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► To cite this version:

Kevin Burchell. Empiricist selves and contingent “others”: the performative function of the discourse of scientists working in conditions of controversy. *Public Understanding of Science*, 2007, 16 (2), pp.145-162. 10.1177/0963662507060587. hal-00571127

HAL Id: hal-00571127

<https://hal.science/hal-00571127>

Submitted on 1 Mar 2011

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Empiricist selves and contingent “others”: the performative function of the discourse of scientists working in conditions of controversy

Kevin Burchell

The objective of this article is to report the results of 18 semi-structured interviews, conducted in the UK during the spring of 2003, with scientists working in the locally controversial area of crop genetics. Results suggest that, when talking about their own beliefs and actions, most of the scientists utilized what can be referred to as an empiricist repertoire, in which beliefs and actions are seen to derive from the natural world, an objective and rigorous method, and an ethical framework. By contrast, when talking about the beliefs and actions of four key “others,” most of the scientists relied upon a contrasting contingent repertoire, in which beliefs and actions are seen to derive from personal shortcomings, inclinations and self interest, and to be in contradiction of an ethical framework. It is suggested that the extent to which the discourse of these crop geneticists followed this pattern may be related to the conditions of controversy within which they were working at the time of the interviews. The small number of cases that contradict this pattern are also examined. The implications of this for relationships between science and the public are briefly discussed.

1. The performative function of discourse: the empiricist and contingent repertoires

In their report of scientists’ discourse surrounding the internal workings of a low-key scientific controversy in biochemistry, Gilbert and Mulkay (1984) reject the notion that discourse relating to actions and belief might be a resource, from which the facts of a social reality or “what really happened” might be derived. Instead, they regard discourse as a topic, and suggest that the analysis of discourse should be a matter of identifying and explaining the social or performative function that discourse serves (also see Potter and Wetherell, 1987).

While acknowledging that their informants utilize any number of discourses in the course of an interview, Gilbert and Mulkay (1984) note that the biochemists predominantly utilized two contrasting discursive repertoires, which they call the empiricist repertoire and the contingent repertoire. Gilbert and Mulkay (1984: 56) describe the empiricist repertoire as follows:

The guiding principle of this [empiricist] repertoire appears to be that speakers depict their actions and beliefs as a natural medium through which empirical phenomena make themselves evident. ... We call this repertoire the empiricist repertoire because it portrays scientists' actions and beliefs as following unproblematically and inescapably from the empirical characteristics of an impersonal natural world.

By contrast, Gilbert and Mulkay (1984: 57) describe the contingent repertoire in the following way:

When the [contingent] repertoire is employed, scientists' actions are no longer depicted as generic responses to the realities of the natural world, but as the activities and judgments of specific individuals acting on the basis of their personal inclinations and particular social positions.

According to Gilbert and Mulkay (1984), the reason that scientists utilize two contrasting discourses relates to the performative function or social intent of discourse. In particular, use of the empiricist repertoire can be seen as a reflection of the overwhelming significance of conveying the intellectual legitimacy and status of scientists' own beliefs or actions. At the same time, they argue that the use of the contingent repertoire by scientists often serves the performative purpose of questioning the legitimacy of the beliefs and actions of other scientists with whom the speaker disagrees. For example, this is noted with respect to highlighting the perceived intellectual, technical and personal errors or shortcomings of other scientists, groups of scientists or scientific institutions. Also see the examples of this discursive pattern in Collins (1992); in particular, in his work on gravitational radiation research. Thus, we might refer to the discursive construction by scientists of *empiricist* selves and *contingent* "others" in the form of other scientists.

For the purposes of the analysis that follows, however, Gilbert and Mulkay's (1984) core notion of the empiricist and contingent repertoires is enhanced in two key ways. Firstly, the range of discursive practices encapsulated within the two repertoires can be extended to include methodological and ethical considerations and, secondly, the range of "others" can be extended to include the public, the media and environmental non-governmental organizations (NGOs). Thus, the empiricist repertoire can be enhanced to include the discourse that the actions and resulting beliefs of scientists flow unproblematically from a methodology that is characterized by an objectivity and rigor that renders it distinct from non-scientific practices and knowledge outcomes. Of course, these ideas have been summarized, with critical intent, by a number of writers working on the sociology of scientific knowledge (SSK), including Chalmers (1982: 1):

Scientific knowledge is proven knowledge. Scientific theories are derived in some rigorous way from the facts of experience acquired by observation and experiment. Science is based on what we can see and hear and touch, etc. Personal opinion or preferences and speculative imaginings have no place in science. Science is objective. Scientific knowledge is reliable knowledge because it is objective.

Further, Gilbert and Mulkay's (1984) core empiricist and contingent repertoires can be enhanced along ethical contours. The discursive construction by scientists of unethical scientist "others," with the apparent performative function of enhancing or defending the status of the scientific speaker, is identified in research by Michael and Birke (1994a). These researchers offer a UK analysis of semi-structured interviews with scientists working in animal experimentation for medical purposes. In this context, scientist "others" were constructed

by interviewees along ethical lines relating to the relative treatment of animals by themselves when compared with other scientific animal experimenters; for example, those who are non-British or who are working in the cosmetics sector.

In addition, a collection of UK case studies illustrates that the construction of negative, contingent "others" by scientists and other experts also extends to those outside of science. Michael and Birke (1994b) report that their animal experimenter interviewees utilized an ethical framework to distinguish between their own treatment of animals and the treatment of animals in wider society; for example, as household pets, in "blood sports", in agriculture and in abattoirs. Michael and Birke (1994b) also note a desire to distinguish between rational, reflexive and expert animal experimenters and an irrational, unreflexive and non-expert "other," in the form of anti-vivisection NGOs. In their work with crop geneticists, Cook, Pieri and Robbins (2004) make a similar comment with respect to NGOs and sections of the media that oppose genetic modification. Cook et al.'s (2004) research, as well as Michael and Brown's (2005: 55) work with a variety of experts in xenotransplantation ("the transplantation of animal organs or tissues into humans"), also illustrates the construction, by scientists and other experts, of broader public "others." In these studies, the public is variously constructed by scientists and other experts as ignorant, irrational, emotional, skeptical, and easily influenced by NGOs and the media. As is suggested within these papers (also see Michael, 2002), this view can be understood as part of, what has become known in the UK and more widely as, traditional or deficit-model public understanding of science (PUS).

To summarize, in the analysis that follows, the objective is to assess the extent to which a small group of scientists working in crop genetics employ discursive strategies that distinguish between empiricist selves and contingent "others" of various kinds. In an enhancement of Gilbert and Mulkay's (1984) core notion, the empiricist repertoire describes the view that beliefs and actions flow unproblematically from conditions in the natural world, from a method that is distinctive for its objectivity and rigor, and from an ethical framework. By contrast, the contingent repertoire describes the view that beliefs and actions flow from personal and social inclinations, from prejudices and interests, from methodological shortcomings, and are perhaps unethical.

This introductory section is followed by a discussion of the public and political controversy surrounding crop genetics in the UK, and the effects of public and political controversy on the discursive practices of scientists with respect to the issues raised above. A brief discussion of the semi-structured interview methods that were used in the current study is followed by a comprehensive report of the results and data. The implications of these results, for relationships between science and the public, are briefly discussed.

2. The effect of public and political controversy on scientists' discourse

As Michael and Birke (1994a, 1994b) and Michael and Brown (2005) point out, their studies of animal experimenters should be understood in the context of the public controversy that surrounds such issues. In the context of crop genetics, in the UK in spring 2003, the current research should be regarded as a study of discursive practices in conditions of public and political controversy that became known as the "GM crisis."¹ The extent of the "crisis" might be discerned in the UK government's decision to implement two novel policy initiatives that were designed to determine the future for GM crops in the UK. First, a series of farm scale evaluations (FSEs) was designed to assess the effects on farmland biodiversity of certain GM

crops, and their conventional equivalents. Second, a public debate which became known as *GM Nation?* (and was accompanied by economic and scientific reviews of the risks and benefits of GM agriculture) was implemented (Mayer, 2000; Gaskell, 2004; Mayer and Stirling, 2004; Burchell, 2005).

This discussion focuses on the discourse, in semi-structured interview, of a small selection of crop geneticists in the spring of 2003. At this time, the FSEs had already been implemented (although results were not forthcoming until autumn 2003) and the *GM Nation?* public debate had been announced and was due to commence just two months later. Thus, this discussion can be seen to focus upon the discourse of scientists whose discipline was the subject of considerable political and public debate. Indeed, it can be argued that this discourse should be placed within the context of a scientific discipline whose future was in the balance in the spring of 2003. As Gaskell (2004) has since commented, it may very well be that the unexpectedly poor performance of the GM crops in the FSEs has all but eliminated the prospect of the commercial growing of the first generation of GM crops in the UK.

This is important because research by Waterton et al. (2001: 25) suggests that a distinction can be discerned between the discourse, regarding their own work, of environmental scientists working in non-controversial fields (climate change and ecological protection) and that of environmental scientists working in areas that had recently 'undergone some kind of trauma as a field' (bovine spongiform encephalopathy (BSE) and crop geneticists) when the interviews were conducted in the late 1990s. Waterton et al. (2001) make use of Gilbert and Mulkay's (1984) core notion of the empiricist and contingent repertoires; however, they make the normative judgment that use of the contingent repertoire represents a positive reflection of the reality of scientific research (as conceived, of course, within SSK). Within this context, Waterton et al. (2001) note that the scientists who are working in non-controversial areas use the contingent repertoire to a greater extent than those working in the controversial areas of crop genetics and BSE. With this research in mind, it might be expected that the empiricist repertoire will be a significant feature of crop geneticists' discourse when discussing their work in 2003.

3. The construction of empiricist selves and contingent "others"

The results that follow are based on 18 one-to-one, one hour, semi-structured interviews with scientists working in crop genetics. Nine interviews were conducted at the John Innes Centre (JIC), near Norwich in East Anglia. Nine interviews were also conducted at Long Ashton Research Station (LARS), near Bristol in the west of England (this research center relocated to Rothamsted Research in Hertfordshire, north of London over the summer of 2003). The interviews were conducted in March and April 2003. The interviews focused on: the status of science and scientific knowledge; the status of public knowledge; the appropriate role for scientific issues and scientific knowledge in policymaking; the appropriate role of other issues and other forms of knowledge in policymaking; specific issues relating to crop genetics; and the role of the media and NGOs.

The results are organized in two sections. Overwhelmingly, the discourse of this small group of crop geneticists conformed to the prediction of Gilbert and Mulkay (1984) of the construction of both empiricist selves and contingent "others". These results are described in detail and illustrated in this section. In the following section, the relatively few results that contradict this discursive pattern are examined.

Empiricist selves

Of the 18 crop geneticists that were interviewed, the discourse of 16 can be said to follow the pattern of constructing empiricist selves and contingent "others." Certainly, some of these interviewees made comments that could be interpreted as contradictory to this discursive pattern, and not all of the interviewees offered definitive discourse with respect to all of the themes of the empiricist and contingent repertoires. However, in all of these 16 cases, contradictory instances were highly unusual and were hugely outnumbered by comments that conformed to the pattern identified by Gilbert and Mulkay (1984).

In the material that follows, each theme of the two discursive repertoires is illustrated by one or two interview quotes. In each case, such quotes should be considered as exemplars of similar comments by several or many other interviewees. When considering this thematic presentation of the data, it is important to remember that each individual interviewee consistently reflected the empiricist self and contingent "other" discursive contrast.

The interview data reveal that this small group of crop geneticists utilize the empiricist repertoire when describing their own actions and beliefs—in terms of themselves as scientists, the scientific method, and scientific knowledge—to a considerable extent. In keeping with the empiricist repertoire, as discussed by Gilbert and Mulkay (1984), such practices were largely presented as the obvious way in which to understand the natural world. In particular, interviewees focused on the importance of various aspects of experimentation, including: replication, hypothesis testing, and the rigid and formalized nature of the scientific method.

LARS2 (Programme Head): Whatever you do has to be repeatable. You have to be able to show that something that you do is real and repeatable. Obviously, you have to start with a hypothesis that you test and you design an experiment to test the hypothesis and at the end of the experiment you either prove or disprove the hypothesis that you set out to do with the experiment.

LARS3 (Programme Head): The way we tend to work is to ask specific questions, and these days it's usually to test a hypothesis. This is particularly important as, certainly for a grant proposal to be successful these days, it needs to be hypothesis-driven. So you set up by saying, this is the way you think something happens based on previous results either from yourself or other people, and then you set up a series of experiments to test whether this is true or not, and that's the way we tend to work.

LARS8 (Post Doc): It's [science] a tried and proven technique. Specific techniques are used so, therefore, they're being used in many research groups. So, I mean they're kind of our standard to use those protocols and it's been shown that they actually do work. They do kind of follow the, how would you say, the predicted model or the predicted result.

LARS9 (Technician): You have a certain aim. You're looking for something specific or you're looking for something to back up something you suspect might be the case. So you're less likely to get side tracked. [Unclear] If you took a very open view and said "we're just going to look at this and see what we find", you can find a million and one things, and you don't know what's important and what's not. You have a much more structured aim in a traditional scientific project.

LARS9 (Technician): If you've got good scientific practice then, yes, everything should be repeatable. ... You have all the protocols and Standard Operating Procedures, and all the rest of it. So you know you haven't got the variation in the way the results were gained.

Informants also often commented on the importance and positive influences of both formal and informal peer review in terms of providing highly rigorous checks and balances on the knowledge that is generated via scientific experimentation. For example:

JIC3 (Project Leader): It relies upon the integrity of the individual, gaining, processing, if it's all going through peer review. There may be weak links, but it's not a chain, it's a network. So there may be weaker links, but hopefully overall it's a strong robust structure, and it's continually under test. If a part breaks, it doesn't necessarily mean the whole thing collapses; it means you re evaluate the part.

LARS1 (Deputy Head of Division): You then submit those results to peer review or you present them at meetings. And as a consequence of that open debate, if you like, that can be questioned. And the consequences of that can lead you ... you may be wrong in what you were assuming. It may be that there were other approaches and that you can be given other knowledge that will change your interpretation of something.

LARS2 (Programme Head): When you publish something it goes out to external referees and they judge the competency of you, your experiments and your results. And that's a very important process of peer review because that's the check that what's coming out is real and is true in a scientific sense, and it can become part of the bigger scientific base.

LARS5 (Project Leader): Anonymous peer review is a process that has stood the test of time. I think many other professions would scream if they were subjected to anonymous peer review where somebody said "you think you're doing a good job?, well let's test this, and examine your ideas, and examine your hypotheses", sent it off to some experts and you just have to take it.

A lesser feature of the interview data, surprisingly perhaps, was the notion of objectivity; though it was largely acknowledged when specifically raised by the interviewer. Three aspects of objectivity were commented on during the course of the interviews. Most frequently, perhaps, objectivity was discussed in largely empiricist terms, with respect to the content of scientific knowledge. In this sense, science was described as a means of providing the "objective" facts or the answers about a topic in the natural world. The objectivity of the knowledge was often explicitly or implicitly linked to the notions of experimentation and peer review discussed above. Objectivity was also discussed in interviews in the sense, recognizable as part of the empiricist repertoire, that scientists must not have preconceived ideas about their results (though see the following comments on the value of preconceptions).

JIC7 (Bioinformatics Technician): Science, I think it is objective, not subject to external influences. All science is trying to do is unravel the mysteries within nature, how does nature function?

Interviewer: Would you say, [name], that scientific knowledge is objective?

LARS1 (Deputy Head of Division): I would hope so [laughs].

Interviewer: What is it that ensures that?

LARS1: Um, objective. Well, you pose specific questions, then you design experiments to try to answer those questions. You then submit those results to peer review or you present them at meetings or whatever.

LARS9 (Technician): Science being as it is, it is factual, either it's there or it's not, usually. So, you can't, you know, because of the way it's done and the nature of the whole

system, you don't have that kind of variation. So, virtually always, the facts are straightforward answers, it's an answer, it's either there or it's not, it exists or it doesn't.

However, in some cases, claims to the objectivity of scientists were complemented by assertions that subjectivity and preconception are also characteristics of scientists' approach. However, interestingly, informants portrayed subjectivity as a positive or valuable approach in terms of providing inspiration or a "leap of faith." In this context, a distinction was often drawn between the subjectivity of scientists and the objectivity of the scientific knowledge that scientists produce.

Interviewer: Would you say that science is an objective undertaking? Is the knowledge strong because it's objective?

JIC3 (Project Leader): The knowledge gained is objective, but much of what leads one on is subjective. And this is probably where people talk, or this idea that people have, of almost a painful, step-by-step progression and a gaining of knowledge [unclear] hypothesis testing, experiment, results, new hypothesis. And then one has this subjective, this individual or group who say, "Well, I think we'll have a look at this. We can't really say this is happening on the basis of our results". And then it's much more of a "leap of faith". And those are where some of the bigger jumps are made. [Lengthy swapping escalators metaphor]

Interviewer: And the "leap of faith" would then be tested?

JIC3: Yes, it's testable. But you come out from your firm structure and you say, "Well, OK, I should carry out these experiments, but I've just had a—I suppose you would say—an inspirational thought that makes a big difference".

LARS6 (Senior Post Doc): It's the testing of hypotheses, in an entirely objective fashion, by experimentation, and the repetition of experimentation. [Pause] It's also important not to have a preconceived idea of the answer [example].

Interviewer: Is it realistic to have no preconceptions, do you think?

LARS6: Erm. [Laughs] Well, probably not entirely. [Laughs] Obviously, when you're asking a question you have, not necessarily a gut feeling of what the answer is, but you have some idea. I mean, the point of the question: you might see how the system works, and work backwards from that, and test those hypotheses.

Finally, with respect to the construction of empiricist selves, interviewees drew to a limited extent upon an ethical discursive resource with respect to themselves and their work. This was in terms of identifying a concern with tackling "third world hunger" as a motivation for going into crop genetics.

JIC8 (Research Assistant): [I did my studies at a] time when biotechnology was going to "save the world" and "save the population". ... Biotechnology was a way of increasing yields and increasing production and "saving humanity", if you like. ... That's why I got involved in biotechnology.

Contingent "others"

With respect to the discursive construction of contingent "others," four key categories of "others" can be readily identified in the interview data: the public, the media, environmental NGOs and unspecified other scientists. In interviews, most informants portrayed the public as

anti-GM (interviewees were often surprised to hear that many members of the public are not resistant to the technology). As predicted by Gilbert and Mulkay's (1984) contingent repertoire, explanations of public resistance focused almost entirely on social factors rather than legitimate issues relating to the natural world. Resistant public attitudes towards crop genetics were often explained by a lack of knowledge or understanding of how genetic manipulation works and the benefits it could bring; in some cases, this lack of knowledge was placed within the context of a broader paucity of scientific education and understanding in the UK.

Interviewer: So, the objections to GM that you perceive among the public, what do you put them down to?

JIC8 (Research Assistant): Lack of understanding, I would say.

LARS1 (Deputy Head of Division): Basically, I think that they [the public] are pretty ill informed about what's involved and what goes on [in GM].

LARS2 (Programme Head): I think the public really have no understanding of what we do, or they have a very big misunderstanding.

Interviewer: So, do you think that overall the members of the public are well informed about the issues?

LARS4 (Project Leader): No, I don't think so. If you're interested, I think the science training in this country is very good. If you're not interested I think the science training is bad, I think we specialise very early.

LARS6 (Senior Post Doc): It's [the public response] horrendous. The perception is it's all "Frankenstein food". ... From what I see, the general public view is it's OK not to know anything about science and, therefore, it's OK to be scared by it.

LARS8 (Post Doc): I do feel that a lot of the outrage, and the destroying of crops, and protests were due to people's ignorance basically, and not knowing what the whole issue of GM was.

Public attitudes were also sometimes seen as inappropriate in terms of: having a lack of trust in scientists, an unhelpful resistance to novelty and change, and an inappropriate tendency to link GM with the BSE/vCJD crisis.

JIC8 (Research Assistant): I don't think scientists are given the esteem by the public that they should.

Interviewer: Why would people be sceptical, do you think?

LARS9 (Technician): Change. Anything new or change, I think people your instinctive reaction is to question something new or different. And I think from that point of view if you question it and you find that you have any hint of negativity you'll pick up on that.

LARS2 (Programme Head): The problem came when people realised that companies were not labelling and that came at the same time as the Putzsai affair which was also ludicrous and the media blew out of all proportion. Which together made the public distrustful of the scientists and put them in the frame of mind of CJD, whereas before the two things hadn't been linked at all, and from then on, they're always linked now, always. Which is so silly because they are so different.

However, as hinted in the quote by LARS2, the key reason for public antipathy to crop genetics was described by the interviewees as the adverse influence of the media and environmental

NGOs. As the following quotes indicate, the public was portrayed as easy prey to manipulation by the media and environmental NGOs by many interviewees.

JIC8 (Research Assistant): You've obviously got newspapers, you've got large organisations like Greenpeace who are bombarding people with fears continuously.

Interviewer: How would you characterise the public's response to biotechnology?

LARS4 (Project Leader): I think it's hostile, but I think it's because of a hostile media.

Interviewer: The next issue I wanted to raise is the relationship between the public and biotechnology or GM, and I'm wondering how you might characterise that.

LARS4 (Project Leader): Yes, I would rephrase it as the relationship between the scientists and the media. I think public opinion is formed by what they are given by the media, generally.

LARS7 (Post Doc): What really worries me is that the decision will go against GM food, as I see it at the moment, because the public just don't have enough information. The only people that the public believe are basically green pressure groups and they'll read scare stories in the paper.

LARS9 (Technician): If you scan any of the newspapers there are very few that put a positive light on GM. The majority of articles are coming from an anti-GM standpoint, which I think is having, you really need some way of counteracting the balance because it all seems to be coming from that perspective. And I think that, as a result, a lot of people, when they see anything about GM, they just think, "Oh, I don't want to touch that."

The interview results also reveal that, for most of this small group of crop geneticists, as predicted by the contingent repertoire, the approach of the media and environmental NGOs to crop genetics in particular and science more generally has more to do with social and political inclinations than conditions in the natural world. Thus, the media and NGOs were often portrayed as scaremongering or exaggerating risk, as dumbing-down, as sensationalizing or as following a political or self-serving agenda. On occasion, these comments had an ethical component to them. Some informants were especially scathing about the unethical motives of NGOs (in particular, Greenpeace). These were sometimes portrayed as being entirely self-serving in terms of increasing memberships and donations, while behaving unethically towards developing countries in which hunger and poverty are problems.

JIC6 (Project Manager): Now, I think that this public opinion has been shamelessly manipulated by lots of different organisations, often for very dishonest purposes of self-publicity, and of creating memberships, of creating subscriptions and donations.

LARS1 (Deputy Head of Division): I mean, science is not presented, if you like, in the media very well, is it. I mean, it's a relatively small part of any ... I mean, in newspapers, science gets very very small, even in *The Guardian* [a UK broadsheet]. And on TV it's all the wacky arm wavers and stuff for the kids. Everything has got dumbed down so much, I mean, everything's only to be dealt with in very small. Even on [BBC] Radio 4, you don't really hear what I would call full scientific debate on any particular topic.

LARS3 (Programme Head): I think they [the media] like to sensationalise, because it sells newspapers.

LARS3 (Programme Head): It was pushed very hard, early on, by certain environmental groups who were, I think, in principle opposed to it. ... And they obviously put their case more convincingly than, certainly, the commercial people and maybe the scientists involved as well. ... Another aspect of this, that I didn't mention earlier, is that the media latched on this, and helped the NGOs make their point.

Interviewer: How would you characterise science reporting in general, or reporting on biotech in particular?

LARS4 (Project Leader): I think it's too shallow. It's rather the nature of the beast, to get a message across you've got to use a few one-liners, and that's very difficult with science because there's a great depth to it.

Interviewer: Why do you think that newspapers react in that way [negatively]?

LARS5 (Project Leader): I think it could be simple things. That most journalists aren't scientists, they're probably arts graduates. [Pause] Newspapers, whether they're tabloids or broadsheets, have to sell copy. It's easier to write a headline saying "We're all going to die" rather than "No, we're not".

LARS5 (Project Leader): People ate GM food for several years in the UK, without batting an eyelid, before the NGOs decided to make it a big campaigning issue to bump up their subscriptions. ... I have some friends who work for Greenpeace and they tell me that they don't care one way or another.

LARS5 (Project Leader): I mean, the technology is phenomenal, but if you have Greenpeace basically telling Zambia that they shouldn't take genetically-modified food to feed their starving population because it's genetically-modified. This is grain that is coming from the US where fifty to sixty percent of grain is GM. This is what the US population eat, but this tin pot dictatorship is prepared to let its people starve because an NGO is meddling in the politics of another country and trying to peddle their own ideology. I mean, I think that's beyond absurd, I think that's obscene. And then they have the gall to talk about food security, and they keep saying to African countries that they shouldn't be taking GM food from the US. That's just, I mean, I don't know how these people sleep at night.

LARS8 (Post Doc): I honestly think that, on a personal level, that it [media coverage of GM] was just to sell papers. It had a handle on something. It knew that it struck fear into the public. It knew that the British public would react this way to GM foods. ... I do feel that the media definitely caused a lot of the problems.

With respect to the discursive construction of a contingent "other" in the form of other scientists, a much smaller number of interviewees commented on the failure of certain, unspecified other scientists to reach the standards of practice that are demanded by the empiricist repertoire. Such failings were attributed to two main causes: firstly, personal preferences which might be linked to poor training and, secondly, to the increased pressure—for example, to compete for funding and to publish—in contemporary science. In the interview quotes that follow, particularly note the consistent way in which JIC5 cites practices that are central to the construction of empiricist selves, and then notes the ways in which contingent "other" scientists fail to conform to those practices.

JIC5 (Senior Post Doc): Yes, replication is important, but I have to say [laughs], especially in some of the work that I do [technical explanation], that you need to replicate over and over again—I'm very well aware—to get a very good idea of where the gene is expressed. But I'm also aware that people often don't replicate these experiments. So it's an individual

thing. Myself, I would be extremely uncomfortable to publish without being certain myself that I have repeated it and got the same signal a number of times. But, because some people—well, the pressure to publish is huge—people sometimes don’t take the time.

JIC5 (Senior Post Doc): I know it’s often portrayed as a specific method to follow, but I mean, it is more random than people think. Even from goings on in our lab, I know that things are plucked—not by some rational means—but, “Oh, I happen to know this person who’s using this thing, so I’ll use it too”. At that kind of level, that’s not the strength, that’s the weakness; so, I haven’t really answered your question really.

Interviewer: Well, you have, you have.

JIC5: At the same time, we are trained to stand back and do controls. I get quite furious when people don’t do positive and negative controls. And each experiment is supposed to have a hypothesis which you test, so those are the foundations, but the technical details are rather randomly plucked out.

JIC5 (Senior Post Doc): It’s absolutely ridiculous; you live and die by your publications. It is just so the measure that is used. ... But it’s about which journals, not what you publish, but which journals. And that’s a terrible thing because it’s not even about the science. It’s just about a badge that some people want to put on things. It’s very unscientific.

JIC5 (Senior Post Doc): I suppose it [peer review] is special about science. I’ve tried to think of an alternative, I can’t, I can’t think of an alternative.

Interviewer: Why do you need an alternative? What bothers you about it?

JIC5: Because some people again say that peer review is beginning to break down. There isn’t enough time for people to do it properly or there are personal things overriding a fair assessment.

Interviewer: Are there times when that [the rigor and objectivity of science] breaks down?

LARS6 (Senior Post Doc): I do occasionally hear about fraud in science, but I’ve never witnessed it myself [laughs]. I guess within groups where there are large amounts of stress to publish, and you’re in a highly competitive field, then I suppose that sort of thing can happen.

4. Contradictory discourses

As discussed above, the dominant discursive practice among this small sample of crop geneticists was to contrast between empiricist selves and contingent “others.” However, consistent results that deviate from this pattern can be detected with respect to one interview theme and in the case of two individuals.

The direction of scientific research

The one interview theme that drew strongly contingent responses was the contemporary process by which scientists select the direction of their research. To a considerable extent, discourse emphasized the highly directive nature of contemporary funding systems (both public and private) and the overriding influence that this has on research agendas within research institutions. In no sense did the data reflect the notion that scientists select the direction of their research on the basis of curiosity about conditions in the natural world. The following quotes illustrate this; in addition, they illustrate the belief that such funding influences do not undermine the basic objectivity of the scientific researcher and the scientific knowledge that is produced:

JIC7 (Bioinformatics Technician): I don't believe the researcher is as immune to outside influences as he should be because he depends on funding for his work. And, if you are talking about the area where you do your research, could it be that most research is performed in an area where there is a commercial interest? [Comment on the developing world] The research focuses on the immediate areas where there are commercial opportunities.

Interviewer: Do you sense that that might compromise objectivity or just that the direction that the funding goes is more-or-less commercial?

JIC7: More in terms of the direction, and the body of knowledge that is pursued, instead of the approach to gathering knowledge.

LARS1 (Deputy Head of Division): The funding is a major driver of the way science is going. In other words, people are tending to respond to the sources of funding that are available. And that has been, in a sense, to restrict a lot of the activity that individuals might have undertaken in the past.

LARS1 (Deputy Head of Division): There's a lot of fashion in science, at the government level. I mean, government might be concerned that, er, you know, the UK is non competitive in a certain area, and notionally wish to rectify that. And they direct funding if they see that the US is putting in a big pot of money on genomics they claim they don't want to be left behind.

LARS2 (Programme Head): You have to be doing fashionable science. I mean, I could be doing the same kind of research using maybe physiological processes as opposed to genetic processes and there's no way I'd get any money. So I have to take an approach that's considered appropriate for the time that we're in.

Interviewer: Would you consider that scientific knowledge is objective?

LARS4 (Project Leader): [Very long pause] I think so. On the whole. But money influences to a certain extent. Money is put forward for certain initiatives, so you're kind of led towards certain areas.

Interviewer: So you're talking about the selection of projects or questions for investigation rather than—what would be more worrying, I guess—that the money might influence the outcomes.

LARS4: Yes, I'm talking about the selection of problems rather than getting the answer that the money requires. That's a very different matter [laughs].

The mixed and nuanced discourses of JIC4 and JIC5

In addition to this one theme in which the actions of scientists were consistently attributed to social factors rather than conditions in the natural world, more mixed and nuanced discourse can also be identified with respect to two specific interviewees: JIC4 and JIC5. In addition, the discourse of these two informants can be identified as more equivocal and questioning, and less certain. Further, they paused more, and they used verbal signals—such as “um,” “er” and “ah” —more. It is important to note that the differences that are described here are not absolute. For example, it is the case that both JIC4 and JIC5 made comments that can be identified as part of the empiricist repertoire and that some other informants were also sometimes equivocal. However, aside from the issue of funding discussed above, it is fair to say that the other informants only very rarely, if at all, deviated from the empiricist self/contingent “other” dualism. By contrast, JIC4 and JIC5 did this with far greater regularity. The differences

between the discourse of these two informants and the dominant discourse—and conjectural explanations for this variation—are explored below.

JIC4 (Project Leader): mixed and nuanced responses

The discourse of JIC4, see illustrative quotes below, deviated from both the empiricist self and contingent “other” discourses. In particular this informant challenged the notions that science is distinctive due to its intellectual and methodological rigor, and due to its objectivity and factual basis. With respect to the public, JIC4 eschewed the view that the public were ignorant or irrational, preferring to explain public resistance to the crop genetics in terms of a lack of perceived benefits, and what would appear to be a legitimate “conservative” and “cautious” approach. Finally, with respect to the media, JIC4 expressed uncertainty about the direction of influence between the public and the media, as well as suggesting that the media treats all issues in an “alarmist” manner.

Intellectual and methodological rigor:

Interviewee: By and large, I don’t strongly feel that we do things in a different way. Erm. ... The thing about science is it’s not really about questions, it’s about questions about how things work. But if you were a historian, you know, researching some particular topic, you know, you would gather the information about the question, construct some ideas and say, “Do we have evidence for this or was it done in some other way?”

Interviewer: Can the historian test, though?

Interviewee: Well, he can test in the sense of he has to say, “Well, we should be able to find additional evidence from the sources that can verify this particular idea.” So, they can test to that extent. It’s true that you can’t replicate that experimentally and that is a difference, yes. But in terms of the thought processes of the individual, I’m not sure that’s so different.

Objectivity and facts:

Interviewer: For example, it is suggested that the scientific method is a particularly objective one and that, as a result of this, scientific knowledge is special in terms of its objectivity: these are the facts.

Interviewee: Well, facts are facts, where ever they come from. Erm. So, whatever the fact is—this is the mortgage rate on this particular day or this is a wheat plant—those are just facts and, you know, I don’t see that there’s more validity to one or the other.

Public:

Interviewer: What was your reading of that [the public response to GM], in terms of why?

Interviewee: I think it’s two things. One is that it didn’t surprise me at all. That’s always been my expectation that, certainly in Europe, I’ve always been very sceptical that consumers would go for genetically-modified foods.

Interviewer: Why was that?

Interviewee: I think the why is more difficult to answer. I think it’s because we have, in a lot of ways, a very conservative culture, I think this is a new thing, and I think people are uncomfortable with this. Secondly, I think there’s no obvious benefit to the individual consumer. So, whether you have Round-up Ready soya in a frozen pizza, there’s no discernible difference, so people say “Well, why should we go for it then?” ...

Interviewer: Did you have a sense that it was because people did not understand the technology or had an irrational reaction to the technology?

Interviewee: No, I don't really feel that, because it's not at all difficult to understand ..., it's a perfectly easy concept to grasp. I think the fact that consumers have been reluctant to take on these products, it's not really irrational, I think they are cautious.

Media:

It's hard to know whether they [the media] inform public opinion or whether they reflect public opinion. I don't really have a clear grasp of how influential it is. I would say that the media tend to report everything in a way that is alarmist.

JIC5 (Senior Post Doc): mixed and nuanced responses

As was mentioned earlier, JIC5 consistently discusses scientific practice (replication, methodological rigor and peer review) in terms of an empiricist aspiration and a contingent reality. Having said this, it is interesting to note that the informant utilizes all of these aspects of the contingent repertoire with respect to *other* scientists rather than to herself (these comments were included in the previous section). With respect to the relative lack of public knowledge about crop genetics, JIC5 places this in the context of the extensive training that crop geneticists undergo rather than any pejorative judgment about the public. More significantly, perhaps, despite suggesting that public knowledge of crop genetics is poor, this informant argued that the public should be involved in policy decisions surrounding the technology. Finally, the comments made by JIC5 regarding the media are more nuanced than most others. For instance, this informant chooses to judge—and to note distinctions in—the quality of media reporting, rather than whether they are pro- or anti-GM.

Replication, methodological rigor and peer review: please see interview quotes in earlier section regarding the construction of contingent other scientists

Public knowledge:

Interviewer: In terms of genetic modification, would you say that [public] knowledge is particularly good?

Interviewee: I'd say not particularly good, because I know how much study we have to do to get to the point where we can understand it. Years. So you can't expect the public to have all done that as well. So it's almost impossible for the public to have the same perception of it as people who've been trained for, how long's a PhD?, five years. ...

Interviewer: Does that mean then that public perceptions are without value, because clearly they're not experts, they're not very well informed necessarily. Where does that leave public perceptions?

Interviewee: That's very difficult. [Pause] But in the end, it's the public who are going to have the crop in their country. So it has to be the public's decision.

Media:

Interviewer: How would you characterise the role of the media?

Interviewee: Mixed. There's good reporting and bad reporting, as always. ...

Interviewer: ... So you see distinctions?

Interviewee: Oh yeah. So you might get a quite well-informed, educational description in a broadsheet newspaper, whereas you'd get a ridiculous description in another newspaper. ... those other ones are sensational. ... I think TV is less sensational.

Explanations

Two conjectural explanations might be suggested for the distinctions between the discursive practices of these two interviewees and those of most of the others, although with respect to

both explanations it is easy to identify contradictory cases. In terms of position and age, as a Project Leader (JIC4) and a Senior Post Doc (JIC5), both in their late 40s, these two interviewees can be identified as among neither the most junior nor the most senior of the interviewees. By contrast, most of the more junior interviewees (JIC8: Research Assistant; JIC9: Research Assistant; LARS9: Technician) and two of the most senior interviewees (LARS1: Deputy Head of Division; LARS2: Programme Head) provided the interviews in which the empiricist self/contingent "other" dualism was most pronounced. With this distinction in mind, it might be suggested that among this small sample it is some of the middle-ranking scientists who are the most comfortable reflecting some of the more contingent realities of scientific practice in their discourse. It might be conjectured that junior scientists are less likely to do this, due to their inexperience and their ongoing participation in scientific training. It might also be argued that the extent to which senior scientists utilize the contingent repertoire is constrained by their role as managers and as funding applicants. Within the context of the fact that LARS2 is a Programme Head at just 40, it might also be suggested that a discourse that is based on the certainties of the empiricist repertoire may be important for career progression as a scientist.

The observation that both of the informants who utilized more mixed and nuanced discourse work at the John Innes Centre raises the possibility that there is a difference at the institutional or departmental level that might influence discourse. Reference to the institutional websites does indeed reveal a difference—at both the institutional and departmental level—in the kind of work that is undertaken. While the John Innes Centre website, and the Department of Crop Genetics website within, both place emphasis on the "fundamental research" in which they specialize, it is clear from the Long Ashton Research Station website, and the Developmental Genetics Programme website within, that the emphasis here is on applied research (John Innes Centre, 2003; Long Ashton Research Station, 2003). Although contradictory examples can be easily found within the data, this distinction raises the prospect that an emphasis on applied research might lead to an intensification of the empiricist self/contingent "other" discursive dualism in some cases. As discussed below, this might particularly be the case in conditions of public and political controversy.

5. Discussion

The foregoing material suggests that, in the case of this small sample of crop geneticists working in the UK in 2003, a conspicuous performative function of discourse is to demarcate and distinguish between their own beliefs and actions, and those of four different "others." More specifically, the majority of scientists portrayed their own beliefs and actions as legitimate because they flow from conditions in the natural world, are based on an objective and rigorous method and—to a more limited extent—represent a straightforward response to an ethical framework, as predicted by the enhanced empiricist repertoire that was discussed earlier.

By contrast, four categories of illegitimate, contingent "others" were portrayed by most of these scientists. Public knowledge about the science of crop genetics, and science more generally, was typically depicted as very poor. Thus, public views were seen to be not rooted in conditions in the natural world. In this context of scientific ignorance, public views about crop genetics were portrayed as based on a mixture of subjective and personal inclinations and the malign influence of the media and NGOs. Both the media and NGOs were also generally portrayed in negative terms. Specifically, the presentations of the issues relating to crop genetics by both of these actors were seen to be based upon their own interests, rather than

conditions in the natural world as understood through science. In the case of the actions of NGOs, in particular, these were sometimes drawn as a direct contravention of the ethical framework within which scientists themselves work. In addition, certain other unspecified scientists were often portrayed as behaving in ways that did not meet the very high standards demanded of scientists in terms of their objectivity, methodological rigor or honesty. Such shortcomings tended to be explained by poor training or by the pressures of working in contemporary scientific research in the UK.

Of course, as previously discussed, this research should be understood as a study of the discourse of scientists working in conditions of public and political controversy. Work by Michael and Birke (1994a, 1994b) and Michael and Brown (2005) would seem to hint, and research by Waterton et al. (2001) might claim to confirm, that conditions of public and political controversy can lead to an exaggerated recourse by scientists to various aspects of the empiricist self/contingent “others” discursive dualism. Of course, the current research would appear to conform to this pattern. According to the framework provided by Gilbert and Mulkay (1984), use of this discursive dualism can be related to the performative function or social intent of defending or justifying one’s own beliefs and actions, while at the same time attacking those of others with whom one disagrees. Thus, this research would appear to contribute to the notion that, in conditions of public and political controversy, the performative imperative of distinguishing between a legitimate self and illegitimate “others” is heightened.

Waterton et al. (2001) provide normative reasons as to why this might be important, with respect to the relationship between science and the public, within the context of what Michael (2002) has referred to as critical PUS. Within critical PUS, the root of public resistance to some technologies is to be found in the inflexible and alienating stance of scientific and policymaking institutions in public and policymaking debates. Typically, it is argued that the tendency of such institutions is to privilege scientific “facts,” such as those that emerge from formal assessments of technological efficacy and risk, and to ignore, or bluntly deride and dismiss public understandings, knowledge, concerns and questions as irrational or irrelevant (Wynne, 1996, 2001; Brown and Michael, 2001; Marris et al., 2001; Michael, 2002). Within this context, Waterton et al. (2001) interpret the greater use of the contingent repertoire by some of their interviewees, when discussing their own work, in positive terms. Waterton et al. (2001) argue that acknowledgement by scientists of the “everydayness,” the contingency, and the uncertainty of their work might result in a reduction in the alienation from and resistance to certain technological developments felt by many members of the public. Within critical PUS, it is felt that this, in conjunction with a greater willingness to acknowledge and respect public concerns (see Marris et al., 2001), might lead to a restoration of trust in scientists, scientific institutions, and policymaking regarding technological issues.

Within this critical framework, the results of the current study, and those of Michael and Birke (1994a, 1994b), Waterton et al. (2001) and Michael and Brown (2005) are not encouraging. This body of research would seem to suggest that when technological issues become matters of public controversy—that is, when the construction of contingent selves by scientists might be perceived to be most useful, according to Waterton et al. (2001)—scientists are *less* likely to discursively construct contingent selves and *more* likely to construct empiricist selves. At the same time, conditions of controversy would appear to increase the extent to which scientists construct contingent “others,” contrary to the wishes of Marris et al. (2001). Of course, although the empiricist self/contingent “others” discursive dualism dominates the data that are presented here, it is important to note that these comments are based upon a relatively small number of semi-structured interviews with scientists, all of whom were working in conditions of controversy.

With this in mind, it is important that the issues of interest here be discussed with more groups of scientists working in scientific fields of lesser and greater controversy. In the UK context, such work is particularly important within the context of the UK government's new found faith in public dialogue as a means of ameliorating controversy surrounding technological developments—see the websites of the Office of Science and Innovation *Sciencewise* Programme (<http://www.sciencewise.org.uk/index.htm>) and of the sciencehorizons project that is funded by *Sciencewise* (<http://www.sciencehorizons.org.uk/>).

Acknowledgements

I would like to express my gratitude to Yvonne Rydin for guidance over a number of years, to Mike Michael and Brian Wynne for assistance with the theoretical framework of this paper, to Michael Antoniou for telling me about genetics, to two anonymous reviewers for the rigor of their comments, and to all of my informants who gave so generously of their time. Any remaining shortcomings are mine alone.

Note

1 As is well known, genetically modified (GM) crops are held by advocates to offer enhanced crop yields, as well as improved processing and nutritional characteristics, that have the potential to meet the ever increasing food demands of a growing global population. However, in the UK in particular, during the late 1990s and early 2000s, opposition to GM crops revolved around a number of issues, including: the potential health and environmental risks associated with GM food and crops; the way in which risk is handled with regulatory institutions; the role of multinational corporations; consumer choice; international trade rules; developing world issues; and the appropriate direction for agricultural production.

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