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Performed and preferred participation in science and technology across Europe: exploring an alternative idea of 'democratic deficit'

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Abstract

Republican ideals of active scientific citizenship and extensive use of deliberative, democratic decision making have come to dominate the public participation agenda, and academic analyses have focused on the deficit of public involvement vis-á-vis these normative ideals. In this paper we use latent class models to explore what Eurobarometer survey data can tell about the ways in which people participate in tacit or in policy-active ways with developments in science and technology, but instead of focusing on the distance between observed participation and the dominant, normative ideal of participation, we examine the distance between what people do, and what they themselves think is appropriate in terms of involvement. The typology of citizens emerging from the analyses entails an entirely different diagnosis of democratic deficit, one that stresses imbalance between performed and preferred participation.

1. Introduction

In studies of science and technology, and in practices related to the governance and communication of science and technology, attention has turned towards the issue of public participation (Jasanoff 2003; Felt & Fochler 2008). Increasingly, academics examine the patterns, trends and institutional structures for citizen involvement in science and technology, and communicators and practitioners explore inclusive, dialogical formats for information exchange and decision-making. The rationales and motivations for commitments to active public participation include normative, instrumental, and substantive arguments (Stirling 2008): participation can be considered an essential part of legitimate decision making processes, a means to achieve desired or strategic outcomes, or a mechanism for generating more qualified solutions to social, environmental or technical problems within particular policy areas.

Among the various rationales and formats, aspirations for 'deliberative' models have come to dominate the field (Felt and Wynne 2007; Siune and Markus 2009). The ideal of undistorted, non-coercive interaction between rational individuals, each contributing their science-based or experience-based expertise, and thus providing a context for informed collective decision making, has become principal and preferred among the influential actors in science communication and, albeit to a lesser extent, in science policy making. The deliberative model has its philosophical and political anchorage in deliberative (Eriksen 1995; 1999) or discursive (Dryzek 1990; cf. Dryzek 2000) democracy, and it reproduces a 'republican' image of strong scientific citizenship (Mejlgaard 2009; Horst 2007), where active citizens engage horizontally in science culture, by keeping informed, talking with friends and family, attending lectures or visiting science museums, but also vertically in the decision making processes related to science and technology.

The deliberative agenda has achieved a privileged position, in spite of plentiful examples of failures to accomplish normative ideals. Often, evaluative studies have served to illustrate that there is a de facto distance between the actual practice or performance of public participation on the one hand and the normative model on the other hand. Some have shown that sites and institutions for public deliberations are fragile and either effectively detached from political decisions (Jamison & Ostby 1997; Jamison 1998) or only superficially committed to linking deliberations and policy making (Levidow & Marris 2001). Other contributions point at the ways in which the role of participants in deliberative contexts is constructed by diverse factors, and how deliberative exercises can adapt simplistic contrast structures that opposes science and the public as contained, antagonistic social entities (Kurath & Gisler 2009). Institutional location, preframing of the questions for discussion, the degree of activity that is accorded to the citizens, and the underlying scientific assumptions are all elements that challenge the normative ideals of deliberative democracy (Irwin 2001). The values, understandings, and imperatives, or what Bickerstaff et al (2010) refer to as the 'institutional rationality' of the commissioning organization, tend to be imposed, explicitly or tacitly, onto the exercises and the participants, thus constructing particular representations of scientific citizenship and techno-scientific legitimacy. The very process of recruiting participants pose challenges, ranging from considerations related to random selection of citizens, when deliberative exercises are based on invitation (Carson & Martin 2002) to the more general observation that invited public deliberation nearly almost imposes a frame with implicit normative commitments, and implicit politics regarding what is salient and what is not (Wynne 2007). In addition, while deliberation organizers often conceive of the participating 'ordinary' citizens as demographically reflecting the population, lacking science and technology background, and having no advocacy position towards issues in question, in fact they tend to be comparatively more alert and aware, with higher incomes, more liberal orientation, and comparatively better educational background than the average citizen (Powell et al 2010).

Measuring, evaluating, or even benchmarking up against normatively derived criteria and visions of deliberative democracy and scientific citizenship thus tend to reproduce a common conclusion: that there is a democratic deficit in decision making related to science and technology. This has progressively led to a reformulation of the notorious 'deficit model' of the relation between science and citizens, which initially pointed at a knowledge deficit on the side of the public, but increasingly tends to emphasize a deficit of mutual trust and democratic legitimacy in decision making related to science and technology (Bauer et al 2007). Overall, survey-based studies of the public reveal modest levels of active horizontal participation in science and technology and even less vertical, or policy-oriented, participation (European Commission 2005; 2010). On the backdrop of republican ideals of an active citizenry, it is stumbling close to call the democratic deficit, but the pitfall of current approaches might be that 'deliberative democracy' has an unduly privileged position as an overly ambitious benchmark. Considering levels of public engagement in other policy areas, and taking into account the complex demands on citizens in modern societies, other evaluative methods might be required, based on competing models or understandings of appropriate public participation in science and technology.

Our contention is that it is relevant to consider whether democratic deficiencies might be most severe when citizens' actual participation is out of balance with what they desire and consider legitimate. Rather than examining the distance between observed levels and forms of participation on the one hand and the ideal model of extensive, dialogical public participation on the other hand, we offer an alternative analysis of the distance between observed behavior, or what we call 'performed' participation, and individually desired or 'preferred' participation. In comparison with the republican ideals of participation underpinning the currently dominant deliberative model, clearly our approach in this paper is more in line with liberal conceptions of citizenship and public participation, which tend to emphasize individual interests rather than civic responsibilities, and opportunity for participation rather than obligation to participate.

Below, we develop a composite measure of public participation that includes indicators of citizens' participatory practice as well as their preferences with regard to the level of public involvement in science and technology. By identifying commonly occurring groups of people on the basis of a combined measure of 'performed' and 'preferred' participation, we aim to explore an alternative idea of 'democratic deficit', based on the distance between performed and preferred participation, and to examine the patterns and extent of such democratic deficits across Europe.

2. Data

The data analysed are from two modules within the Eurobarometer survey (73.1): 'Europeans, Science and Technology', and 'Biotechnology and the Life Sciences'. The survey was conducted in 2010, in 32 European countries, with samples of mostly circa 1,000 respondents per country (samples of 500 were drawn in Luxembourg, Cyprus, Malta and Iceland). Two items in the set were part of the split ballot design of the survey, and posed to only half of respondents. For this reason, the analyses in this paper are all based on respondents who were asked the full set of relevant questions; a total sample of 15,650 people. Table 1 shows the frequencies of responses at the European level, and with each country's contribution to the total weighted according to its population size.

The first item is a measure of horizontal participation. Respondents are asked first if they have heard of animal cloning for food products, and if so, if they have talked about it or searched for information about it. Questions on awareness like this were asked in relation to specific technologies, rather than (as in previous Eurobarometers) about science and technology in general[1]. Levels of technology-specific familiarity are therefore, as to be expected, lower in this survey wave than levels of general science familiarity in the previous wave. Still, a fairly large proportion of the European public – more than 40 per cent – has heard of animal cloning for food production and considered it in some form, either in conversation or by searching for information about it.

The three following items relate to vertical participation. Respondents are asked if they have attended public meetings or debates about science and technology; signed petitions or joined street demonstrations about science issues likely to attract such activities (nuclear power, biotechnology or the environment); or taken part in the activities or non-governmental organisations (NGOs) dealing with science and technology related issues.[2]

These first items in the set are regularly used to capture engagement with science and technology. They indicate the performance aspect of engagement: they are positive indicators of participation. The next two items in our set capture people's preferences, or the normative elements of participation: how do respondents think people in general should be involved in decisions about science and technology? Firstly, respondents are asked how much public involvement is appropriate when it comes to science and technology. Should the public be uninvolved; or simply kept informed about the decisions scientists and other experts make; should they be consulted and public opinion borne in mind when decisions are taken; or should public opinion even be binding when decisions are made about science and technology?[3] Across Europe clearly some people do take the extreme views – that the public should be kept completely out of decisions about science, or given great authority in them – and a few cannot choose between the available options, and say ‘don’t know’. But most people choose between one of the two middle positions. The response categories reflect what Arnstein (1969) called ‘the ladder of participation’ in policy issues, and which has also been adopted in studies of public participation in science, technology, and environmental issues (Wiedemann & Femers 1993; Smith et al 1997; Salomon 2000). The response distribution across Europe show that people tend to prefer the rungs on the middle of the ladder, either in terms of citizens being informed, or by being consulted in relation to science and technology decision making. Both levels of preferred participation leave decision making authority in the hands of experts, but they differ in terms of the interaction between decision makers and the public. ‘Informing’ citizens involves a one-way flow, where citizens take a passive, recipient role, whereas ‘consultation’ implies two-way interaction, where citizens actively ‘speak back’ (Gibbons et al 1994).

Finally, we consider people’s views on processes of governance in science and technology – and due to the design of the survey, specifically in relation to the development of animal cloning for food production. Here, about half of Europeans would delegate decisions on animal cloning to the advice of experts, with roughly a third saying that public opinion should be the guiding influence, and 13 per cent unable or unwilling to choose between the two.

It is important to note that the items included here do not exhaust - and are not tailored to measure - in any detail public sentiments towards core components of ‘deliberative’ practices or degrees of satisfaction with experienced participation in deliberative exercises in science and technology. Most people have never taken part in a ‘consensus conference’ or any other manifestation of the deliberative model for science and technology decision making, and the items applied in our study do not provide an evaluation instrument for such exercises. On the contrary, and reflecting our aim to explore a different idea about democratic deficits, the items outlined in table 1 below offer an overall measure of horizontal and vertical (performed) participation, and a measure of preferred participation that captures preferences regarding the overall degree of inclusion of the public in decision making, without differentiating between the particular forms of participation involved in different approaches. The survey asks respondents for broad impressions only, not for specific details of public participation; our analysis is framed at a corresponding level of generality.

Table 1. Basic frequencies of item responses

Survey question	% responses
Horizontal participation	
*Let's speak now about cloning farm animals. Cloning may be used to improve some characteri*stics of farmed animals in food production. Due to the high cost of cloning, this technique would mainly be used to produce cloned animals which will reproduce with non-cloned animals. Their offspring would then be used to produce meat and milk of higher quality. However, critics have raised questions about ethics of animal cloning.	
- Have you ever heard of animal cloning in food production before?	
- If yes, have you ever talked about animal cloning in food production with anyone before today?	
- If yes, have you ever searched for information about animal cloning in food production?	
Responses coded into a single variable:	
Heard of animal cloning in food production, talked about it and/or searched for information about it	43
Heard of animal cloning in food production, but not talked about it or searched for information	30
Not heard of animal cloning in food production	27
Vertical participation	
And now, there will be a few questions on how you engage with science and technology. Do you…?	
Responses recoded: yes, regularly/yes, occasionally into 'yes'; no, hardly ever/no, never/don't know into 'no' (not presented here)	
Attend public meetings or debates about science and technology	10
Sign petitions or join street demonstrations on matters of nuclear power, biotechnology or the environment	13
Participate in the activities of a non-governmental organisation dealing with science and technology related issues	8
Involvement	
Which of the following public involvement do you think is appropriate when it comes to decisions about science and technology?	
Public opinion should be binding when making decisions about science and technology	14
The public should be consulted and public opinion should only be considered when making decisions about science and technology	31
Decisions about science and technology should be made by scientists, engineers and politicians, and the public should be informed about these decisions	40
The public does not need to be involved in decisions about science and technology	8
Don't know	7
Governance	
Which of the following views is closest to your own?	
Decisions about animal cloning should be based mainly on what the majority of people in a country thinks	36
Decisions about animal cloning should be based mainly on the advice of experts	51

Don't know	13
n= 15,650 for all items apart from involvement, for which 'valid' n=14,361; see note in text on responses to this item	

3. Analyses

Following the approach employed in Mejlgaard and Stares (2010), we use latent class models (Lazarsfeld and Henry 1968) to explore what types of participation might be found among the European public. Briefly put, latent class models can be thought of as logistic regression models, with several observed response variables (answers to the survey questions) and a single unobserved variable with a certain number of unordered categories (types of participation). Here, we start from the idea that there are a number of more or less distinct orientations towards participation, and that these explain people's responses to the various questions that capture elements of participation. The model is probabilistic: we estimate the probability of giving a certain response to certain survey items, given (conditional on) membership of a certain latent class – for all classes and all possible survey responses. This entails the theoretical advantage of allowing for measurement error in the survey items, i.e. the idea that any particular survey response is a noisy indicator of the concept it is designed to represent. It also entails the practical advantage that it allows us to classify all of the combinations of responses people give, into one or other participation class. This would be unfeasible with a deterministic approach. The data contain 318 different response patterns, out of a possible (3*2*2*2*5*3)=360.[4] Latent class models help us to decide how to group those 318 response profiles into a much smaller number of classes of responses. Studying the estimated conditional item response probabilities enables us to arrive at substantive descriptions of the classes or types of participation in the data. We also estimate the proportions of people belonging in each of those classes (often termed 'prior probabilities'), at the European level and by country.

With the particular focus of analysis being to explore cross-national patterns in orientations towards participation, we approach this task from two directions: bottom-up, and top-down. For the bottom-up approach we explore latent class models separately within each country, and informally gauge which sorts of classes tend to appear in many or all countries, and which appear less frequently. For the top-down approach we run a single model across all the data together, with country as a covariate. This joint model specifies that the conditional item response probabilities are the same for all countries, i.e. that the classes are defined in the same way across all of the countries. Having defined a common set of classes across Europe, the proportions of people belonging in each of the classes can be compared country to country. For this to be credible, the joint model needs to fit the data reasonably well, and be interpretable in a meaningful way. So we consider for a number of models their statistical goodness of fit and interpretability.

Statistical fit is assessed using two approaches. The comparative fit indices, AIC and BIC, are adjusted forms of the likelihood ratio chi-squared statistic (L^2). Akaike's Information Criterion (AIC) is given by L^2-2(degrees of freedom), and the Bayesian Information Criterion (BIC) is L^2–log(n)degrees of freedom, where n is the sample size, and the degrees of freedom are given by the difference between the number of cells in the observed data and the number of parameters estimated. AIC and BIC can be used to select one from a set of models: the model with the lower value is the better fit. It is worth noting that they do not always provide the same instruction on which is the 'better' model; BIC tends to favour more parsimonious models compared to AIC for example. And they provide no information on the absolute fit of the model. For this, we report two-way marginal residuals, drawing on Bartholomew et al (2002), Bartholomew and Knott (1999) and Jöreskog and Moustaki (2001)[5]. More specifically, we present for each model the percentage of two-way margins that are 'large' (greater than 4), both for overall models and also conditional on country, so as to gauge where the best and worst fit is across the set of 32 countries. Absolute fit statistics for latent class models appear only rarely in the published literature, and there are no published guidelines on what percentage of large residuals marks the division between well fitting and poorly fitting models, so we can offer only informal comments on the ways in which we have interpreted them for our analyses.

Interpretation of latent class models is achieved by inspecting the patterns of conditional item response probabilities for each class. For each class we note the most likely combination of answers to the survey items (that is, those with the highest probabilities), and formulate a label for the class accordingly, based on our interpretation of what that response profile signifies. For some classes, certain sets of responses are very clearly defined, with probabilities of 0.8 or higher, while for others they are less clearly defined with probabilities around the 0.5 mark. Once again there are no thresholds in the literature for interpreting what counts as 'high' or 'low' in terms of probabilities. We quote them in parentheses where we are drawing on them for interpretation, and invite the reader to review them critically.

Our analyses here are more exploratory than confirmatory: we do not constrain the item response probabilities to particular values; so the typologies we obtain emerge from the data rather than being tested deductively. However, we do force the item response probabilities to follow the same pattern in each country; this is in a sense an exercise in confirmatory latent variable modelling. It is also, indirectly, an exercise in reliability assessment, in the sense that we evaluate these models to decide whether the items 'work' in the same ways across countries. We note that the composition of the classes described in the next section resonates strongly with those we found in Mejlgaard and Stares (2010), which we hope conveys informally an impression of reliability over time of some of the items which were similarly worded in the two surveys. We can hardly mention reliability without validity, and refer the reader to the Discussion for a brief comment on the correspondence between these Eurobarometer analyses and those resulting from another project addressing scientific citizenship.

4. Results

There are clearly elements of convergence and divergence between countries in terms of orientations towards participation. Table 2 describes the best joint cross-national model of participation that we could find. Each class is represented by a column and each item response by a row. The notably high probabilities that help us describe the classes are marked with a grey background. For example, conditional on membership in the class labelled 'unengaged' (the first column of figures), respondents are most likely to report not having heard of animal cloning before, with a probability of 0.56. They are extremely unlikely to have attended public meetings or debates on science and technology, signed petitions or joined demonstrations on nuclear power, biotechnology or the environment, or participated in an NGO that works on science issues (the chances of saying 'no' to these questions are 0.98, 0.98 and 0.99, respectively). When asked what role the public should have in decisions about science and technology, they are most likely to say either that the public should be kept informed (with probability 0.33), but almost as likely to say 'don't know' (probability 0.28). On the subject of whether decisions should be made on the basis of public or expert views, they might choose either way, and are in fact most likely to say 'don't know' (with probability 0.41).

The next class, of 'spectators', tend to have a somewhat higher level of awareness of animal cloning, but still very low chance of active engagement in science and technology issues. And their behaviours seem congruent with their preferences; they are most likely to say that the public only needs to be informed about decisions in science and technology (probability 0.59) and that decisions about animal cloning should be based on the advice of experts (probability 0.76) rather than on what the majority of people think. As a group, spectators are more likely than the unengaged to keep informed or simply to be exposed to information about science and technology, but they refrain from getting 'on the field', which is congruent with their preferences.

The middle class is an intriguing revelation from this model. It comprises a group of people with a high level of awareness (0.72 probability of having heard and talked about or searched for information about animal cloning) but low level of active vertical engagement – with at most a 0.22 probability of having signed a petition or joined a demonstration on science and technology issues. As a group these respondents are split on the subject of preferred participation. They have very similar probabilities of saying the public should be consulted on science and technology issues (probability 0.50) or just kept informed (0.41); and similar probabilities of wanting to place decisions about animal cloning with experts (0.50) or the majority view (0.42). This combination of high awareness, low policy-oriented action, and ambivalence on the public's proper role suggests to us that they might comprise an 'attentive' section of the public, with rather unsettled preferences with regard to public involvement.

The fourth class represents the 'discontented'. These people are not notably highly aware of applications like animal cloning, and are extremely unlikely to report having taken part in science and technology issues in an active way. But these low levels of participation in terms of performance do not seem to match people's preferences. People in this class are most likely to say either that the public should be consulted about decisions relating to science and technology (probability 0.33) or that public opinion should even be binding (probability 0.34); and overwhelmingly that decisions about animal cloning should be made on the basis of what the public thinks (probability 0.78). This mismatch between performed and preferred levels of participation leads to the idea of discontentment.

The last class also denotes a mismatch of a kind, but with the opposite pattern. These people are likely to have a high level of awareness of animal cloning (probability 0.63) and high probabilities of having attended meetings or debates (0.70), signed petitions or joined demonstrations (0.57) and working with an NGO (0.64). But their personal experience does not necessarily reflect their preferences regarding wider public involvement. They are most likely to say that the public only needs to be informed about science and technology decisions (probability 0.40) and that the advice of experts should prevail in these decisions (probability 0.53). We label this class, for the time being at least, as the class of 'over-achievers'.

Table 2. Conditional and prior probabilities for a joint cross-national model of participation

Item/response	Unengaged	Spectator	Attentive	Discontented	Over-achiever
	Response probabilities for categories of items, conditional on class				
Awareness of animal cloning for food production					
Heard and talked/searched for info	0,09	0,39	0,72	0,44	0,63
Heard only	0,34	0,34	0,21	0,28	0,11
Not heard	0,56	0,26	0,08	0,28	0,26
Attend public meetings or debates about science and technology					
Yes	0,02	0,03	0,07	0,01	0,70
No, or don't know	0,98	0,97	0,93	0,99	0,30
Sign petitions or join demonstrations about nuclear power, biotechnology or the environment					
Yes	0,02	0,06	0,22	0,09	0,57
No, or don't know	0,98	0,94	0,78	0,91	0,43
Participate with an NGO dealing with science and technology issues					
Yes	0,01	0,01	0,09	<0.01	0,64
No, or don't know	0,99	0,99	0,91	>0.99	0,36
Preferred level of public involvement in science/technology decisions					
Public opinion should be binding	0,08	0,11	0,05	0,33	0,16
Public should be consulted	0,21	0,22	0,50	0,34	0,31
Public should be informed only	0,33	0,59	0,41	0,26	0,40
Public does not need to be involved	0,11	0,09	0,03	0,04	0,09
Don't know	0,28	<0.01	0,01	0,03	0,04
Decisions about animal cloning should be based on…					
What the majority of people think	0,27	0,23	0,42	0,78	0,33
The advice of experts	0,32	0,76	0,50	0,13	0,53
Don't know	0,41	0,01	0,08	0,09	0,14
Estimated proportion in each class (population weighted)	0,17	0,36	0,19	0,19	0,09

Table 3 shows fit statistics for a set of joint models including this one, marked in bold. From the relative fit statistics, BIC suggests that the five class model is the best among this set, while AIC characteristically favours the largest model. As mentioned above there is no benchmark for how to use the marginal residuals statistics to decide on ‘good fit’. By comparison to the simpler models we presented in this journal recently (Mejlgaard and Stares 2010), we would have to retain seven or eight classes to achieve anything close to the same degree of closeness of fit. But we find that six, seven and eight class models do not yield useful interpretations, and tend to duplicate classes rather than provide useful extra insights.

Table 3. Fit statistics for joint cross-national models of participation

						% 2-way standardised marginal residuals >4					
								Conditional on country			
No. classes	L^2	d.f.	p (bootstrap)	AIC	BIC	Overall	Item by item	Mean	Median	Min-imum	Max-imum
3	11,444	13,663	<0.001	-15,882	-120,516	25.6	17.1	27.5	28.2	4.3	42.7
4	10,521	13,620	<0.001	-16,719	-121,024	20.1	12.8	21.8	22.2	0.9	41.9
5	**9,971**	**13,577**	**<0.001**	**-17,183**	**-121,159**	**15.1**	**6.8**	**17.9**	**17.5**	**0.9**	**39.3**
6	9,646	13,534	<0.001	-17,422	-121,068	13.5	5.1	15.4	15.0	0.9	35.9
7	9,324	13,491	<0.001	-17,658	-120,975	9.8	5.1	12.4	12.0	0.9	35.9

There are indications that the apparently poor model fit of the joint models might be due to cross-national heterogeneity. The column in Table 3 labelled ‘item by item’ shows residual statistics calculated from the survey questions only, ignoring the country covariate. For these, the five class model returns an undeniably good fit, much better than four classes, and not much worse than six; only 6.8 per cent of all the two-way combinations of survey answers are poorly represented by the model. But this conceals a great deal of variation country to country – from 0.9 per cent of high residuals in the Czech Republic to 39.3 per cent in Greece.

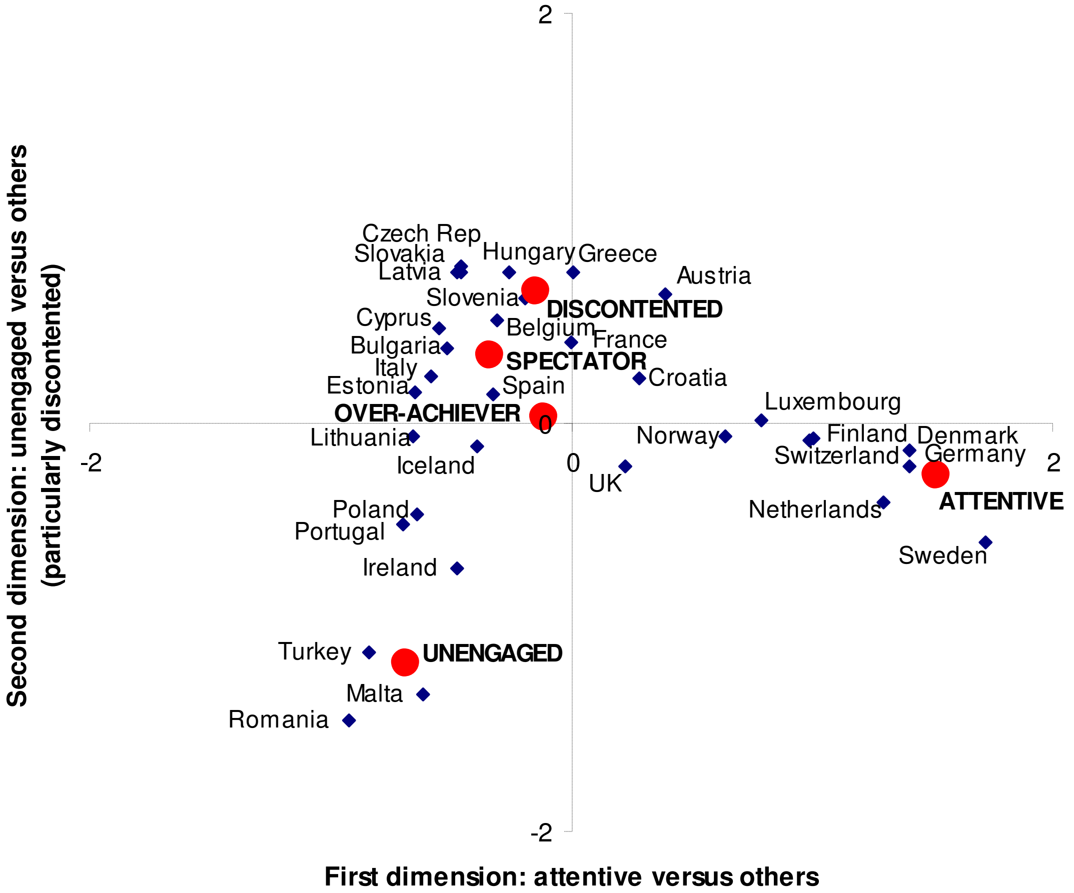
Five-class models run separately within each country reveal variations from the main themes in the joint model, but alongside a good deal of common ground. For example, a ‘spectator’ class can be identified clearly in all countries but Iceland; often in fact in two forms within countries, one with higher and one with lower levels of performed participation. ‘Discontented’ classes are found clearly in thirteen countries, ‘over-achievers’ and ‘unengaged’ in nineteen. The ‘attentive’ as seen in the joint model appear clearly in six countries, but in all countries there is at least one class that contains this or a similar intriguing mixture of preferences as regards participation.

Finer nuances will be explored in a future paper. At the current time we lack the computational tools to calculate residual fit statistics for joint models with any of the existing parameter constraints relaxed. For example, we cannot assess the fit of models that allow the relationship between the survey responses and the underlying participation orientation to vary by country (i.e. including interactions between item, country and latent variable). Given our current computational capabilities, and weighing up interpretability and fit, the five class joint model in Table 2 seems to be the best stopping point, for now at least.

Given the cautionary note attached to this model, it would be unwise to make too much of the proportions of people estimated to belong to each of the classes, particularly conditional on country. Table 2 gives these prior probabilities across Europe as a whole – with roughly a third identified as spectators, just under a fifth each in the classes attentive, discontented and unengaged, and less than ten per cent in the class of over-achievers. For country-by-country analysis, we focus on the relative association between country and class prevalence, rather than presenting the absolute figures. Figure 1 presents the bi-plot from a correspondence analysis of country by estimated proportions in the classes. It serves as a useful face validity check of the model.

The two-dimensional plot accounts for more than 80 per cent of the variance, or inertia, in the data. The horizontal dimension can be mostly defined by the contrast between the attentive class and the others, particularly the unengaged class. Sweden, Germany, Denmark and the Netherlands are more strongly associated with attentiveness than with the other participation types. The vertical dimension owes most of its variation to the contrast between the unengaged class and the rest, particularly the contrast with the discontented. Turkey, Malta and Romania are in relative terms more strongly associated with the unengaged class, compared to the average profile of class memberships. A cluster of countries at the top of the plot are a shade more closely associated than on average with an outlook of discontentment – these include Austria, Hungary, Greece, Latvia, Slovakia and the Czech Republic. It is interesting that the relative variation in country-by-country patterns is in terms of these extremes. Notably the spectator and over-achiever classes fall near to the centre of the plot, indicating that no countries are particularly strongly associated with them.

Figure 1. Bi-plot from correspondence analysis of participation classes by country



5. Discussion

We have used latent class models to explore what Eurobarometer survey data can tell about the ways in which people participate in tacit and in policy-active ways with developments in science and technology, as well as about their preferences with regard to public involvement in science and technology. Based on this composite measure of public participation, we have identified dominant groups across Europe, and the typology that emerges provides a background for discussing prevailing and alternative ideas about democratic deficits in the relation between science and the public.

Public participation is a central concern within a European 'Science in Society' context, usually entailing efforts to describe sections of the public in terms of their levels of involvement, with a view to increasing participation across the board and particularly embracing the idea of scientific citizenship and deliberative policy making. Benchmarked against such a ‘thick model’ (cf. Møller and Skaaning 2011) of democratic decision making concerning science and technology, clearly the ‘unengaged’ and the ‘spectator’ classes emerging from the analyses under-perform. For the unengaged class, science and technologies are not at all on the radar, and citizens belonging to the spectator class are primarily passive recipients of information, with no involvement or sense of duty related to this policy area.

If, on the other hand, democratic deficiency is conceptualised as the distance between performed and preferred participation, rather than the distance between performed participation and the ideal version of republican, scientific citizenship, the interpretation of these two classes of unengaged and spectator citizens is markedly different. The spectators tend to keep moderately informed, they have heard about the issue, sometimes even searched for information, but they have not engaged actively in any policy-oriented activities; and this is in fact entirely congruent with their group preferences: they prefer to be informed about science and technology, but leave decisions with experts. For the unengaged citizens science and technology is a non-issue, which is also reflected in preferences, with a high likelihood that citizens within the group either prefer not to be involved or have no set preferences with regard to the level of public involvement, and consequentially answer ‘don’t know’ to these questions. Approaching the matter of democratic deficits based on a ‘thinner’ model of democratic governance of science and technology, in which citizens would engage in accordance with their individual preferences rather than based on a pre-fixed model, then, implies that these two groups are actually not to be considered particularly problematic or deficient.

Instead, our approach would emphasize the group of ‘discontented’ citizens, where the distance between performed and preferred participation is substantial. Among citizens in this group, the level of active involvement is very low, which is out of balance with a strong desire for public participation and deliberative decision making. The democratic deficit is clearly in evidence.

Likewise, the group that we have tentatively called over-achievers are characterized by an imbalance between performed and preferred participation; but with a reciprocal relation. Levels of participation are high within the group, but the overall desire for involvement is modest.

This alternative diagnosis of democratic deficiencies prompts questions about how such feelings of disproportionality between actual participation and desire for involvement arise, and about which policy measures might be relevant for levelling imbalances. An in-depth analysis of the roots of discontentment is beyond the scope of this paper, but the cluster of countries relatively more closely associated (than the average profile) with the characteristic of discontentment, including Austria, Hungary, Greece, Latvia, Slovakia and the Czech Republic, is suggestive of the importance of what might be called 'opportunity structure' as a significant factor in accounting for discontentment. A recent cross-European project involving 38 countries and aimed at 'Monitoring Policies and Research Activities on Science in Society in Europe', the MASIS project (Mejlgaard et al. 2011), is indicative of the lack of opportunity structure, or infrastructure for public participation, in the before mentioned countries. Broadly speaking, these six countries are characterized by having no, or only infant, formalized procedures and institutions facilitating public participation in science and technology decision making, by paying no, or only sporadic, attention to so-called 'upstream engagement', where citizens get involved in prioritizing and agenda setting at early stages of scientific and technological developments, and by having no or only few civil society organizations aimed at influencing science and technology policy making. The picture that emerges from the MASIS national reports is quite consistent across the six countries in question, but a more fine-grained resolution would require careful examination of the full set of national reports in combination with supporting material. On the surface level, though, the qualitative material does seem to have a plausible, consistent linkage with our survey-based typology.

It is interesting that the countries that come out relatively more closely related to the outlook of 'attentiveness', that is with high levels of horizontal engagement but modest levels of vertical participation combined with rather diversified opinions on preferred participation, are in fact countries with long traditions for citizen involvement in science and technology and extensive institutional infrastructures for facilitating public participation, such as Denmark, Sweden, and the Netherlands. So, while lack of opportunity may be source of discontentment, plentiful opportunities do not necessarily entail a clear-cut picture of satisfaction. The orientation of attentiveness, with which these countries are relatively more closely related, does combine moderate performed participation and middle-rung preferred participation, but the class of attentiveness is by far the least straightforwardly interpretable among the latent classes emerging from the analyses.

The typology presented in this paper raises questions and considerations for social scientists as well as science policy makers and communicators. Rather than imposing, top-down, a particular normative model of democratic governance of science, and, in turn, continuously discovering that observed levels of public participation do not live up to expectations, it might be relevant to take public preferences as an alternative point of departure when studying the democratic legitimacy of science and technology, and to address, when developing science communication activities and political initiatives aimed at enhancing such democratic legitimacy, specifically those groups of citizens, who are discontented. It is our argument that current studies and discussions of democratic deficiencies in science and technology would be more meaningful and rich if social scientists would challenge the dominant deliberative model, and that science communication and engagement activities would be more effective if they would take seriously the actual desire for involvement and conceptions of appropriate governance among the different publics for science and technology.

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[1] We used the item on animal cloning for food products on the grounds that it was more widely known than the other technologies in general, and simpler for the unfamiliar to grasp.

[2] The set also contained an item asking if respondents donated money to fundraising campaigns for medical research such as research into cancer – intended to allow respondents who lack the opportunity for active engagement to give a positive response. We excluded this item from our analyses on two grounds: primarily theoretically – giving to charity is not a good indicator of active participation, and we rather wish to explore differential opportunities to participate in this and subsequent studies, rather than correct for it by means of a proxy indicator; also empirically – leaving the item in the models or leaving it out of the models made very little difference to our substantive findings, and only worsened the fit of our models. Invoking Occam's razor, we opted to leave it out.

[3] Two extraneous responses: 'NGOs should be partners in scientific and technological research' and a spontaneous 'None [of these]' are treated as missing. This decision rests on both theoretical grounds – that the NGO response does not fit within the frame of reference of the other responses, or of our theoretical interests – and also on empirical grounds, that including it as an observed response does not change our substantive story at all. Models were estimated using full information maximum likelihood, i.e. assuming these responses are missing at random (MAR); doing so seems to do no damage to our analyses.

[4] Not counting response profiles including missing responses – see the note on how we handle missing values.

[5] For responses to each pair of items, we create a two-way marginal table, by collapsing over responses to the other variables. We then compare O, the observed frequency in a single cell of such a table, with E, the expected frequency for that same cell. The residual for each cell is calculated in standardized version, as (O–E)2/E, where values greater than 4 are taken to indicate poor fit (Bartholomew et al. 2002). The greater the number of large residuals, the worse the model is, and we take as our fit statistic for each model the percentage of standardized marginal residuals greater than 4. For cross-national models we give this statistic for the model overall, and item-by-item (collapsing over country), as well as conditional on country, reporting the range and average number of large two-way marginal residuals for each model. Note that these statistics are calculated excluding response combinations that contain one or more 'missing' value. These actually differ very little from the figures which include 'missing' values – providing further reassurance that making the MAR assumption is not unjustified.