democracy" (Michael & Brown, 2000, p. 7; Held, 2006, pp. 125-157). In classic Schumpeterian or Weberian competitive elitist democracy, publics are seen as emotional and unable to guide policy; they can only choose between leaders (Held, 2006, pp. 135-36, 149-150). The parallel here is that publics cannot guide science policy or product development; only choose between the options made available to them by science. In this restricted democracy, legitimacy derives from having the educated elites in positions of power (e.g. creating knowledge and products), with the public able to vote them out (e.g. refuse to buy their products) if they are no good (Held, 2006, pp. 149-150).

Ideal type IV – PE as a Public Relations exercise

In this ideal type, scientists should ideally be left alone to self-regulate

as they have all the necessary technical capital to do so. However, irrational public fears can go against scientific progress and need to be managed through engagement, which involves projecting a good image of research. This ideal type was constructed from core elements of an interview with a senior Australian adult stem cell researcher and from more minor elements of interviews with seven other researchers (working in both countries, at various levels of seniority).

Scientists here portray themselves as objective and endowed with all the necessary technical capital to set agendas around science and know what is right for society. Similar to engagement type I, they consider themselves responsible enough to self-regulate, with the internal workings of science ensuring that fraudsters and pseudo-scientists are not given free rein. For instance, scientists have better things to do than clone human beings (Marks, 2012).

Publics are portrayed as unable to contribute to science but nevertheless able to counter progress if not effectively managed. Informants focus on a variety of specific publics, depending on who they have had interactions with. These include: funders, who hold the purse strings and therefore need to be shown promising results if they are to continue investing their money; members of ethics boards, who need to be won over to permit research; animal rights groups who already have had a detrimental effect on science by increasing scientists' paperwork; and the media, who have a strong influence on public opinion and, therefore, need to be given the "right" stories to prevent widespread unpopularity. Thus, all these publics have political capital that can go against science: they can mobilise existing modes of communication and power structures to slow science down.

PE is about promoting science. One respondent is unusually clear and consistent with her criticism of public interference in science and the need for engagement to highlight the promises of therapies and to "portray a certain message to the general public that isn't too complicated". She does not allow her students to participate in PE as they are "still developing their communications skills". Most other researchers who draw on this ideal type do so intermittently, and express discomfort at the idea of being explicitly strategic in theirommunications. They often blame the contexts of research (e.g.

funding pressures) which might dictate the need to select the sorts of information made available to particular publics.

This ideal type is similar to ideal type I, but draws on lessons learnt from experience of PE or from critiques of the deficit model; I call it the in new republic of science. Scientists here long for the independence of science from politics and publics, but have learnt that they need money and to be strategic about their engagement. Both promises and risks of research can be discussed within the republic; however PE only involves telling people about the promises of science. Like in ideal type I, scientific citizens are scientists, and legitimacy comes from being accountable to members of the republic. The concerns seen here about disruptive publics and science's dependence on others when it comes to resources is reminiscent of the problems encountered by Renaissance Italian city-republics: these were successful whilst small (with similar-minded people in power), but encountered challenges when those who were excluded claimed their right to citizenship or with the historical changes towards bigger, more densely populated cities and nation-states, with complex international inter-dependencies (see Held, 2006, pp. 29-55).

Ideal type V – PE as mixing elite Expertises

In this ideal type, scientists and other experts decide together on the course of action in a rational way. They can be aware of, and interested in, broader public views. It was developed from interviews with thirteen scientists - from both countries, of all areas of seniority and working in all areas of SCR.

Scientists who used this ideal type describe themselves as holding partial objective knowledge, and needing help from others to make decisions about science; they are expert and lay at the same time (cf. Kerr, Cunningham-Burley, & Tutton, 2007). Technical capital, which encompasses various types of knowledge and symbolic power, is shared amongst different groups, or diverse "publics-in-particular" (Michael & Brown, 2000). Suggestions of appropriate publics depend on informants' experiences. For instance, those with experience setting up companies acknowledge the expertise of business people and patent

lawyers; those involved in clinical trials acknowledge the expertise of clinicians and biotech companies. One respondent suggests the need for input from experts in community views into the design of clinical trials, to ensure these would be publically acceptable. Not all publics, however, hold this technical capital. In particular, emotional or subjective publics, such as "individual patients" must not be included in these interactions. They need to be represented by, for instance, experts of community views, ethicists, or patient groups. To qualify as a potential "public-in-particular", people must convert their capital into capital recognised by scientists (e.g. publications on PE).

 The tacit model of dialogue drawn on here is "external" (Michael & Brown, 2000), where decisions are made externally to the scientific community, in discussion with other experts. For Michael and Brown, the purpose of these "external" discussions is to educate these publics-in-particular (see especially 2000 pp. 5-6). By contrast, in my version of "external" discussions, the purpose is to share expert knowledges; one respondent for instance talked about "constructive dialogue". Accounts such as these echo what Collins and Evans (2002) advocate when arguing that people with relevant technical expertise can shape research.

 This ideal type of PE shares resemblances with deliberative democracy - which emphasises the importance of decisions based on informed public discussions amongst equals (e.g.Held, 2006, p. 232; Dryzek, 2000) -- but an elitist version thereof. The type of public discussions that the above informants describe most closely resembles the versions of deliberative democracy described in early Habermas and Rawls or some aspects of Benhabib's thesis. Their respective focus on "ideal speech situations", reasoned arguments and "practical rationality" all emphasise the importance of an impartial standpoint from which to judge public deliberations; citizens should come together and reach decisions through rational debate that articulate reasons that all can accept (Held, 2006, pp. 238-241; Benhabib, 1996, p. 83; Dryzek, 2000, pp. 11, 15-17, 22-14). Legitimacy is gained through proper procedures, for instance "each individual has the same symmetrical rights to various speech acts, to initiate new topics, to ask for reflection about the presuppositions of the conversations, and so on" (Benhabib, 1996). Here, scientific citizenship is bestowed upon anyone who can enter

reasoned discussion resting on sound argumentation, rather that personal, emotional opinion. There is also a focus on learning (from others' expertise) to improve decision-making (Held, p. 238), which is key to Habermas' view of deliberation, but not Rawls's which assumes fixed and competing individual interests (Dryzek, 2000, p. 15).

Ideal type VI – PE as Upstream mixing of Situated Knowledges

In this ideal type of PE, scientists and a variety of publics hold diverse socially contingent knowledges that can be used to shape the future direction of research. This ideal type was developed from core elements of an interview with one mid-career researcher working on embryonic stem cells in Australia and from more minor elements of interviews with six informants, including PhD students, post-docs and group leaders, from the UK and Australia.

One of the most striking differences between this ideal type of engagement and the five others discussed, is that scientists here do not portray themselves as completely objective and rational. For them, "science is inherently political" and they argue they cannot dissociate their science from their other views and ethics, e.g.: "it's the evidence that you're prepared to accept that influences your medicine". These scientists draw on, and recognize, a diversity of fragmented identities, such as: researcher, mother and relative of a sick person.

Publics are seen as multiple and include scientists. Examples are: highly informed patients, patients who want no say in their treatments, people who have no problem donating tissue or embryos, people who only want to donate certain tissues, scientists who have never entered a fertility clinic, and people with paraplegia who have heard too many unrealised promises. Knowledge is depicted as non-universal and based on life experience. For me, this implies that these informants accept it as "situated" or "contingent".

These scientists do not believe they can, or should, self-regulate. PE involves the upstream shaping of science (including future directions of research and the set-up of clinical trials) by diverse people sharing their situated knowledges during constructive conversations. For example, one neuro-scientist explained how he changed his research priorities after meeting particular patients.

The criteria for legitimate scientific citizenship are different from the ones discussed above: one does not have to present one's contribution as based on rational and objective facts, and on expertise certified through formal education. One scientist talks about the "expertise" of patients and of people with infertility then, after demonstrating knowledge of social science studies on the limits of the deficit model, she criticises the need for high levels of knowledge in order to have a valid opinion and act upon it. Another informant highlights that certain decision making bodies, such as ethics committees, can be too elitist.

Features of this ideal type resonate with more recent models of deliberative democracy, in particular those that come out of critical theory and identity politics. These models build on work by radical plural democrats and others who argue against the focus on reason as the one guiding principle for deliberation since it can reinforce power imbalances and fails to recognise the existence of multiple standpoints (e.g. Mouffe, 1992, p. 237). For instance, Dryzek's (2000) "discursive democracy" highlights the need to make room for a plurality of voices and identities, not just those that sit well with the constraints of ideal speech; he argues for the inclusion of story-telling and other means of communication into deliberation. He also emphasises the possibility of changing people's views through deliberation and learning. Legitimacy comes from the inclusion of diverse voices, expertises and ways of communicating. Thus here, there can be multiple forms of scientific citizenship for people from all parts of society; they can participate in the creation of agendas for science, or even shape legislation. However, many of the scientists who highlighted the importance of alternative voices also highlighted the current need to, at least rhetorically, appeal to reason and rationality (see also Marks, 2012). Thus, situated knowledges, if acknowledged as such, do not easily convert into symbolic power.

Reflections on Capital, Legitimacy and Democracy in Public Engagement

Six ideal types of public engagement with science and technology were developed in this paper and connected to models of democracy. These are: Type I - internal dialogue with scientists as publics; Type II -

recruiting publics/patients to support science or lobby; Type III - educating scientific consumers/citizens; Type IV - public relations exercise; Type V - mixing elite expertises; and Type VI - upstream mixing of situated knowledges. These were constructed from an analysis of empirical findings: from stem cell researchers' discourses, in particular their "performances of lay political science" (Michael & Brown, 2000) and their normative visions of publics, scientists, dialogue, relevant technical and political capital, and scientific citizenship. This typology develops previous studies of science-public interactions. Although the respondents here work in a specific area of science, their discourses echo those of scientists working in other areas such as xenotransplantation, and of social scientists and scientific institutions (e.g. Michael & Brown, 2000; Elam & Bertilsson, 2003).

My informants draw on various conceptions of relevant "capital" (Bourdieu, 1986). In ideal types I and IV, they argue that decisions about science should be made internally, by scientists who have all the necessary technical and political capital; this illustrates Michael and Brown's (2000) "internal" model of dialogue. All those who are experts are those who belong to the republic of science and should be making decisions. Here, technical capital should automatically convert into political capital; technical knowledge of science implies the ability to make decisions about science and society. Expertise is "certified" (Collins & Evans, 2002) through years of study and the acquisition of diplomas or the publication of papers.

The remaining four ideal types illustrate Michael and Brown's (2000) "external" model of dialogue. In ideal types II (recruiting publics) and III (educating consumer/citizens), technical capital is held by an elite minority who do not automatically have the power to make decisions alone but can educate decision-makers with the appropriate knowledge. Relevant knowledge in these two ideal types is scientific technical expertise. For ideal type V (mixing elite expertises), the pool of relevant knowledge is widened and technical capital derives from scientific technical expertise as well as technical expertise in patent law, bioethics or professional social sciences. Diverse elites hold partial technical and political capital.

In ideal type VI (upstream mixing of situated knowledges) capital is

not split between technical and political. Rather knowledge is culturally and socially situated. Technical knowledge is not the main source of symbolic power, and experience as well as opinions can be converted into capital relevant to discussions and decision-making about science. I would argue that expertise here is not given by a higher order - such as reason - but negotiated politically (see Turner, 2001).

This typology then may be used as a heuristic device to examine the unacknowledged norms which underlie practices of, and discourses about, PE, thus following Weber's exhortations to use ideal types to examine empirical reality. Social scientists can identify which kinds of expertise are put forward (e.g. by examining who is invited to be part of a panel or who is described as an important participant) and reflect on whether these expertises are certified, experience-based or negotiated politically. They can identify which kinds of capital (scientific/technical, other technical) are easily converted into political capital (e.g. used in decision-making). This will indicate who can more straightforwardly take on a role as a scientific citizen in particular types of science-public interactions. Social scientists can then compare their findings to the ideal types put forward here and identify which ones most closely resemble their data. They can also contrast the ideal types that different participants draw upon, or contrast those drawn upon by organisers and by participants. This may help identify future areas of tension and challenge how particular instances of PE are set up.

In particular, by highlighting that different forms of expertise are considered legitimate in different ideal types, social scientists can enable reflections on why this is the case and whether other forms of expertise should be legitimised. They can also identify the structural conditions that may inhibit or promote different kinds of PE. For example if the sponsoring institution of a particular instance of PE is a scientific body for which certified expertise is the only recognised capital that can provide symbolic power, ideal type VI may be harder to enact. Nevertheless, an opportunity for transformation comes from highlighting this and therefore making possible discussions about other sources of symbolic power.

In addition, because these ideal types of PE are connected to models of democracy, we can turn to the political theory literature for further

reflection and critique. For instance, liberal versions of democracy draw their legitimacy from people being seen as able to shape their lives through active participation in politics (e.g through voting, see Held, 2006, p. 82) and having educated elites in positions of power. However, Marxists, pluralists and deliberative democrats have highlighted unavoidable power inequalities that may exclude people from full participation (e.g. Cunningham, 2002, pp. 52-72; Held, 2006, pp. 103-08, 138-109; Mouffe, 1992; Habermas, 1996). For instance, just because voters seem to consent to something because they had the option to vote against it or not purchase it, this does not mean that they really had the choice not to consume or vote in a particular way (Held, 2006, p. 155). Moreover, criticisms have been levelled at the form of liberal democracy called competitive elitism: although it claims to be democratic, the conditions for legitimate participation can be very exclusive and technocratic, thus leading to this form of government being relabelled an "oligopoly" (Held, 2006, pp. 155-56). Therefore, if a particular instance of PE draws on liberal democratic principles such as those echoing ideal types II (recruiting supporters) and III (educating scientific consumers/citizens), social scientists might want to encourage organisers to pay particular attention to power inequalities. Depending on their desired outcomes, they may wish to implement processes that invite better inclusion, or be explicit as to why only particular kinds of experts can be given scientific citizenship. These decisions then become open to challenge.

Republicanism draws its legitimacy from decisions being accountable to members of a small group of people with similar interests and from "trusted club members" being in positions of power. Republicanism has been criticised for being undemocratic due to the limited constituency for citizenship (Held, 2006, p. 32) and for relying too heavily on the ethical virtues of individual citizens/club members (Habermas, 1996, pp. 23-4). As such we can ask whether the ideal types of PE that are underpinned by republicanism expect too much of their citizens; for instance whether they take for granted that scientists are more virtuous than others and whether this is appropriate (see also Fuller, 2000 for a critique of Polanyi's republic of science). Republicanism has also been criticised for being inapplicable to complex modern societies. This

suggests that instances of PE that draw upon ideal types I (internal dialogue with scientists as publics) and IV (public relations exercise) may need to open-up by including more people as legitimate citizens, by improving the quality of participation or as above, by not claiming to be democratic or to involve the public. This can help us address the disjuncture between calls for inclusive participation (that might correspond to ideal type V which rests on deliberative democracy, see below) and engagement practices that are exclusionary.

Deliberative democracy has been put forward as a solution to the issue of ethical over-burdening of republicanism (Habermas, 1996; Dryzek, 2000). This is done by institutionalising the conditions for democratic opinion- and will-formation (Habermas, 1996, p. 27 especially) through providing the conditions for "ideal speech" (Benhabib, 1996), thereby lending deliberative democracy its legitimacy. However, a number of people have criticised ideal speech, for instance for its "naivety about the politics and power relations of such encounters" (Leach & Scoones, 2005, p.25). Similarly, Elam and Bertilsson argue that its emphasis on "rationality, reserve, selflessness and powers of argumentation" (2003, p. 242) fails to provide conditions for members of the public to fully participate in discussions about science and, rather, reinforces scientists' power to dominate these discussions. Instead, they put forward "radical and plural" versions of democracy that recognise the complex and situated nature of knowledge, and recognise a diversity of scientific citizenships, including activism (Elam & Bertilsson, 2003, pp. 243-6; see also Papadopoulos, 2011).

Versions of democracy that draw on radical pluralism and inclusive versions of deliberative democracy (and which draw their legitimacy from this inclusiveness) have also been criticised. For instance, they are seen as impractical - marred by "utopian irrelevance" and inapplicable to complex modern societies (discussed in Benhabib, 1996, pp. 84-5). Benhabib responds to this by highlighting that many current ways of making decisions draw on some principles of deliberative democracy, thus indicating its feasibility. Inclusive versions of deliberative democracy are also seen as likely to lead to demagoguery and arbitrariness because of the emotionality of arguments that do not follow the conventions of ideal-speech (Benhabib, 1996, p. 83; Held, 2006, p.

236). Dryzek (2000) responds to this in his normative account of discursive democracy by putting forward a set of conditions for communication that focus on the absence of coercion rather than rationality and impartiality.

These discussions about the legitimacy of different forms of deliberative democracy can help us reflect on ideals types V (mixing elite expertises) and VI (upstream mixing of situated knowledges). Organisers of PE who aim to draw on deliberative democracy should reflect on their normative positions regarding reasoning: e.g. are the best decisions made by seeking an impartial standpoint from which to judge all positions put forward and reach informed and value-neutral consensus, or should there be a recognition of irreducible value-differences that might need to be expressed through non-rational expositions such as story-telling and that may never lead to consensus? This reflection can be aided by drawing on Schumpeter: he argues that people have irreconcilably different values that are beyond logic and that therefore there is no "common good" derived from rational thought; thus it is illegitimate to reject someone's view as sectarian since all views are in some sense (Held, 2006, pp. 146-8). Highlighting this literature forces organisers and participants of PE to consider the legitimacy of including/excluding particular voices and modes of reasoning.

Conclusion

The typology put forward here may be a useful heuristic device to highlight some of the contrasts between individual people's implicit and explicit normative visions of PE and between different people's normative visions thereof. This can highlight the arbitrariness of how PE is practiced in particular instances and open up opportunities for transformation through an acknowledgement of these norms (see Bourdieu, 1980, 1975). By connecting ideal types of PE to particular versions of democracy, this typology enables us to turn to political theory to seek further critiques of social arrangements, reflections on legitimacy and potential ways of improving science-public interactions. This is important in order to better understand our current forms of

public engagement with science and technology and to strive towards "democratic" and "legitimate" decision-making - in all its complexity and contradictions.

   This typology is a work in progress and hopefully can be built upon by constructing additional ideal types of PE and refining the ones discussed here. One avenue for further development would be to examine what kinds of PE are appropriate for different topics of discussions; some might require more attention to inclusivity than others. A second avenue would be to examine how applicable this typology is to "performances of lay political science" by other groups such as publics or policy makers. A third avenue could focus on institutions and how they can facilitate (or not) different types of PE (e.g. see Brown, 2009). Finally, this typology might be complemented by investigating the role of public engagement in education and how that connects to scientific citizenship; this could be done by drawing on pedagogical models, in particular from critical pedagogy (e.g. see Freire 1972; Kincheloe, 2008).

Notes

[1] I follow Rowe and Frewer (2005, p.255) in using the term public engagement broadly to designate all science-public interactions, whilst public education indicates a one-way flow of information from scientists to the public, and public participation indicates two-way interactions.
[2] E.g. Michael and Brown (2000), Elam and Bertilsson (2003), Irwin (2006), Michael (2009), Bickerstaff et al. (2010).
[3] E.g. Michael and Brown (2000), Elam and Bertilsson (2003), Chilvers (2008), Papadopoulos (2011), Lövbrand et al. (2011), Durant (2011).
[4] E.g. Michael and Brown (2005), Felt et al. (2008), Wilkinson et al. (2011), Parry et al. (2012), Marks (forthcoming).

[5] For Bourdieu, fields are objective complexes of socially and historically contingent relations, structured by the uneven distribution of capital (e.g. Bourdieu, 1986; Bourdieu & Wacquant, 1992).

[6] This is slightly different to Weber's approach: he starts with concepts that are already used in everyday language (e.g. agriculture, Christianity). He is aware that these have multiple meanings and uses, and his interest is in constructing one ideal type that highlights what he interprets to be the key elements (of Christianity etc.). By contrast, I derive my own labels for each ideal type: the term "engagement" is used in everyday language, but the point here is to show its multiple meanings, so I do not wish to construct one ideal type of engagement. Weber also considers historical "facts", whereas I focus solely on discourse.

[7] "Model" here means a mixture of normative and descriptive features (Held, 2006, pp. 6-7).

[8] Each interviewee often presented different visions of PE during one interview, but it is beyond the remit of this paper to discuss this in more detail.

[9] For reasons of space, I only offer a few quotes for illustrative purposes here.

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