Belief in Public Efficacy, Trust, and Attitudes Toward Modern Genetic Science

J. Barnett,1* H. Cooper,1 and V. Senior1

Government and policymakers 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 article 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 toward 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 toward 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 toward 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 believe in high-level public involvement are less likely to think that these technologies should be allowed than those who do not.

KEY WORDS: Attitudes; engagement; genetic science; public efficacy; trust

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.

First, surveys of public attitudes to science reveal that general optimism is often accompanied by public skepticism 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 United Kingdom, 14% of the U.K. public felt that science and technology could sort out any problem, compared with an E.U. average of 21% (European Commission, 2005). More than half of U.K. 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).

Second, there is evidence that a sizeable proportion of the public perceive themselves to be disconnected or disengaged from science. A recent U.K. study found that only 40% 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% were very interested in new scientific discoveries, inventions, and technologies, this was 8% 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 its 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 that show that scientific interest, awareness, and knowledge are not uniformly distributed among the public but correlate with age, gender, education, and social class (Durant et al., 1992; Gaskell et al., 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, skeptical, or worried “because it does not understand the science” (Irwin & Michael, 2003, p. 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 contextualized public understandings of science are thus now as widespread as those of a deficit in public understandings were 25 years ago. However, the deficit model undoubtedly remains influential in shaping views of publics and of ways of engaging with them (Michael, 2002; Levitt et al., 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 et al., 2001; Wynne, 2001)—attributed to several well-publicized controversies over the last 2 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 scientists (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 (Worchester, 2001; Poortinga & 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 & Cveticovich, 1995), thus being particularly valuable in affording the development of scientific technologies that challenge values, raise social and ethical questions, or are more obviously characterized by long-term uncertainties (Siegrist & Cveticovich, 2000; Poortinga & Pidgeon, 2003a). In contrast, a lack of trust can serve to intensify public concerns; trigger secondary impacts such as the stigmatization of places, products, or processes (Flynn et al., 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 et al., 1997; Marris et al., 2001), although rather than locating a deficit of trust within the public, the focus here is upon the required reorientation of policy institutions.

2. ENGAGING THE PUBLIC

Faced with the difficulties of promoting and advancing science in a climate of public skepticism, disconnection, and apparent distrust, the attention of policymakers 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 its 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 recognized that scientists and policymakers 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 and Mort suggest that “being in favour of public consultation . . . is rather like being against sin; at a rhetorical level, it is hard to find disagreement” (1998, p. 61).

The involvement of publics in science can, however, serve the more instrumental purpose of increasing trust in decisionmakers 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 license to practice.

Public participation can, and has, taken many forms, from the informal sharing of information to organized events such as consensus conferences or citizen 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 the 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 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 views participation and dialogue and its 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, while at the same time concede that they know little or nothing about it (MORI, 2005). The 2005 Eurobarometer survey found a majority of E.U. 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 E.U. report talking to friends about science and technology, and the proportion who read about it is low at 19% (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 United Kingdom, public awareness of organized 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 it (Veenstra, 2000; Duffy, 2004). It is, however, debatable 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 organized action between 1983 and 2001 (Bromley et al., 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 U.K. 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 socioeconomic groups, were younger, and were 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), failing short of attracting the widespread, socially inclusive support often considered the prerequisite 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 U.K. 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 et al., 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 behavior or take some form of civic action. Marris et al. (2001) highlight the notion of agency and hypothesize 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.

4. MODERN GENETIC SCIENCE—AN EXEMPLAR

This article 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 decisionmakers and attitudes toward 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.

First, the term genomics encompasses a range of new genetic applications that will have profound implications for human health and the environment. The long-term outcomes of genetic technologies are, however, characterized 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 et al., 2003), the most longstanding one being GM crops and foods (Vidal, 2003), but more recently human cloning and so-called savior siblings (Marsh, 2003).

Second, genomics is an area where public opinion is visibly nuanced and fluid. In general, public attitudes to genetic science can be characterized as skeptical 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, 1999, 2005; Gaskell et al., 2003; Sturgis et al., 2004), 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 2 decades, with the genetic modification of plants widely perceived as risky and of limited
usefulness (Gaskell et al., 2003). However, over the last 5 years, a number of surveys have reported less outright public hostility toward GM crops and foods, which could be indicative of greater ambivalence toward these technologies (Sturgis et al., 2004; MORI, 2005; Horlick-Jones 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 et al., 2003) and that less than half of Europeans agree that government and industry are “doing a good job for society” (Gaskell 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 online completion of a short survey (see Gaskell, 2004; Horlick-Jones et al., 2004). The conduct of the debate has not been without its critics, among them Wilsden and Willis, who 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” (2004, p. 39). Arguably, it failed in its remit to inform decision making because it took place “downstream,” that is, once political, economic, and organizational 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 threefold. First 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. Second, 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 hypothesize 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 toward three distinct genetic technologies. We test the assumption that more positive attitudes toward 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 (i.e., to genetic technologies that have developed in the postgenomic 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 3,272 interviews, an overall response rate of 59% (Park 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 5-point scale from 1, “strongly agree,” to 5, “strongly disagree.” We were mainly interested in the people who indicated that public agreement is realistic and thus disagreement with this proposition was used as an indicator of a belief in public efficacy. We were aware that using a single-item indicator of public efficacy in our analysis was less than ideal; however, it could not be avoided in this instance as the BSA survey was not designed specifically to measure public efficacy. To go at least some way toward 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. Both items have been used to represent the concept of political efficacy (Bromley et al., 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 a member of Parliament or signing a petition. An “organizational 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 ($\alpha = 0.78$). 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. These items were combined into a single values scale ($\alpha = 0.59$) where a high score was indicative of positive values toward scientific progress and intervention and a low score reflected values associated with the preservation of the natural order.

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”; and 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 an 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; and 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 ($\alpha = 0.82$) and attitudes for gene therapy ($\alpha = 0.68$), where a high score was indicative of a more permissive attitude. Public attitudes toward use of genetic databases were assessed by five items about databases used for the following purposes: 1: illness and disease; 2: serious crimes; 3: ancestry; 4: health and life insurance; and 5: employment. Responses to each item were scored from 1, “definitely not in favour,” to 4, “strongly in favour.” Scored responses were summed into a single scale ($\alpha = 0.66$) where a high score was consistent with a more favorable attitude toward use of genetic databases.

6. RESULTS

6.1. Beliefs about Public Efficacy

A small majority (52%) 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% disagreed that the complexity of the science precluded any public contribution at the 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
Table I. Belief in Public Efficacy (BPE) by Indicators of Citizen Engagement

<table>
<thead>
<tr>
<th></th>
<th>BPE</th>
<th>No Say in Government</th>
<th>Government Too Complex</th>
<th>Government Action Index</th>
<th>Organizational Membership Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPE</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No say in government</td>
<td>0.11***</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government too complex</td>
<td>0.22***</td>
<td>0.19*** 1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government action index</td>
<td>0.19***</td>
<td>0.12*** 0.24*** 1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizational membership index</td>
<td>0.11***</td>
<td>0.10*** 0.14*** 0.34*** 1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***p < 0.001.

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 II). Although more than one-third had heard or read about the issues to a large extent over the past few months, more than 50% 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 re-coded 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 bivariate 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 other questions in the survey pertaining to public perceptions of governance. Sixty percent 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 I), 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” \( (r = 0.22, p < 0.001) \) and that “people like me have no say in government” \( (r = 0.11, p < 0.001) \). 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 \( (r = 0.19, p < 0.001) \) and to be a member of an organization \( (r = 0.112, p < 0.001) \). 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.

Table II. Public Attentiveness to Issues about Genes and Genetics

<table>
<thead>
<tr>
<th></th>
<th>Interest</th>
<th>Heard or Read About</th>
<th>Talked About</th>
<th>Thought About</th>
</tr>
</thead>
<tbody>
<tr>
<td>A great deal or quite a lot</td>
<td>24</td>
<td>36</td>
<td>14</td>
<td>21</td>
</tr>
<tr>
<td>A small amount</td>
<td>25</td>
<td>30</td>
<td>27</td>
<td>26</td>
</tr>
<tr>
<td>Not very much or not at all</td>
<td>51</td>
<td>33</td>
<td>59</td>
<td>53</td>
</tr>
<tr>
<td>%</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Base</td>
<td>3,251</td>
<td>3,251</td>
<td>3,251</td>
<td>3,251</td>
</tr>
</tbody>
</table>

Table III. Predictors of Public Efficacy for Modern Genetic Science

<table>
<thead>
<tr>
<th>Included</th>
<th>95% CI for Exp b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>B</td>
</tr>
<tr>
<td>Age in years</td>
<td>−1.34</td>
</tr>
<tr>
<td>Gender: female</td>
<td>−0.005</td>
</tr>
<tr>
<td>Attentiveness to genes and genetics: high</td>
<td>−0.403***</td>
</tr>
<tr>
<td>Educational Qualifications</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>0.494***</td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>O level or equivalent</td>
<td></td>
</tr>
<tr>
<td>A level or equivalent</td>
<td></td>
</tr>
<tr>
<td>Higher</td>
<td></td>
</tr>
<tr>
<td>Core values about science and nature: pro</td>
<td></td>
</tr>
<tr>
<td>scientific progress and intervention</td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.05; **p < 0.01; ***p < 0.001.  
χ² = 197.1; df = 8; p < 0.001; Cox & Snell R² = 0.10; Nagelkerke R² = 0.139.  

6.2. Public Efficacy and Trust

A comparison of trust in stakeholder groups for modern genetic science is presented in Table IV. This table shows that opinion differs according to the stated object of trust, with “those in charge” perceived more favorably than “genetic scientists” on our science and nature. A total of 1,801 cases were included in the analysis. The full model was significant (χ² = 197.1, df = 8, p < 0.001). Table III 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 characterized as pro-nature and against scientific intervention were more likely to perceive high-level public involvement as realistic.

Table IV. Belief in Public Efficacy by Trust in Key Stakeholder Groups

<table>
<thead>
<tr>
<th>Believe in Public Efficacy</th>
<th>Belief in Public Efficacy</th>
<th>95% CI for Exp b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belief in Public Efficacy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trust:</td>
<td>No</td>
<td>Yes (BPE)</td>
</tr>
<tr>
<td>Those in charge of new developments in genetic science cannot be trusted to act in society’s interests.</td>
<td>24</td>
<td>31</td>
</tr>
<tr>
<td>% Disagree</td>
<td>13</td>
<td>21</td>
</tr>
<tr>
<td>Genetic scientists only tend to tell us what the people paying their wages want us to hear.</td>
<td>2,153</td>
<td>846</td>
</tr>
<tr>
<td>% Disagree</td>
<td>25</td>
<td>22</td>
</tr>
<tr>
<td>Rules set by government will keep us safe from any risks linked to modern genetic science.</td>
<td>2,153</td>
<td>846</td>
</tr>
</tbody>
</table>

Belief in Public Efficacy, Trust, and Attitudes

6.3. Public Efficacy and Attitudes Toward Genetic Technologies

Linear regression models were used to examine the impact of public efficacy on attitudes toward human cloning, gene therapy, and the use of genetic databases (see Table V). Attitudes toward human cloning and gene therapy are based on 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.

<table>
<thead>
<tr>
<th>Variables in Model</th>
<th>Human Cloning (Allow)</th>
<th>Gene Therapy (Allow)</th>
<th>Genetic Databases (in Favor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>−0.001</td>
<td>0.012</td>
<td>−0.001</td>
</tr>
<tr>
<td>Gender: female</td>
<td>−0.11***</td>
<td>−0.64***</td>
<td>−0.016</td>
</tr>
<tr>
<td>Belief in public efficacy</td>
<td>−0.142***</td>
<td>−0.58***</td>
<td>−0.23***</td>
</tr>
<tr>
<td>Attentiveness (high)</td>
<td>−0.008***</td>
<td>−0.136***</td>
<td>−0.044***</td>
</tr>
<tr>
<td>Trust in genetic scientists</td>
<td>0.071</td>
<td>0.229</td>
<td>0.021</td>
</tr>
<tr>
<td>Trust in government rules</td>
<td>0.219***</td>
<td>0.761***</td>
<td>0.183***</td>
</tr>
<tr>
<td>Trust in those in charge</td>
<td>0.207***</td>
<td>0.319***</td>
<td>0.149**</td>
</tr>
<tr>
<td>Education: higher</td>
<td>−0.15***</td>
<td>−0.603***</td>
<td>−0.170***</td>
</tr>
<tr>
<td>N</td>
<td>1,860</td>
<td>2,906</td>
<td>2,890</td>
</tr>
<tr>
<td>F</td>
<td>21.1, p &lt; 0.001</td>
<td>33.1, p &lt; 0.001</td>
<td>35.9, p &lt; 0.001</td>
</tr>
</tbody>
</table>

Table V. Regression Coefficients of Public Efficacy and Trust on Attitudes Toward Genetic Technologies

*Regression coefficients are unstandardized.

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 one in three 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 do 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 recognized 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 policymakers 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 leveled 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 toward 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 coexisting 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 that, given the uncertainties associated with this area of scientific development, it cannot provide. In an investigation of how the public evaluates government with respect to key scientific developments, Poortinga and Pidgeon (2003a) found that general trust, incorporating notions of competence, care, fairness, and openness, was important, alongside skepticism toward a government perceived to be distorting the facts. The authors report that different degrees of general trust coexist with different levels of skepticism. 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 toward 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 toward 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 favor 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 counterintuitive. 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 conceptualized, 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 United Kingdom, there is reason to believe that the public generally associates
the government with a permissive attitude to genetic technologies (Gaskell et al., 2001, 2004). If someone has a rather more negative attitude to such technologies it is entirely plausible that he or she would wish to be consulted about the development of these technologies. 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 that powerful groups supported—and you were against—while not believing that such involvement would make much difference.

Second, 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 evidence of having made a difference, fatigue and skepticism—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, 2000; Fernández-Ballesteros 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 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 to expressions of concern being seen as pointless.

Moving on to methodological caveats, we have endeavored to be explicit about the shortcomings of our single-item measure of BPE and of this largely exploratory analysis. In addition, we recognize 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.

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 et al., 2004). 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 legitimizing of technological 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 of a “critical but involved” citizenry that Poortinga and 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 counterintuitive 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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5 We are grateful to an anonymous reviewer for highlighting this point.

6 We are similarly grateful to a second anonymous reviewer for highlighting this.
also grateful for the comments of three anonymous reviewers.

REFERENCES


MORI. (2003). *7 Out Of 10 Members of the Public Support the Use of Embryos for Medical Research*. MORI poll for the Association of Medical Research Charities. April 5.


