BELIEF IN PUBLIC EFFICACY, TRUST AND ATTITUDES TOWARDS MODERN GENETIC SCIENCE

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ABSTRACT

Government and policy makers want to engage the public in a dialogue about the conduct and consequences of science and increasingly seek to actively involve citizens in decision making processes. Implicit in this thinking is that greater transparency and public inclusion will help dispel fears associated with new scientific advancements, foster greater public trust in those accountable and ultimately increase the acceptability of new technologies. Less understood, however, are public perceptions about such high level involvement in science and how these map onto public trust and attitudes within a diverse population.

This paper uses the concept of 'public efficacy' - the extent to which people believe that the public might be able to affect the course of decision making - to explore differences in trust, attentiveness and attitudes towards modern genetic science. Using nationally representative data from the 2003 British Social Attitudes Survey, we begin by examining the characteristics of those who have a positive belief about public involvement in this area of scientific inquiry. We then focus on how this belief maps on to indicators of public trust in key stakeholder groups, including the government and genetic scientists. Finally, we consider the relationship between public efficacy and trust and attitudes towards different applications of genetic technology.

Our findings run contrary to assumptions that public involvement in science will foster greater trust and lead to a climate of greater acceptance for genetic technology. A belief in public efficacy does not uniformly equate with more trusting attitudes towards stakeholders but is associated with less trust in government rules. Whereas trust is positively correlated with more permissive attitudes about technologies such as cloning and gene therapy, people who have a belief in high level public involvement are less likely to think that these technologies should be allowed than those who do not.

Keywords: public efficacy, trust, genetic science, attitudes, engagement

1. SCIENCE AND THE PUBLIC

Advancements in the biomedical sciences, such as the decoding of the human genome, pave the way for technologies that have potentially profound impacts on human health and the environment. These same technologies bring to the fore ethical, social and political challenges. In this context of rapid scientific advancement, the relationship between science and its public has come under scrutiny in three key respects:

Firstly, surveys of public attitudes to science reveal that general optimism is often accompanied by public scepticism or concern (MORI, 2005). Although the British public are generally supportive of science, with a majority agreeing that science and technology make our lives 'healthier, easier and more comfortable' (Office of Science and Technology, 2000: p.22) and that 'the benefits of science and technology are greater than any harmful effects it may have' (European Commission, 2005: p.53), the same data highlight accompanying reservations. The 2005 Eurobarometer survey on public attitudes to science and technology showed that in the UK 14 percent of the UK public felt that science and technology could sort out any problem compared with an EU average of 21 percent (European Commission, 2005) . More than half of UK citizens concurred with the view that 'science and technology are responsible for most of the environmental problems we have today' (MORI, 2005) and there is often general unease at the speed with which scientific developments often outpace public awareness and consultation (House of Lords, 2000).

Secondly, there is evidence that a sizeable proportion of the public perceive themselves to be disconnected or disengaged from science. A recent UK study found that only 40 percent consider themselves well-informed about science and confusion exists about what the public consultation process actually involves (MORI, 2005). In a survey of European member states, only 1 in 10 citizens felt 'very well informed' about new scientific discoveries in 2005 (European Commission, 2005: p.17). The same survey reported that although 30 percent were very interested in new scientific discoveries, inventions and technologies, this was 8 percent less than in 1992. Of those that expressed disinterest in science, the most commonly cited reason was a 'lack of understanding', with a 'lack of concern' coming a close second. A number of empirical studies report

low levels of scientific literacy among the public based on their comprehension of basic scientific 'facts' or scientific reasoning (Miller, 1983). Such indicators of public understanding of science have been found to correlate with reported interest and with a range of demographic variables which show that scientific interest, awareness and knowledge are not uniformly distributed among the public but correlate with age, gender, education and social class (Durant, Evans & Thomas, 1992; Gaskell, Allum & Stares, 2003). The identification of a discrepancy between the public's expressed interest and knowledge and that of experts represents a particular perspective on the public understanding of science that is often considered to be discredited, although interest in the relationship between 'scientific knowledge' and attitudes continues (Sturgis & Allum, 2004). The essence of such a deficit model is that the public is passive, ignorant, sceptical or worried, 'because it does not understand the science' (Irwin & Michael, 2003:14).

Within a constructivist view of public knowledge that has developed in response to this 'deficit' model, there is now considerable evidence for the validity of other variants of lay knowledge (Irwin & Wynne, 1996; Yearley, 2000). Notions of lay expertise and knowledge and a focus upon contextualised public understandings of science are thus now as widespread as those of a deficit in public understandings were twenty five years ago. However the deficit model undoubtedly remains influential in shaping views of publics and of ways of engaging with them (Michael, 2002; Levitt, Weiner & Goodacre, 2005, Petts & Brooks, 2006)

A third dimension of the relationship between science and the public that has received considerable attention is the low levels of trust and confidence that publics often have in some scientific experts and the institutions that develop science based policy and practice.. This 'crisis in confidence' (House of Lords, 2000) is widely (though some would say mistakenly – see Marris, Wynne & Simmons *et al.*, 2001; Wynne, 2001) attributed to several well-publicised controversies over the last two decades - most notably that surrounding BSE (Jasanoff, 1997), and continuing today, for example, through public disquiet about the MMR vaccination (Hobson-West, 2003). This disquiet is echoed in opinion surveys where members of the public are cynical about the motivations of scientific researchers (Office of Science & Technology, 2000). It is notable that in surveys there is more evidence of trust being differentially attributed to,

for example, national government, variously affiliated scientists, politicians, and the media, than there is for changing levels of trust over time (Worcester, 2001; Poortinga and Pidgeon, 2004; MORI, 2005).

Certainly the restoration or maintenance of trust is seen as vital to facilitate scientific innovation; a lack of trust is thought to contribute to public resistance, which in turn may threaten future science and technology development (House of Lords, 2000). Trust is believed to reduce social complexity (Earle & Cvetkovich, 1995), thus being particularly valuable in affording the development of scientific technologies that challenge values, raise social and ethical questions or are more obviously characterised by long-term uncertainties (Siegriest & Cvetkovich, 2000; Poortinga & Pidgeon, 2003a). In contrast, a lack of trust can serve to intensify public concerns, trigger secondary impacts such as the stigmatisation of places, products or processes (Flynn, Slovic & Kunreuther, 2001) or render risk prevention or reassurance messages less effective (Bennett & Calman, 1999). In short, building trust is seen to lessen the significance of differences between expert and lay perspectives and to provide a means to increase the acceptability of expert decision making. Qualitative work has also been influential in drawing attention to the central importance of trust in governance around science (Grove-White, R., Macnaghten & Meyer *et al.*, 1997; Marris, Wynne & Simmons *et al.*, 2001) although rather than locating a deficit of trust within the public, the focus here is upon the required re-orientation of policy institutions.

2. ENGAGING THE PUBLIC

Faced with the difficulties of promoting and advancing science in a climate of public scepticism, disconnection and apparent distrust, the attention of policy makers has increasingly focused on developing what the Prime Minister in 2002 termed a 'robust and engaging dialogue' between scientists and the public (Prime Minister, 2002). This imperative for dialogue ostensibly signals a move away from the traditional model of science communication where the communication of scientific 'facts' is essentially top-down from the scientific community to the lay public and has been recast as a two-way dynamic exchange to which each party brings, not only their existing knowledge, but a

host of background characteristics, beliefs and life experiences (House of Lords, 2000; Department of Trade & Industry, 2001). Informing the public remains an important goal in order to facilitate informed debate and decision making, but alongside this it is recognised that scientists and policy makers have much to learn from attending to public opinions, attitudes and values (MORI, 2000; Worcester, 2001). Assent to the necessity, if not the value, of public consultation is now widespread to the extent that Harrison & Mort (1998) suggest that "being in favour of public consultation (..) is rather like being against sin; at a rhetorical level, it is hard to find disagreement' (p. 61).

The involvement of publics in science can, however, serve the more instrumental purpose of increasing trust in decision makers and, more contentiously, the acceptability of the decisions themselves. Wilsden and Willis (2004) note how governments may want to engage with the public in order to build trust in science and to be seen dealing with issues in a competent way, heading off any potentially embarrassing or unmanageable public alienation on risk issues. Put another way, communication with the public can be an effective means to reach desired policy ends (Fioriono, 1990) – namely, to facilitate greater public acceptance of science and its licence to practise.

Public participation can, and has, taken many forms, from the informal sharing of information to organised events such as consensus conferences or citizens panels, through to what has been termed a 'high level of active public dialogue' (Department for Environment, Food & Rural Affairs, 2001) where substantive public input is sought at policy decision making level. Public involvement at this stage is argued to improve the quality of decision making, particularly when it occurs 'upstream', as the issues emerge (Wilsden & Willis, 2004) although evaluation of the difference that dialogue makes to outcomes as well as to processes is rarely conducted (Rowe & Frewer, 2000; Rowe, Horlick-Jones & Walls *et al*., 2005). Still less is known about the way in which publics view their participation and involvement. It is to this question and the implications of public involvement for building trust and impacting on public attitudes, that we hitherto focus our attention.

3. PUBLIC PERCEPTIONS ABOUT ENGAGEMENT

Although, as noted above, the case has been made for public involvement in science, it is unclear how the public view participation and dialogue and their potential role within such processes. Still less is known about how such beliefs may map on to other beliefs and the background characteristics of publics. A greater understanding of this may be helpful particularly in formal participation initiatives where demands upon the public to acquire and assimilate information may be high, as well as requiring considerable investments of time.

When questioned, members of the public (like experts) appear to endorse the principle of their greater involvement and consultation in science, whilst at the same time conceding they know little or nothing about it (MORI, 2005). The 2005 Eurobarometer survey found a majority of EU citizens agreed that the public is not sufficiently involved in science and that 'scientists put too little effort into informing the public about their work' and should 'listen more to what the public think' (European Commission, 2005). Coupled with widespread support for more information and debate on scientific issues (MORI, 2005), this could be construed as a 'latent interest' for science among the public. However, a large disparity exists between general agreement that public input is a 'good thing' and some formal indicators of engagement with science drawn from survey work. Only 1 in 10 people surveyed in the EU report talking to friends about science and technology and the proportion who read about it is low at 19 percent (European Commission, 2005). More than three-quarters of people in this survey had never actively participated in science, for example, by signing a petition or attending a meeting about an issue they felt strongly about and, in the UK, public awareness of organised science events is very low (MORI, 2005). This is significant because research suggests that it is these more active kinds of civic participation that are most fundamental for building trust between members of a local community, as well as between the public and institutions who govern them (Duffy, 2004; Veenstra, 2000). It is, however, debateable whether this is part of a wider decline in public participation of this type, with British survey data showing little evidence of a fall in political participation or willingness to engage in organised action between 1983 and 2001 (Bromley, Curtice & Seyd, 2001).

Low levels of active public engagement with science are likely to stem in part from public perceptions of its value. Approximately 3 in 10 UK citizens surveyed in the Eurobarometer agreed with the proposition 'it is not important for me to be involved in decisions about science and technology'. Of those who disagreed with the statement, a disproportionate number were from higher socio-economic groups, were younger and more knowledgeable about science. Qualitative research finds that public consultation exercises tend to be viewed by people as unrepresentative and the preserve of those who have strong opinions (MORI, 2005), falling short of attracting the widespread, socially inclusive support often considered the pre-requisite for making balanced and effective decisions and for building public trust.

Importantly, people may doubt the potential of the public to make a difference. In 2005, half of the surveyed UK public felt they personally had no influence on decision making in science and scientific research and 2 in 10 were of the opinion that the government fails to listen or act on the outcome of any public consultation on science (MORI, 2005). This issue has been empirically investigated with respect to the British political system where the concept of 'political efficacy' was used as an indicator of the confidence people had in their own ability to articulate demands and in the system to respond to them effectively (Bromley, Curtice & Seyd, 2001). The analysis found that political efficacy was associated with greater trust in government to put the needs of the nation first and those with higher levels of efficacy were more likely to engage in voting behaviour or take some form of civic action. Marris, Wynne & Simmons *et al.*, (2001) highlight the notion of agency and hypothesise that lack of agency may obscure the expression of concern. More recently, Simmons and Burchell (2005) have noted that the motivations of key actors to participate are crucial, but are often poorly understood. Focusing on one such group – service users – they explore the extent to which users are motivated by individualistic or collectivistic concerns and suggest that both should be incorporated into the design of effective public participation initiatives.

3. MODERN GENETIC SCIENCE – AN EXEMPLAR

This paper will conduct an exploratory analysis using the concept of efficacy as it relates to perceptions about public involvement in a particular area of scientific inquiry – modern genetic science. Using data from the 2003 British Social Attitudes Survey, we investigate how a belief in the effectiveness of public involvement in decision making about genetic science relates to trust in decision makers and attitudes towards new genetic technologies. A relatively new and rapidly advancing field of scientific inquiry, genomics has many characteristics that make it a particularly suitable domain within which to investigate the mutually reinforcing relationships often held to exist between public efficacy, trust and attitudes.

Firstly, the term 'genomics' encompasses a range of new genetic applications which will have profound implications for human health and the environment. The long-term outcomes of genetic technologies are, however, characterised by considerable uncertainty and controversy, with many scientific, legal, social and ethical questions as yet unanswered. In recent years, a number of biotechnology issues have been brought to the public's attention through widespread media coverage (Gaskell, Allum & Bauer *et al.*, 2003), the most longstanding one being GM crops and foods (Vidal, 2003), but more recently human cloning and so-called 'saviour siblings' (Marsh, 2003).

Secondly, genomics is an area where public opinion is visibly nuanced and fluid. In general, public attitudes to genetic science can be characterised as sceptical, but not overwhelmingly hostile. However, public opinion differentiates between different technologies according to their outcome. Majority support is found for applications where there are clear medical benefits for the diagnosis and treatment of human disease (MORI, 2005; Sturgis, Cooper, Fife-Schaw *et al*., 2004; Gaskell, Allum & Stares, 2003; MORI, 1999) but opinion becomes markedly more oppositional if the same technology is used to different ends, for example, to clone human cells or decide whether or not to continue a pregnancy (Human Genetics Commission, 2001; MORI, 2003). It is the 'green-biotechnologies' that have attracted most public anxiety over the last two decades, with the genetic modification of plants widely perceived as risky and of limited usefulness (Gaskell, Allum & Bauer *et al*., 2003). However, over the last five years, a number of surveys have reported less outright public hostility towards GM crops and foods which could be indicative of greater ambivalence towards these technologies

(Sturgis, Cooper, Fife-Schaw *et al*., 2004; MORI, 2005; Horlick-Jones, Walls & Rowe *et al*., 2004). Mirroring the picture for science as a whole, surveys also show that government institutions as well as those associated with the biotechnology industry are among those commanding the least confidence about GM (Gaskell, Allum & Stares, 2003) and that less than half of Europeans agree that government and industry are 'doing a good job for society' (Gaskell, Allum & Bauer *et al*., 2003).

Finally, genetic science is an area that exemplifies the governments' commitment to public engagement but where the complexity and uncertainty of many of the processes and outcomes associated with new genetic technologies arguably render engagement of the general public difficult. To date, the most ambitious exercise has been the government sponsored 'GM Nation? public debate' with the British people in 2002. This debate was explicit in its aim to 'inform decision making' (Department of Trade & Industry, 2003: p.11) and incorporated several strands of public involvement, including discussion workshops and on-line completion of a short survey (see Horlick-Jones, Walls & Rowe *et al*., 2004; Gaskell, 2004). The conduct of the debate has not been without its critics, among them Wilsden and Willis (2004) argue that it was a prime example of an instrumentally motivated exercise - 'ministers wanted to be seen as doing the right thing in order to build trust in their handling of the issue and perhaps to move towards greater acceptance of the technology' (p.39). Arguably, it failed in its remit to inform decision making because it took place 'downstream', that is, once political, economic and organisational commitments were already in place. People expressed little confidence in their own power to influence decisions about GM, although among the British public there remains a high level of support for government consultation on GM food (Poortinga & Pidgeon, 2003b).

The aims and hypotheses of this study are three fold. Firstly we investigate public perceptions of involvement in modern genetic science using an indicator of public efficacy (BPE) derived from existing survey data. We examine what, if any, background characteristics distinguish the efficacious public from those who reject the notion of public involvement using key demographic indicators as well as values and attentiveness in relation to this area of science. Secondly, we investigate the relationship between our indicator of public efficacy and trust in key stakeholder groups for modern genetic

science. Our overview of the literature and policy discourse leads us to hypothesise that any association between public efficacy and trust will be a positive one, with those expressing most confidence about public participation having more trusting attitudes than those who do not. Finally we empirically examine how public efficacy and trust impact on attitudes towards three distinct genetic technologies. We test the assumption that more positive attitudes towards genetic technologies will be found among those who do not reject high level public involvement in this area of science and who express greatest trust in stakeholder groups.

5. METHOD

5.1 Survey and respondents

The British Social Attitudes Survey provides nationally representative data on adults aged 18 and over living in private households in Great Britain. A module of questions assessed public attitudes to both modern genetic science (that is, to genetic technologies that have developed in the post genomic era, such as cloning) and to the scientists working in these areas. These questions were administered through face to face interview and self completion to approximately two thirds of the BSA sample, giving a total of 3272 interviews, an overall response rate of 59 percent (Park, Curtice & Thomson *et al*.,. 2004). In our analysis, all percentages are based on data weighted for differences in the probability of individual and household selection. The bases shown in tables are unweighted.

5.2 Measures

Belief in public efficacy is based on the following item; 'modern genetic science is so complex that public involvement is not realistic'. Responses were on a five-point scale from 1: 'strongly agree' to 5: 'strongly disagree'. We are mainly interested in the people that indicate that public agreement *is* realistic and thus disagreement with this proposition is used as an indicator of a belief in public efficacy. We are aware that using a single-item indicator of public efficacy in our analysis is less than ideal, however it cannot be

avoided in this instance as the BSA survey was not designed specifically to measure public efficacy. To go at least some way towards validating the measure we note its relationship with other indicators of efficacy from a different section of the BSA survey that we might expect it to relate to[1]. Both items have been used to represent the concept of 'political efficacy' (Bromley, Curtice & Seyd, 2001) and are based on responses to the following propositions: 'government is too complex to understand' and 'people like me have no say in government'. We also note the relationship between our belief in public efficacy measure with two indicators of active public engagement taken from the wider survey. A 'government action index' was derived from a series of items about whether or not respondents have undertaken action on a government issue they perceive to be unjust or harmful, such as writing to an Member of Parliament or signing a petition. An 'organisational membership index' is based on whether or not the respondent currently belongs to any voluntary or community group.

Background characteristics were used to show the social composition of the efficacious public for modern genetic science and as control variables in our analysis of the relationships between public efficacy, trust and attitudes. In addition to age and sex, we included an indicator of educational level based on highest reported qualification. We assessed public attentiveness to issues concerning genes and genetics by combining four items that asked respondents the extent to which they had heard or read about such issues, talked about them or thought about them in the past few months. The scores could vary from 1: 'a great deal' to 5: 'not at all'. The items were combined into a single summed scale of attentiveness (alpha=.78). A series of six questions in the survey were designed to gauge people's core values concerning science and nature; respondents chose between two anchoring statements concerning scientific progress and its role in the natural world[2]. These items were combined into a single values scale (alpha = .59[3]) where a high score was indicative of positive values towards scientific progress and intervention and a low score reflected values associated with the preservation of the natural order.

[1] Questions pertaining to political efficacy were not administered to the same sample of the BSA as our measure of public efficacy. We therefore do not combine them for the main analysis presented here.
[2] Items available from Park et al. (2004)
[3] We recognise that the reliability of this measure is marginal

Public trust was based on responses to three items that distinguished different stakeholders as follows. 1: 'Those in charge of new developments in genetic science cannot be trusted to act in society's interests'. 2: 'Rules set by government will not keep us safe from any risks linked to modern genetic science'. 3: 'genetic scientists only tend to tell us what the people paying their wages want us to hear'. Responses to these three items were given on a scale ranging from 1: 'strongly agree' to 5: 'strongly disagree'.

Public attitudes to modern genetic science were examined for three distinct genetic technologies: human cloning, gene therapy and the use of genetic databases. Respondents were asked four items about whether or not human cloning should be allowed for 1: organ transplants, 2: treatment for Parkinson's Disease, 3: for someone in good health who wants to live longer and 4: for a infertile couple who cannot have a child. Four items probed whether or not gene therapy should be allowed for the following purposes. 1: to lessen aggression or violence, 2: alter sexuality; 3: reduce chances of getting breast cancer: 4: determine the sex of an unborn baby. For both human cloning and gene therapy, responses were scored from 1: 'definitely not allowed' to 4: 'definitely allowed'. Scored responses were summed into a single scale for attitudes to cloning (alpha=.82) and attitudes for gene therapy (alpha=.68) where a high score was indicative of a more permissive attitude. Public attitudes towards use of genetic databases were assessed by 5 items about databases used for the following purposes, 1: illness and disease, 2: serious crimes; 3: ancestry; 4: health and life insurance; 5: employment. Responses to each item were scored 1: 'definitely not in favour' to 4: 'strongly in favour'. Scored responses were summed into a single scale (alpha=.66) where a high score was consistent with a more favourable attitude towards use of genetic databases.

6. RESULTS

6.1 Beliefs about public efficacy

A small majority (52 percent) agreed with the statement 'modern genetic science is so complex that public involvement in policy decisions is not realistic', thus failing to endorse the notion that members of the public think that they can play a meaningful role in this area of science. Only 28 percent disagreed that the complexity of the science precluded any public contribution at policy level, thus displaying what we term belief in public efficacy (BPE). As noted earlier, the survey was not specifically designed to address this issue, so in this exploratory work we must rely on this single measure to represent public efficacy. However, we can explore how our measure of BPE relates to other questions in the survey pertaining to public perceptions of governance. 60% of the public are of the opinion that 'government is too complex to understand' and 65% agree that 'people like me have no say in government'. We also find small but significant correlations between these measures and the measure of BPE (Table 1), suggesting that these items relate to each other in the way that we might expect: people with a belief in public efficacy are both more likely to disagree that 'government is too complex to understand' ($r = .22$, $p<.001$) and that 'people like me have no say in government'($r = .11$, $p<.001$). The relationships between these three measures suggest that a low belief in public efficacy for genetic science mirrors a wider feeling of powerlessness around government for a significant proportion of the public. In addition, the BPE item corresponds to indicators of active citizen engagement. We find that people with a belief in public efficacy are both more likely to have taken government action ($r = .19$, $p<.001$) and to be a member of an organisation (r.112, $p<.001$). Overall, the consistency of these findings suggests that it is not unreasonable to proceed with using a single item measure of BPE in this exploratory analysis.

As well as a lack of public efficacy for modern genetic science we find fairly low attentiveness among the public to issues of genes and genetics. Only about one-quarter of the public rate themselves as having 'a great deal' or 'quite a lot' of interest in such issues, with approximately half having little or no interest (Table 2). Although more than one-third had heard or read about the issues to a large extent over the past few months, more than 50 percent responded that they had talked or thought about the issues 'not very much' or 'not at all'.

A logistic regression was conducted in order to identify significant predictors of BPE. A linear regression was not conducted as the required assumptions of normality are problematic when using a single item outcome measure. The outcome variable was thus recoded and had two levels: those who agreed with the BPE item (scored as 0) versus those that disagreed or were undecided (scored as 1). Only those background variables that had a significant bi-variate association with the outcome variable were considered as predictors.

The predictors were entered into the analysis simultaneously: age, gender, attentiveness to genes and genetics, educational levels and core values about science and nature. A total of 1801 cases were included in the analysis. The full model was significant (chi square = 197.1 df = 8 $p < .001$). Table 3 gives the summary statistics and shows how important each predictor variable was independently of the effect of the others. The final regression model indicates that those with a belief in public efficacy can be identified as male and with higher educational qualifications. They tend to be those most attentive to this area of science. We also find that people's core values concerning the balance between science and nature are significantly associated with their belief about public involvement in genetic science; those who had values that can be broadly characterised as pro-nature and against scientific intervention were more likely to perceive high level public involvement as realistic.

6.2 Public efficacy and trust

A comparison of trust in stakeholder groups for modern genetic science is presented in Table 4. This table shows that opinion differs according to the stated object of trust, with 'those in charge' perceived more favourably than 'genetic scientists' on our attitude measures. However, trust in genetic scientists is significantly higher for those with a belief in public efficacy (21 percent) compared with those who do not (13 percent) (correlation = .08, $p<.001$). The same pattern is evident for trust towards 'those in charge' where approximately 3 in 10 of those who believe in public efficacy express a trusting attitude, but this correlation did not reach significance. When the object of trust is the government, however, the opposite picture emerges. Here, a belief in public efficacy is

associated with significantly *less* trust in government rules to keep us safe from any risks linked to genetic science; 22 percent compared with 25 percent (correlation = -.128, p<.001). Thus, on what might be viewed as the most important object of trust with regard to public perceptions of genetic science, we find that those with an efficacious belief are less inclined to agree that government rules will offer public protection against risks associated with genetic science than those who reject public involvement.

6.3 Public efficacy and attitudes towards genetic technologies

Linear regression models were used to examine the impact of public efficacy on attitudes towards human cloning, gene therapy and the use of genetic databases (see Table 5). Attitudes towards human cloning and gene therapy are based on public perceptions about whether or not they should be allowed, whilst attitudes towards genetic databases use different response options to gauge the extent to which the public are in favour. The overall variance explained in each of the models although significant was small (the adjusted R^2 values were .08, .08 and .09 respectively). However, after controlling for trust and background characteristics, our measure of belief in public efficacy was significantly associated with attitudes towards each of the three genetic technologies. This was not a positive effect; rather those with a belief in public efficacy had consistently less permissive attitudes towards human cloning (B= -.142, p<.001) and gene therapy (B= -.58, p<.001) and are less in favour of genetic databases (B=-.23, p<.001) than those who did not consider public involvement to be realistic. This finding of more negative attitudes among the efficacious public contrasts with the trust variables included in the models. Trust in 'government rules' and trust in genetic scientists was positively correlated with more permissive attitudes whilst trust in 'those in charge' made no significant contribution to any of the models. Thus, the belief in public efficacy measure opposes trust in its relation to the permissiveness of attitudes to each of the three technologies. Rather, our results show that belief in public efficacy functions in a similar way to measures of attentiveness and education which also have a consistent negative association with attitudes. Members of the public with higher levels of education, who are attentive to issues around genes and genetics or who have a belief in high level public

involvement, fail to endorse the future development of genetic technology in three key areas.

7. DISCUSSION

This study has focused on public efficacy for modern genetic science and its links with public trust and attitudes. Our first aim was to better understand the size and composition of the public that consider that public involvement around modern genetic science is realistic. Agreement with the proposition that this area of science is 'too complex for public involvement in policy decisions' was high, with less than 1 in 3 displaying a belief in public efficacy. To some extent, this seems to reflect a broader picture of public disenfranchisement with their capacity to 'make a difference' in society through participation in government processes, as evidenced by similarly low levels of political efficacy in our analysis. The relatively small proportion of people who did display a belief in public efficacy for modern genetic science were more likely to be those who were active citizens in their community and were most educated or familiar with, and interested in, the relevant issues. Although our data does not allow us to infer any causal relationship between public efficacy and attentiveness, it seems feasible to infer that people who are not conversant with the issues are more likely to reject a role for the public at large in this area of science whereas engagement with science or civic action more generally may reinforce positive beliefs about public efficacy, particularly if the outcome of such participation can be recognised as successful. An opposing argument, that the attentive public will *know* that genetic science is complex and thus might infer that a public role was not feasible, is not supported by our data. A future challenge for policy makers is to reach out to a more socially inclusive public in order to avoid the pitfall of simply attracting people with the strongest, usually negative, opinions – a criticism levelled at the GM Nation? consultation. Although exploratory in nature, our analysis suggests that increasing a sense of efficacy may be a valuable precursor to soliciting actual engagement.

Our second aim was to better understand the relationship between public efficacy and trust towards relevant stakeholders in this area of science. The nature of these

relationships bears further consideration although their strength was weak. For one of our trust measures, the results are consistent with public efficacy co-existing with greater trust. The efficacious public are more willing to trust in the independence of genetic scientists. However, for trust associated with government rules, we find that people with a belief in public efficacy are less likely to agree that such rules will keep us safe from any risks associated with modern genetic science. The term 'any risks' here is likely to be significant since agreement with this statement implies some sort of guarantee in the blanket protection of legislation and government which, given the uncertainties associated with this area of scientific development, it cannot provide. In an investigation of how the public evaluate government with respect to key scientific developments, Poortinga & Pidgeon (2003a) found that general trust, incorporating notions of competence, care, fairness and openness was important, alongside scepticism toward a government perceived to be distorting the facts. The authors report that different degrees of general trust co-exist with different levels of scepticism. Thus, people can be critical about the risks associated with a technology without rejecting the technology outright, a scenario they term 'critical trust'. Consistent with this work, it may be more appropriate to view our finding of greater distrust of government among the efficacious public as indicative of a healthy dose of realism, a more critical trust in the legislative system to contain genetic technologies.

Our final aim was to examine how both trust and public efficacy map onto attitudes towards genetic technologies, net of other relevant factors. Here, across three different applications with two different outcome measures, our results present a consistent picture of more permissive attitudes among those who had trusting attitudes towards genetic scientists and government rules. Although this is consistent with the view that efforts to foster public trust may 'pay off' by softening public opinion, our results do not endorse the notion that greater public involvement will provide a route to public acceptance of genetic technologies. We find that people who see a role for public involvement within this area of science are less likely than those who do not to agree human cloning and gene therapy should proceed and less likely to be in favour of human genetic databases. In sum, public efficacy opposes trust in its relationship to attitudes. Our efficacy measure rather functions in a similar way to education and attentiveness to

genes and genetics, both of which were associated with more cautious attitudes across each domain of genetic technology.

To some extent these results are counter intuitive. As noted earlier, increasingly engaging the public is seen as one of the main routes to increasing public trust. This in turn is considered as essential for increasing the acceptability of subsequent decisions. This exploratory analysis has rather suggested that considering public involvement to be realistic tended to be associated with less permissive attitudes to genetic technologies. Of course, such a conclusion, stemming as it does from an exploratory analysis requires a range of both conceptual and methodological caveats.

First of all, depending on how the notion of efficacy is conceptualised it might be argued that the relationship found here between a belief in public efficacy and attitudes to genetic technologies *is* to be expected. Within the UK there is reason to believe that the public generally associates the government with a permissive attitudes to genetic technologies (Gaskell, Allum, Wagner & Kronberger *et al.,* 2004; Gaskell, Allum, Wagner & Hviid Nielsen *et al.,* 2001). If someone rather has a rather more negative attitude to such technologies it is entirely plausible that they would wish to be consulted about their development[4]. However we would contend that there is an important difference between a desire for such involvement and believing that publics might actually be able to influence the course of decision making. It is the latter variant that we believe is closer to the way in which belief in public efficacy is conceived of in this study. It would seem eminently possible that you could wish to be involved in considering a matter which powerful groups supported – and you were against - whilst not believing that such involvement would make much difference.

Secondly, it is worth noting that the conclusions that we have reached about the nature of the relationships between trust, attitudes to genetic technologies and a belief in public efficacy do not involve a consideration of actual involvement of publics in engagement processes that formally access and, at least purport to, take account of their beliefs. Thus far we know little about the impact of such mechanisms on perceptions of collective efficacy. The little we do know however might tend to suggest that, where there is little

[4] We are grateful to an anonymous reviewer for highlighting this point.

evidence of having made a difference, fatigue and scepticism – and presumably a weakened belief in public efficacy - are likely outcomes (Kasperson, 2000) . The notion of BPE in this study has some links with the concept of 'collective efficacy' (Bandura, 1998; Bandura, 2000; Fernández-Ballesteros, Díez-Nicolás & Caprara *et al.*, 2002) which is currently emerging in relation to community, crime and health policy issues. It would seem potentially valuable to broaden this consideration to the process and outcome of formal participation initiatives as well as, more generally, public appreciations of technological development. Previous qualitative research in this area also suggests that it is important to consider the relationship between a sense of agency and expressions of public concern (Marris, Wynne & Simmons *et al.*, 2001). Their hypothesis is that expressions of public concern may be muted, not because concern is low but rather because a lack of agency may lead expressions of concern being seen as pointless.

Moving on to methodological caveats we have endeavoured to be explicit about the shortcomings of our single item measure of BPE and of this largely exploratory analysis. In addition we recognise that the face validity of the BPE item might be considered limited: it would be possible to agree that modern genetic science is so complex that public involvement is not realistic without feeling a lack of efficacy[5].

Notwithstanding these measurement problems we believe that the results of this work highlight an interesting way in which ongoing considerations of public perceptions of technological developments might be extended. Thus far trust has rightly assumed enormous prominence as an explanatory concept in relation to dissent and conflict over the development trajectory of a wide range of technologies. Consideration of the importance of a belief in public efficacy would potentially seem a valuable complement to this, and in particular to the recent work on critical trust (Poortinga & Pidgeon, 2003a; Walls, Pidgeon, & Weyman *et al*., 2004). In order to do this and to explore the predictive power of a belief in public efficacy considerable work will be needed to refine the concept itself and to develop valid and reliable measures.

On the basis of these data it would seem reasonable to at least question the nature of the link between increased public involvement and the legitimising of technological

[5] We are similarly grateful to a second anonymous reviewer for highlighting this.

development that engagement initiatives can be instrumentally predicated upon. Rather, a belief that the public can make a difference may in fact be part of the forming the 'critical but involved' citizenry that Poortinga & Pidgeon (2003a: p.971) suggest may be a desirable form of relationship between people and risk management institutions.

In conclusion, this tentative introduction of the concept of a belief in public efficacy highlights potentially counter-intuitive relationships between trust, attitudes and a willingness to endorse public involvement in modern genetic science. Taken together, our data suggest that it is overly simplistic to view public involvement in decision making as a route to increase trust and the acceptability of potentially risky new technologies in our society.

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Table 1. *Belief in public efficacy (BPE) by indicators of citizen engagement*

Correlation matrix:	BPE	No say in government	Government too complex	Government action index	Organisational membership index
BPE	1.00				
No say in government	.11 ***	1.00			
Government too complex	.22 ***	.19 ***	1.00		
Government action index	.19 ***	.12 ***	.24 ***	1.00	
Organisational membership index	.11 ***	.10 ***	.14 ***	.34 ***	1.00

*** P<.001

Source: British Social Attitudes Survey, 2003

Table 2: *Public attentiveness to issues about genes and genetics*

	Interest	Heard or read about	Talked about	Thought about
A great deal or quite a lot	24	36	14	21
A small amount	25	30	27	26
Not very much or not at all	51	33	59	53
%	100	100	100	100
Base:	3251	3251	3251	3251

Source: British Social Attitudes Survey, 2003

Table 3: *Predictors of public efficacy for modern genetic science*

		95% CI for exp b		
Included	**B**	**Lower**	**Exp b**	**Upper**
Constant	-1.34		.262	
Age in years	-.005	.99	1.0	1.0
Gender: female	-.403***	.54	.67	.82
Attentiveness to genes and genetics: high	.494***	1.5	1.64	1.8
Educational qualifications:				
None			1.00	
Other	.412*	1.0	1.51	2.3
O'level or equivalent	.061	.69	1.06	1.6
A'level or equivalent	.912***	1.67	2.49	3.7
Higher	1.08***	1.97	2.94	4.4
Core values about science and nature: pro scientific progress and intervention	-.17	.76	.84	.94

**p<.05; **p<.01; ***p<.001*
Chi square=197.1, df=8, p<.001 Cox&Snell R^2= .10 Nagelkerke R^2=.139

Source: British Social Attitudes Survey, 2003

Table 4: *Belief in public efficacy by trust in key stakeholder groups*

	Belief in Public Efficacy			
Trust:	No	Yes (BPE)	All	Spearman Corr (Sig)
Those in charge of new developments in genetic science cannot be trusted to act in society's interests.				
% Disagree	24	31	26	.014 (ns)
Base:	2153	846	2999	
Genetic scientists only tend to tell us what the people paying their wages want us to hear.				
% Disagree	13	21	15	.084 (<.001)
Base:	2176	844	3020	
Rules set by government will keep us safe from any risks linked to modern genetic science.				
% Disagree	25	22	24	-.128 (<.001)
Base:	2153	846	2999	

Source: British Social Attitudes Survey, 2003

Table 5: *Regression coefficients[1] of public efficacy and trust on attitudes towards genetic technologies*

Variables in model	Human Cloning (allow)	Gene Therapy (allow)	Genetic Databases (in favour)
Age (years)	-.001	.012	-.001
Gender: female	-.11**	-.64***	-.016
Belief in public efficacy	-.142***	-.58***	-.23***
Attentiveness (high)	-.008***	-.136**	-.044***
Trust in genetic scientists	.071	.229	.021
Trust in government rules	.219***	.761***	.183***
Trust in those in charge	.207***	.319***	.149***
Education: higher	-.15***	-.603***	-.170***
N	1860	2906	2890
F	21.1, p<.001	33.1,p<.001	35.9, p<.001

Source: British Social Attitudes Survey, 2003
[1] *Regression coefficients are unstandardised*.