The presentation of GM crop research to non specialists: a case study.

a) Introduction

This study will investigate the presentation of genetic modification (GM) crop research at the University of Reading to non-specialists within the university, and to users, potential students and the general public outside. The aim is to uncover how linguistic and rhetorical choices vary with the purpose of the communication and with the communicator's perceptions of audience knowledge and views, and how these choices may persuade or antagonise their receivers. Reading University, one of the largest centres for plant sciences in the UK with a wide range of representative GM crop research activity, is a particularly suitable institution for such a case study, and the research will provide valuable data and insights to all stakeholders in debates over GM technology, and over controversial science in general. Our approach is unique in blending sociological and linguistic perspectives to uncover not only the macro level of social frame and discourse, and the continuity and variance of arguments for GM crop technology, but also the relation of these arguments to the micro level of linguistic choices. The project draws sociological analysis and linguistics-based discourse analysis together in ways which are enriching to both disciplines.

b) Background and rationale

The study is rooted in the need for better communication between specialists and non-specialists in areas of scientific risk and uncertainty, particularly food safety. Since the 1980s, there have been a number of 'food scares' including those linked to salmonella, listeria, *E Coli*, and BSE. Recently, anxiety has centred on GM foods and crops. Government responses have generally focused on food quality, safety and hygiene (UK Government, 1990; 1998) with the expressed aim of restoring public confidence (Shaw 1999). Studies have suggested, however, that in the wake of the BSE and other crises, the public is increasingly unconvinced by such governmental assurances (Grove-White, et al. 1997). Moreover, with GM technology, the increasingly heated debate over food has moved beyond issues of safety and calculation of risk, into areas of ethical, political and other concern. Correspondingly, the language and rhetoric of the debate has increasingly drawn upon styles and techniques beyond those of the factual report and evaluation of evidence with which scientists are most familiar.

At least three relevant perspectives have emerged in the continuing public debate. 1) Government officials and GM scientists argue that GM crop technology is based on 'sound science' and consequently safe for both human health and the environment. 2) Environmental pressure groups and some members of the public contest these scientific judgements, raise ethical concerns about the relation between human activity and nature, and express political concerns about commercially-motivated research and government decision making. 3) Meanwhile the media characterises both scientific reassurances and public anxiety in extreme terms. In February 1999 *The Guardian* ran a series entitled 'What's Wrong with our food?', while phrases such as 'Frankenstein Foods' (*Daily Mail*, January 28, 1999) and 'Mutant Crops' (*The Express*, February 18, 1999) have become commonplace in describing GM food products. One focus of the study would be on how scientists draw upon or react to the various linguistic and rhetorical strategies from this public debate when presenting GM crop research to outsiders.

The contest over meaning related to GM crop research takes place in the linguistic and the social domain. Recent studies of GM research have examined the issue from a number of

different angles. Wynne (1999) examines the breakdown of public trust in science, arguing for a more socially reflexive scientific research agenda. In similar vein, Williams (1998), examines current scientific practice, and claims that reflexivity is not yet included in the formal scientific research agenda. Other analyses consider the framing assumptions of GM risk assessments, and the ways these are justified by key actors such as industrialists and scientists (Stirling and Grove-White 1999). Further studies have examined the extent to which current assurances of safety take into account longer periods, which some refer to as 'glacial time' (Adam 1999).

Reading University conducts a wide range of GM plant research, using a variety of methods, relating to a number of different contexts. This includes both fundamental and applied research into GM crops and food, some with links to industry, and some without. A pilot study has revealed that much of the presentation of GM crop research within the University of Reading, as in the world at large, is aimed at countering concerns about possible risks posed by GM crops and food to the environment and health, and that many rhetorical strategies adopted to do this (e.g. the deployment of metaphor and analogy) are ways of countering perceptions of risk. Consequently, the study will relate ways of conceptualising risk to the different strategies used to represent it, drawing together approaches from both sociology and linguistics (as well as, to a lesser extent, the related literature on the psychology of risk e.g. Frewer et al 1998; Slovic 2001). Sociological risk analysis has long viewed risk perception as a subjective and social process (Douglas and Wildavsky 1982: 6), arguing that risks are socially constructed, that is, their collective meanings are shaped by the various storylines disseminated by competing institutional actors (Gabe 1995), and food scares have been specifically invoked as examples of this process (Beck 1992). People's responses to the risk statements of scientists and government officials are seen as reflexive and embedded in social practices, for example lifestyle choices that preclude eating certain types of food (Beck et al 1994; Macnaghton and Urry 1998). This sociological approach highlights the difference between scientific calculations of risk in objective terms as probabilities, and actual human perception of risk as a factor in daily life (together with other probabilities such as winning the lottery). An aim of the study will be to assess the paradigms of risk used in the presentation of GM crop research and the degree to which there is movement backwards and forward between different rhetorical techniques and styles associated with different genres.

The term 'discourse' is used in the proposal to mean the interaction between the macro-level of social frame, and the micro level of linguistic choices. It thus draws upon two different but related traditions of discourse analysis from cultural sociology and functional linguistics. The term 'rhetoric' is used to mean the structuring of argumentation to persuade the receiver. The research will draw upon both argumentation theory (van Eemeren 1997) and rhetorical structure theory (Mann and Thompson 1988) as well as existing work on the rhetoric of science (e.g. Gross 1990, Harris 1991). One focus of the discussion of rhetoric will be upon the belief, sometimes referred to as the 'deficit model' (Gregory and Miller 1998:89-90), that the simple transmission of scientific findings, is sufficient to justify research to non-scientists.

c) Research Objectives and Research Questions

With this background in mind, the specific research objectives of the current project are to document and analyse: the discoursal and linguistic strategies employed by GM plant scientists in the presentation of their work to non-specialists; the views about science, non-specialist opinion, and communication which inform these strategies; and the effect of these strategies on non-specialist opinion. The project will address the following five research

questions. **First** (drawing upon interview data), what factors guide GM scientists when presenting their research findings to a non-specialist audience? **Second** (also drawing upon interview data), how does presentation vary with the GM scientists' perception of the audience's knowledge and views, and the purpose of the communication? **Third** (drawing upon qualitative text analysis), how does perception of the audience and purpose affect communication at the following three levels: **a)** the general stance of the presentation (framing, reasoning, and storylines), **b)** the choice of text structuring devices (rhetorical structure, functional units assumed schematic knowledge, coherence) and **c)** (involving some automatic text analysis) the linguistic choices (e.g. lexis, modality, syntactic construction)? **Fourth** (establishing a link between interview data and text analysis), how do choices at these three levels vary with the scientists' perception of the level of the formality, the distribution, and the genre of the presentation? **Fifth** (drawing on all the analyses), how do choices at these three levels seem to aggravate or appease public and academic opinion about the desirability of research into GM crops?

d) Datasets

There are a number of existing ESRC datasets that have relevance to the present study. From the sociological standpoint, two recent studies in particular can inform the research. Wynne et al (1998) usefully explored scientists' own reflection on the morality of genetic engineering, and considered ways of incorporating these views into public discourse. Amos et al (1994) examined public attitudes and knowledge, using interviews and analysis of documentary materials to explore the ways individuals perceive risk and implications for public health. Though highly relevant, neither of these projects, nor other datasets relating to the communication of science, are based on an explicit combination of a sociological and linguistic approach. An exception is Macnaghten, Myers and Wynne (1995) who used a rhetorical analysis to explore 'ways in which people understand and make sense of environmental action' and 'lay and committed responses to environmental information focusing inter alia on public information leaflets and adverts'. Despite mutual relevance, however, there are also significant differences in both methodology and content. Our design merges a sociological approach with an analysis of specific linguistic choice. It concerns GM crop science specifically, and explores the unfolding debate within a key public institution, the university. From the linguistic standpoint, studies of the language of science concern such issues as popularisation of science (e.g. Myers 1990) or of scientific texts in general (Lemke 1990, Halliday and Martin 1993) rather than specifically controversial ones such as those around GM. ESRC projects by Kress, Ogborn and associates concern the presentation of science in education (e.g. Kress et al. 1996) through consideration of the interaction of visual and verbal modes.

e) Data Collection

The research would compile two major data sets: a) written texts and transcripts of spoken presentations b) transcripts of interviews and protocols. These are delineated as follows:

1. The first data set will consist of

a) documents from 1997 onwards explaining and/or justifying GM crop research to outsiders and novices including: press releases; reports to university committees (e.g. senate, safety committee, ethics committee); minutes of university, school and department committees; open day posters and brochures; web pages; articles by Reading GM scientists in newspapers and non-specialist journals; articles and reports in Reading University newsletters (e.g. Reading University Bulletin, Reading University Research Digest); materials for

schools, information for farmers (e.g. at National Maize Forage day) and letters to the local and national press.
b) examples of polemic articles from the national press, both pro and anti GM research, for use in interviews and protocols.
c) transcripts and recordings of spoken accounts; lectures and seminars; talks to schools; talks to farmers; talks to non specialists academics (e.g. Reading University SCR seminars on GM). (Our pilot study suggests that the quantity of written texts justifying and explaining GM crop research within the university would be sufficient for the aims of the project, probably in the region of 300,000 words. Transcribed spoken data, however, could be added if it were felt to be necessary. The written corpus aims to include all available relevant documents. It would therefore be a census rather than a sample, making issues of corpus design and text selection relatively unproblematic.)
2. The second data set will consist of
a) transcripts and recordings of open-ended interviews, focused interviews, and protocols in which informants talk through their reaction to linguistic and discoursal choice in the selected documentation in data set 1b.

Informants The numbers of informants will be small, in keeping with the scale of the research, and the need for in-depth discourse analysis. Informants are not intended to be representative samples of their categories, nor of society at large. They form instead a theoretical sample, guided by the emerging analysis, designed to be as diverse as possible, and allowing the exploration of a range of involvement, response and attitudes to GM crop research. They will be:
i) At least 15 GM scientists from Reading University representing the different levels of seniority, different disciplines, different methods and types of GM crop research, and varying experience in explaining GM research to non-specialists, and including authors of data from 1a above.
ii) At least 15 non-specialists representing different types of addressee for data from 1a above, including senior management, research administrators, academic staff from other faculties, students of other faculties, potential students, the local community, farmers, local industry
iii) outside advisors from another research institution (Cranfield University), the GM industry, environmentalist pressure groups. (for further details, see access below)

The stages of the research will be as follows:
1. Collect corpus of texts and transcripts listed in 1a and c above;
2. Analyse these texts, on the following three levels (though with constant cross reference and attention to ways in which one level conditions the other):
i) the macro level of social frame and rhetoric: framing devices; reasoning devices (including consequentialist and non-consequentialist arguments, ethical and utilitarian arguments); storylines.
ii) the textual organisation level: genre conventions and echoes; assumed schematic knowledge; argumentation structure; extended metaphors; coherence; cohesion; analogies.
iii) the micro level of linguistic choices: including **a)** features which can be established automatically such as: lexical frequency; collocation; semantic prosody; impersonal construction; nominals; some types of evaluative language (Hunston and Thompson 2001) and **b)** features which require manual coding such as: sub-sentential metaphors; evaluative language; vague language; agency; modality; hedges.

3. Conduct interviews and elicit protocols. Initial interviews would elicit general attitudes; subsequent interviews would focus upon particular texts, and rhetorical and linguistic choices within them, seeking to elicit in particular features which provoke agreement or antagonism in the reader;

4. Analyse results to establish relations between

i) scientists' beliefs about and attitudes towards GM and non specialist opinion;

ii) the social frame, textual organisation, linguistic choices;

iii) the resulting persuasion or antagonism of the non-specialist audience.

Analysis will prioritise the following key themes: presentation of science; risk and uncertainty; rationality; economic v scientific imperatives; ethical and political concerns.

f) Access

Initial investigations have established that both GM scientists and the authorities in Reading University are keen to participate in this research, as well as an adequate sample of staff and students not directly involved. In Reading, we have the cooperation of the Vice Chancellor, the Pro Vice Chancellor for Research, the Dean of the Plant Sciences Faculty, and the Head of the Department of Agriculture among others. We also have access to the proceedings of the Safety Committee, the Ethics Committee, and the Student Union. We have also arranged for input from relevant experts and non-experts outside the University. MAFF and the DETR Advisory Committee on Releases to the Environment have expressed willingness to comment on the project. At Cranfield University, Professor Phil Warner, the Head of the Biotechnology Centre, Britain's foremost centre in the field, is willing to provide scientific advice. We also have the cooperation of representatives from opposed sides in the GM debate: Dr Sue Mayer, the Head of GeneWatch UK; the scientific advisers to both Friends of the Earth and Greenpeace; Dr Andrew Colburn from Monsanto UK; Dr Andy Greenland at Syngenta.

g) Ethical considerations

The research will abide by the ethical codes of practice of the British Association for Applied Linguistics and the British Sociological Association. Particular care will be taken to respect the confidentiality of informants, and to maintain independence and impartiality.

h) Framework and methodology

The research strategy combines a sociological approach to the content and context of the arguments, with a discourse and linguistic analysis of the wording. On the sociological side, the method employed provides for the examination of discourse by using **frame analysis** (Gamson and Modigliani, 1989). This combines an analysis of the semantics of texts with an analysis of contextual factors, such as the discursive strategies of scientists. The duality of this type of discourse analysis allows the researcher to relate oral and textual representations of social reality to the social processes generating them (Eder, 1996). This is enhanced by the use of **rhetorical analysis**, which has a long tradition of examining persuasion in scientific discourses, including specialist and non-specialist genres (Fahnestock, 1999). The transcripts of interviews and texts will be analysed using a version of the **constant comparative method** (Glaser and Strauss, 1967; Strauss and Corbin, 1990). In this approach, coding paradigms developed before data collection begins are enhanced or rejected through a process of comparing analytical 'dimensions' that emerge through the process of integrated data collection and analysis. This forms the basis for the outcome of the research, which is an empirically grounded theory (Kelle, 2000). Computer-assisted qualitative data analysis software (CAQDAS), will be used which is helpful for managing a medium to large data set (Gaskell, 2000). Of the various packages available, ATLAS/ti is one of the most flexible,

providing for the definition of relationships between concepts in a variety of ways, as well as cross-referencing (hyperlinks).

On the linguistics side, the project will draw upon - and contribute to - three approaches: a) **Applied Linguistics Discourse Analysis** (e.g. Brown and Yule 1983), as practised in the work of the principal applicant (see CV); b) **Critical Discourse Analysis** (e.g. Fairclough 1992); and c) **Corpus Analysis of Texts** (Stubbs 1996). The central tenet of (a) and (b) is that the coherence and meaning of a text cannot be analysed or accounted for separately from the situational and cultural context of its production and reading, its paralinguistic features, the intentions of the sender, and the knowledge, purposes and attitudes of the receiver. Our aim is, using techniques developed in (c), to relate linguistic choices in our data to these factors. These linguistics based approaches, therefore, fit well with, and indeed already draw upon, the sociological methodology outlined above. Our own sociological analysis will enable us to relate senders' purposes and receivers' responses to actual linguistic choice (e.g. default schematic assumptions indicated by definite articles). From Critical Discourse Analysis we shall borrow techniques for relating textual choice to covert ideology, using our sociological data to assess both the intention and effect of such choices. For the Corpus Analysis of Texts, data set 1 will catalogued by genre, and copied/ scanned/ typed into machine readable form. This will allow the deployment of software (Wordsmith Tools, for which the Reading University School of Linguistics is already licensed) for the quantitative analysis of lexical frequencies, patterns and collocations which can then be contrasted with those in more general corpora of English (the British National Corpus and COBUILD corpus, to which the researchers have on-line access). In cases where our data is multi-modal and draws upon diagrams, pictures, graphs and other visual communication strategies, we shall use techniques developed in the analysis of visual communication in general (e.g. Kress and van Leeuwen 1996) or of science communication in particular (Kress et al 1996).

(i) Outputs

Results will be disseminated to the sociology and applied linguistics research communities, to interested parties on both sides of the debate over GM (scientific researchers, commercial producers, environmentalist organisations), and to those studying science communication and the public understanding of science. We hope to present papers at the following conferences: Society for Social Studies of Science; The European Association for Scientific and Technical Studies; the British Association for Applied Linguistics; the British Sociological Association; and to publish findings in the journals such as: *Social Studies of Science*, *Science Technology and Human Values*, *Science Communication*, *Public Understanding of Science*, *Applied Linguistics*.

Conclusion

This project will provide unique insight into the relation between GM scientists' perception and attitudes, their rhetorical strategies in communicating these, and the effect on non-specialists. It will also create unique case-study data sets of how a crucial public debate unfolds within one representative institution, and will thus create an important resource for other researchers, user groups and stakeholders. It will contribute to knowledge of linguistics and sociology, discourse analysis, risk communication and the public understanding of science. The results will be of interest to all involved in the GM crops debate.

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Annex Two: Interview Schedule

FIRST PART OF INTERVIEW - Questions for scientists at University of Reading

First a brief introduction on our project, and then:

1. What in your opinion accounts for the public response to GM in Britain? [Probe the link with the idea of breakdown of trust, and the issue of risk.]

2. What do you see as the best strategy to convey information on GM research/ products?

3. What are the key themes/components that you wish to communicate about GM research? Do you have different strategies you use with different audiences?

4. How are communications with the public produced? In the form of adverts/ press releases? Who participates in their production?

5. Do you see room for improvements in the link between industry and research?

6. Are sustainable business growth and good/quality science linked? If so, how?

7. If you walk in a US supermarket the shelves are full of GM food. What is going to take for the same to happen in the UK? [Probe the future of the industry.]

(8. Drawing on something that they'll have said, paint a scenario for their personal everyday life where they have to explain/justify their work.)

SECOND PART OF INTERVIEW SCHEDULE – Text-related questions

In this section we are interested in your thoughts about the use of the following words and expressions in the text you have just read. Please comment on them in relation to:

a) their factual accuracy;
b) their connotations or ideas they evoke;
c) their appropriateness to what you perceive are the purposes of this text;
d) their likely effect on a reader open to arguments both for and against;

List of words and expressions:

1) genetic modification/ GM/ genetic engineering (line 1[1])
2) basic biological knowledge (line 3) / basic scientific knowledge (line 13)/ fundamental studies (line 20)/ pure and applied science (line 13)
3) organism (line 4)
4) traditional breeding processes (line 6) / traditional breeding programmes (line 8)
5) improvement of crop plants (line 7)/ improved nutritional qualities (line 17)/ to improve the storage properties of fruit (line 18)
6) designer organisms (line 15)
7) toxic pollutants (line 16)
8) pharmaceutical drugs (line 16)
9) the workers engaged in the techniques themselves (line 24)
10) theoretical risks (line 25)
11) [a plant could] escape (line 27).. colonise (line 28).. kill (line 28)..
12) existing plants (line 28)
13) practical experience (line 29)
14) little basis in reality (line 30)
15) in accordance with the relevant legislation (line 31)

[1] Line numbers refer to the original press release text that was being shown to the interviewees.

The University of Reading Draft Press Release

The University of Reading
Press Release on Genetic Modification

Introduction

Genetic modification or 'GM', sometimes referred to by the earlier term of 'genetic engineering, is a key technique in modern biological research that underpins many of the recent advances in basic biological knowledge. In simple terms, it involves the isolation of one or a few genes from an organism, and their insertion into another organism in such a way that all the descendants of that organism inherit the genes. This offers the opportunity to study the function of those genes in other organisms, and also to speed up traditional breeding processes, in a highly targeted manner especially in the improvement of crop plants. Only specific genes are introduced into the new hybrid, unlike traditional breeding programmes, where the whole genetic make-up of the organism is involved. Organisms that have undergone genetic modification are commonly referred to as 'genetically modified organisms' or 'GMOs'.

Applications

The possible applications of the technique in the biological world are almost without limit, and there are a multitude of potential benefits in areas such as Medicine and in both pure and applied science. In Biology, for example, GM techniques help to provide basic scientific knowledge of the biological world. In Biotechnology (where use is made of biological organisms), GM techniques offer the prospect of 'designer organisms', for example, able to clean up toxic pollutants or able to produce chemical or pharmaceutical drugs more effectively. In the specialised area of food biotechnology, improved nutritional qualities can be introduced into foods, and over-ripening delayed to improve the storage properties of fruit. In Medicine, the use of GM techniques offers the prospect of greatly improved methods for controlling diseases such as diabetes, cancer or infections caused by bacteria of viruses. Fundamental studies on how organisms cause disease hold out the prospect of designing drugs to specifically prevent such diseases.

Risks

Because genetic modification is such a powerful technique, it is important that it is used safely, and in a way that represents no hazard either to the workers engaged in the techniques themselves, to the general human population, or to the environment around us. Theoretical risks include the possibility that a novel microorganism could be created that caused a new or unusual disease: alternatively, it has been suggested that a genetically modified plant could 'escape' and colonise the surrounding countryside, where it could kill or displace existing plants, or be uncontrollable by existing control methods. However, practical experience with GM technology has shown that many of the theoretical risks have little basis in reality, when the work is conducted in accordance with the relevant legislation.

University of Reading Draft Press Release - Alternative Version

Introduction

1. By modifying the genes in plants, modern researchers have greatly advanced their knowledge of botany. 2. They first isolate some of the genes in one plant, and then insert them into another one. 3. By doing this, they ensure that the modified plant will transmit the new genes to its descendants. 4. The researchers can then study the effect of the genes. 5. They can breed new plants faster than before. 6. They no longer need to change the whole plant as breeders did in the past. 7. Instead, they can improve crops quickly by giving them specific characteristics.

Applications

8. There is virtually no limit to the uses people can make of these achievements. 9. Biologists and medical researchers can do their work better. 10. Their understanding of their subject increases. 11. They are able to use improved plants to clean up poisons, produce useful chemicals, and make medicines. 12. Practitioners also benefit. 13. People in the food industry can make their products more nutritious. 14. They can store fruit longer because the researchers have developed techniques to stop it ripening too quickly. 15. Doctors are able to improve their treatment of patients with infections, and with diseases such as diabetes and cancer. 16. In future, the researchers who modify the genes in plants may be able to design new drugs to prevent patients from ever developing such diseases.

Risks

17. Researchers involved in this work have a great deal of power. 18. They must be careful not to harm themselves, the public, or the environment. 19. Some people have said that they might create a new plant which spreads a new or unusual disease, or that they might let one of their 'improved plants' spread uncontrollably, causing other plants to die or retreat. 20 In the light of their experience, however, the researchers believe that this is very unlikely indeed - and more related to fiction than fact. 21. In addition, the government has limited what they can do by introducing new laws.

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ESRC AWARD REFERENCE NUMBER	**ESRC R000223725**
AWARD TITLE	**The Presentation of GM Crop Research to Non Specialists: a case study.**
AWARD TERMINATION DATE	**4/11/2002**
END OF AWARD REPORT DUE DATE	**18/02/2003 (extended from 4/02/2003)**
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DECLARATION 1: CONDUCT OF THE RESEARCH

The declaration below must be signed by <u>all</u> the named Award Holders, the Administrative Authority in the institution to which the award was made and the Head of Department, School or Faculty in which the research was located.

<u>THE END OF AWARD REPORT CANNOT BE ACCEPTED AND THE FINAL CLAIM CANNOT BE PAID UNTIL ALL NECESSARY SIGNATURES ARE RECEIVED.</u>

<u>DECLARATION 1</u>:

This report is an accurate statement of the objectives, conduct, results and outputs to date of the research project funded by the ESRC.

Signature(s) of all Award Holder(s)

DATE:

DATE:

DATE:

DATE:

DATE:

Signature of Administrative Authority

DATE:

Signature of Head of Department, School or Faculty

DATE:

Photocopies of this page are acceptable in the seven additional printed copies of the report. This page should be left blank in the email copy.

PAYMENT OF THE FINAL INSTALMENT OF THE ESRC RESEARCH AWARD

DECLARATION 2: Regard

Regard 2000 is the ESRC's publicly available research database on the WWW, containing summary details of all ESRC research projects and their associated publications and outputs. From June 2000, the texts of Summary and Full reports from End of Award Reports have also been made available. Regard offers an excellent opportunity for researchers to publicise their work; the database has a large user base, drawn not only from Higher Education, but increasingly from government, voluntary agencies, business and the media.
The service is managed, on behalf of the ESRC, by a team at ILRT, University of Bristol, 8-10 Berkeley Square, Bristol, BS8 1HH.
Tel:(0117) 928 7194 Fax:(0117) 928 7112 Enquiries: regard@bristol.ac.uk

Summary details of publications and/or other outputs of research conducted under ESRC funded awards must be submitted to the Regard database. Details may be submitted via the Regard website at www.regard.ac.uk, which contains full guidelines. Paper forms are available on request from Regard.

THE END OF AWARD REPORT CANNOT BE ACCEPTED, AND THE FINAL CLAIM CANNOT BE PAID, UNTIL:

EITHER ESRC have received confirmation that details of relevant outputs have been submitted to Regard **OR** the award holder has declared that the award has not so far produced any relevant outputs.

DECLARATION 2 - Regard: Please sign at EITHER A OR B below.

A **Details of relevant outputs of this award have been submitted to Regard and details of any ensuing outputs will be submitted in due course.**

Signature of Principal Award Holder

DATE:

B **This award has not yet produced any relevant outputs, but details of any future publications will be submitted to Regard as soon as they become available?**

Signature of Principal Award Holder

DATE:

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PAYMENT OF THE FINAL INSTALMENT OF THE ESRC RESEARCH AWARD

DECLARATION 3: Data Archive

A machine-readable copy of any dataset arising from the research must be offered for deposit with the **ESRC Data Archive** within three months of the end of the award. All enquiries should be addressed to: The Director, ESRC Data Archive, University of Essex, Wivenhoe Park, Colchester CO4 3SQ. The Data Archive maintains an informative website at **http://www.data-archive.ac.uk/**

Award Holders submitting qualitative data should refer to the **Qualidata** website at **www.essex.ac.uk/qualidata**

The ESRC will withhold the final payment of an award if a dataset has not been deposited to the required standard within three months of the end of award, except where a modification or waiver of deposit requirements has been agreed in advance.

DECLARATION 3 – Data Archive: Please sign at EITHER A OR B below.

A Machine-readable copies of datasets arising from this award have been, or are in the process of being, offered for deposit with the ESRC Data Archive.

Signature of Principal Award Holder

DATE:

B There are no relevant datasets arising from this award to date.

Signature of Principal Award Holder

DATE:

Photocopies of this page are acceptable in the seven additional printed copies of the report. This page should be left blank in the email copy.

ESRC END OF AWARD REPORT: PROJECT DETAILS

AWARD NUMBER:	**R000223725**		
AWARD TITLE: (the box will accommodate up to 4 lines of text)	**The Presentation of GM Crop Research to Non Specialists: a case study.**		
AWARD START DATE	**5/11/2002**	**TOTAL AMOUNT EXPENDED:**	**£38,949.87**
AWARD END DATE	**4/11/2002**		

AWARD HOLDER(S):

NB. This must include anyone named as a co-applicant, as originally listed in the research proposal.

TITLE	INITIALS	SURNAME	DATE OF BIRTH	No HOURS PER WEEK/ % TIME ON PROJECT
Prof.	G.	Cook	10.10.1951	5 hours per week
Dr.	P.	Robbins	29.02.1968	5 hours per week

PRINCIPAL AWARD HOLDER'S FULL OFFICIAL ADDRESS(please list other addresses on a separate sheet if necessary)
Professor Guy Cook
School of Linguistics and Applied Language Studies
University of Reading
Whiteknights PO Box 218
Reading RG6 6AA

E-MAIL:
g.cook@reading.ac.uk

TEL:
0118 378 8139

FAX:
0118 975 3365

THE FOLLOWING REPORT FORMAT SHOULD BE FOLLOWED;

Activities and Achievements Questionnaire

1. Summary of Aims, Objectives and Significant Achievements

In Section 1 overleaf, please summarise:

- the aims and objectives of the research, noting briefly if these have changed since the original proposal.
- in no more than 200 words, suitable for a lay reader, the findings and most significant achievements of the research. The latter might include: theoretical developments, new findings, new methods, new datasets, impact of the research on academics, policy-makers, practitioner's etc.

2-8. Dissemination, Nominated Outputs, Staffing, Virements, Major Difficulties, Other Issues and Unexpected Outcomes, Nominated Rapporteur

Report Executive Summary

In no more than 1000 words, please describe the main research results in non-technical language.

Full Report of Research Activities and Results

A full report of no more than 5000 words should accompany this form, please see the attached guidelines (2.6) for a list of standard headings to follow.

ACTIVITIES AND ACHIEVEMENTS QUESTIONNAIRE

1. Summary of Aims, Objectives and Significant Achievements

The research aimed to understand factors governing the communication strategies and uses of language by GM research scientists when presenting or justifying their work to non-specialists within the context of one representative institution (Reading University). They remain unchanged from the original proposal. GM scientists, non-specialists, and outside commentators were interviewed on social and linguistic aspects of the GM debate, talks and seminars were recorded, and documents on GM within the university were collected. Data was analysed using a combination of automatic analysis to reveal word uses, and content and frame analysis to reveal recurrent themes and opinions. The results reveal GM scientists' perceptions of opposition to GM, and of how language and communication strategies affect non-specialist perceptions. Frequently they characterised opposition as irrational, emotional, and the result of ignorance, and opponents as either easily led (the 'general public') or acting from selfish motives (NGOs and the Press). Findings will be of interest to all players and policy makers in the GM debate, and elucidate why certain approaches to the communication of GM science can bring about public antagonism. The work also contributes to the integration of sociological and applied linguistic methodologies in the analysis of language.

2. Dissemination

a: Please outline any specific plans you have for further publication and/or other means of dissemination of the outcomes and results of the research.

We are in the process of disseminating the work through the publication of books, refereed journal articles, conference papers, and seminar presentations. We are disseminating our work to other academics in our fields of expertise as well as to GM scientists, and non-academic users (see section 2b.). Specific outputs are listed below:

Cook, G. (in preparation under contract for publication in 2004) *Genetically Modified Language: the discourse of the GM food debate.* London: Routledge.

Cook, G., and Pieri, E. 'Like talking to a 12 year old child: how GM crop scientists represent 'the public' and themselves.' Paper given at the BAAL Annual General Meeting, University of Cardiff, 2002 and submitted for publication in Sarangi, S. and van Leeuwen, T. (eds.) (2003) *Applied Linguistics and Communities of Practice: British Studies in Applied Linguistics* 18 London: BAAL in association with Continuum.

Cook, G., Pieri, E. and Robbins, P. 'The discourse of GM science: how scientists view communication with non-specialists' article in preparation for submission to *Discourse and Society.*

Cook, G. and Pieri E. 'Expert to non-expert discourse: an applied linguistic (?) case study' Paper presented to the Reading University Applied Linguistics Circle, November 2002.

Cook, G. 'The communication of GM Science' Paper presented to the Reading University Plant Sciences Seminar Series, February 2003.

Pieri, E. and Robbins, P. (2003) 'GM Scientists Construct Non-Experts: Issues of Agency in the Consumer/Public Dichotomy', paper presented at the British Sociological Association Annual Meeting, York, April.

Robbins, P. *Globalizing Genes: Contesting the Biotechnology Revolution* (Book contract being negotiated with Johns Hopkins University Press).

Robbins, P. 'The Social Construction of Genetic Modification', article in preparation for submission to *Science & Society.*

Robbins, P. (2003) 'Broadening the Discourse', Keynote address given to the 'Trading Genes: The Power of the Market in Shaping a New Genomic Order' Goodenough-Chevening Conference, London, March.

Robbins, P. (2003) 'Genetic Modification and the Politics of Representation', Paper Presented and Panel Convened at the International Institute of Sociology Conference, Beijing, China, July.

Robbins, P. and Pieri, E. (2003) 'GM Scientists and the Politics of the Risk Society', paper presented at the Ecological Justice and Global Citizenship Conference, Copenhagen, Denmark, February. Paper submitted for publication in one of the themed volumes arising from the conference.

b: Please provide names and contact details of any non-academic research users with whom the research has been discussed and/or to whom results have been disseminated.

1. Dr Andrew Cockburn, Director, Scientific Affairs, Monsanto UK
2. Dr Andy Greenland, Senior Research Scientist, Syngenta UK
3. Dr. Doug Parr, Chief Scientific Advisor, GreenPeace
4. Friends of the Earth, GM Campaign Team
5. Dr. Sue Mayer, Director, Genewatch UK
6. Dr Ian Weatherhead, Public Relations, Syngenta UK

3. Nominated Outputs (see Guidelines 2.4)

Please give full details of the two nominated outputs which should be assessed along with this report. With the exception of publicly available web-based resources, eight copies of any nominated outputs must be submitted with the End of Award Report.

not submitted

4. Staffing

Please detail appointments and departures below for ALL staff recruited for this award. Where possible, please note each person's name, age, grade; and for departing staff, destination type on leaving. (Destination types: Academic post, Commercial, Public Sector, Personal, Other).

Title	Initials	Surname	Date Of Birth	Grade	Appointment Date	Departure Date	Destination Type & Post
Ms	E.	Pieri	1.08.1974	RA1A	5.11.2001	4.11.2002	RA, ESRC 000220132
Ms	A.	Whitbread	17.11.62	3 (secretarial)	20.02.2002	4.11.2002	part-time work

NB This section must not include anyone who is an awardholder or co-applicant.

5. Virements

Since 1st April 1996 investigators may vire between grant headings without reference to Council, except where major capital items are being provided for. Please detail below any changed use of resources and the benefits or problems this brought.

£820 from heading staff to heading consumables
£377 from heading staff to heading consumables

The arrangements for virement allowed greater flexibility and were an advantage to the project.

6. Major difficulties

Please detail below any major difficulties, either scientific or administrative/logistical, encountered during your research and comment on any consequent impact on the project. Further details should be included in the main report, including any advice you might have for resolving such problems in future projects.

Printed material produced by the university about its GM research proved to be less in quantity, and of less interest, than anticipated in the research proposal. For this reason, although we have collected a dataset of this on paper, our main work has concentrated on analysis of interviews, as well as to a lesser extent upon talks and seminars given with the university. The findings are thus more concerned with interviewees' attitudes to, and perceptions of, the GM debate, and to the use of language within it, than with texts actually communicating that research. However, given the findings we have made, we do not view this change of emphasis as detrimental. For further discussion, see main report.

7. Other issues and unexpected outcomes

Please describe any outcomes of your research, beneficial or otherwise, that were not expected at the outset, or other issues which were important to the research, where these are not addressed above. Further details should be included in the main report.

8. Nominated Rapporteur

Please suggest the name of one person who would be suitable to act as an independent rapporteur for your project. Please state full address and telephone number.

Dr. Greg Myers
Department of Linguistic and Modern English Language
University of Lancaster
Bailrigg
Lancaster LA1 4YW

CHECKLIST

1	8 x Completed EOA form	❒
2	8 x 1000 word summary	❒
3	8 x Full Report	❒
4	8 x Any nominated outputs	❒
5	All necessary signatures are provided on page 3 of the EOA form	❒
6	The Regard declaration on page 4 of the EOA form is signed.	❒
7	The Data Archive declaration on page 5 of the form is signed	❒

PLEASE NOTE THE EOA REPORT WILL NOT BE ACCEPTED IF YOU HAVE NOT FULFILLED ALL OF THE ABOVE REQUIREMENTS.

THE PRESENTATION OF GM CROP RESEARCH TO NON-SPECIALISTS: A CASE STUDY (ESRC R000223725)

PROJECT SUMMARY

Technical innovations raise important ethical and political questions that must be justified and communicated by their developers. This has become a key area of contemporary discourse, and GM food technology is a timely example, about which important decisions are imminent in the UK. The project aimed to investigate the presentation and justification of GM crop research by scientists to non-specialists within one academic institution. We sought to understand expert perceptions of non-expert knowledge and views, how these perceptions might affect choices of argumentation strategies and of language use, and the actual effect of these choices upon non-experts. Reading University, one of the largest centres for plant sciences in the UK provided a particularly suitable institution for such a case study.

Our research analysed the data from both a sociological and an applied linguistic point of view. Sociologists of science theorise ways in which reflexive modernization produces new relationships between the public, science and technology bringing both emancipation and subjugation.

It is, however, the applied linguistic dimension – studying a 'real world problem in which language is a central issue' – that distinguishes our project from other studies of scientist perceptions. Language in the GM debate is increasingly central, as all sides seek to put their case as clearly and persuasively as possible, in the belief that outcomes may be influenced as much by the manner as the content of communication. The premise of our research has been that the social relations between the GM science community and others will be reflected in, and/or caused by, rhetorical choices, including the micro levels grammar and lexis.

We collected two datasets. The first consists of material about GM crop research produced within Reading University for non-specialist consumption. The second is elicited, and consists of transcriptions of interviews with GM scientists and non specialists from within the university, as well as with 'external commentators' from outside.

The first dataset aimed to census all the material produced within Reading University to explain and/or justify GM crop research to 'non-experts' between 1997 and June 2002. This part proved smaller than anticipated. The other type of material is transcripts of GM-related seminars and talks given at the University.

The second dataset is a collection of interviews with 18 GM scientists and 13 non-experts from the University of Reading, with 10 external commentators working in the GM industry (Syngenta and Monsanto), in anti-GM NGOs (GeneWatch UK, Friends of the Earth and Greenpeace) and in other universities.

Interviews were semi-structured and in two sections. In the first section, interviewees were asked a number of general questions about their own attitudes to the technology, and how GM issues are communicated to non-expert audiences. The second section

focused more specifically on language, and interviewees were asked to read and answer questions on a press release that had been produced (but never released) by the university in anticipation of outside interest in two research projects. The document is of discoursal and linguistic interest. The argument typifies a certain approach to the justification of GM, explaining the technology, arguing its benefits, and discounting fears. It is also hybrid, combining features of the scientific report, with an attempt to be accessible to the non-specialist. Interviewees talked through their responses to the text, as well as specific wording and phrasing. They were then asked to compare the first text with an altered version which retained the propositional content, but in which the clause structure was simpler, sentences shorter, the subject of every sentence was a human agent, and there were fewer definitions of terms. While the second version was textually weak, it overcame some of the difficulties in asking non-linguists to focus upon grammatical as well as lexical choice, and provided a springboard for relevant metalinguistic remarks and for discussions of wider issues.

The results were derived using a grounded theory framework, corpus linguistic analysis, coded content analysis, and a correlation of the latter two methods. Our main conclusions concern the views of the GM scientists, and the interviews with non-specialists and outside commentators as reference points/data. In our analysis, we focus primarily on the scientists' framing of empirical objectivity, and the extent to which they accept this relatively uncritically, and defend it against arguments framed in moral or aesthetic terms. At the extreme, this produces a sense of embattlement among scientists, which may have important implications for the national GM debate.

Among scientists, there is a strong general sense of bounded identity in the GM science community. The use of "we" usually means GM scientists, the word "scientists" usually occurs alone in the expert interviews, whereas for non-experts it is frequently linked with other groups, such as "scientists and politicians". Concordance and collocation analysis suggest that scientists tend to see the "public" as a homogeneous body, and the word "public" typically occupies a semantically passive role, unlike words referring to proponents or opponents. Content analysis also shows that the public are frequently categorised as emotional rather than rational, and uniformly ignorant. Many GM scientists expressed interest in a public 'debate', which they understood as an exercise to 'educate' the public rather than respond to issues beyond scientistic constructs, such as risk. Scientists perceive opposition to GM as emanating from self-interested parties rather than from the public itself. There is a limited discussion of types of opposition, with over half of the references to the press, for example, focusing upon the phrase 'Frankenstein foods' used in the Daily Mail, and references to anti-GM NGOs being almost entirely to Greenpeace. GM scientists' answers to interview questions about the two texts suggest that they, unlike non-specialists, view genre shifts – from science to non-science – in communicating to non-specialists as a problem of simplification only. Generally, they do not appreciate the complexification of adding factors such as politics and ethics. It is ironic that scientists often use highly emotive language and selective use of examples to criticise the irrational nature of the opposition – both apparently in defence of science.

Planned and existing outputs from the research include 2 books, a book chapter, at least 2 articles, 6 university and conference presentations, and a keynote address.

THE PRESENTATION OF GM CROP RESEARCH TO NON SPECIALISTS: A CASE STUDY (ESRC R000223725)

FINAL REPORT

1. BACKGROUND

With technological innovations increasingly impinging upon day-to-day life, and with important ethical and political decisions to be made about their use, the need for the developers of new technologies to justify and communicate their work has become a key area of contemporary discourse, affecting decision making at all levels: international, national, institutional, and personal. GM food technology is a salient example, and one about which important decisions are imminent in the UK. Our project is distinctive in combining linguistic and sociological discourse analysis to understand the factors governing communication strategies of experts in explaining or justifying controversial technology.

2. OBJECTIVES

2.1 Aims.

Our project aimed to investigate the presentation and justification of genetic modification (GM) crop research by GM scientists to non-specialists within one academic institution. We sought to understand expert perceptions of non-expert knowledge and views, how these perceptions might affect choices of argumentation strategies and of language use, and the actual effect of these choices upon non-experts. Reading University, one of the largest centres for plant sciences in the UK with a wide range of representative GM crop research activity, provided a particularly suitable institution for such a case study.

As with other contested new technologies, a marked characteristic of the wider GM debate has been the sharp binary distinction drawn between "scientists" and "the public", although neither are discrete or unproblematic categories. The distinction between experts and non experts in our own research design seems in some ways to reflect this simplistic division, and as our project progressed these two categories became harder rather than easier to define. On the other hand we found (see 4.1.1 below) that for our informants the two categories *were* generally treated as real and relatively unproblematic.

2.2 A contribution to discourse analysis

The communication of GM crop science offers particularly rich material for discourse analysis combining both sociological and linguistic perspectives. Not only is it of intrinsic interest as a technology which will profoundly affect everybody's lives, it also necessitates difficult and often contentious communication between "experts" and "non-experts", touching upon a wide range of key themes in contemporary life, including popular perceptions of science and technology, risk assessment, democratic

decision making, the responsibilities of citizenship, globalisation, and trust of institutions.

In the international and national debate, our survey of the literature suggests that the main areas of contention concern whether GM crop technology:

- reduces or protects biodiversity;
- is a health risk or advantage;
- remedies malnutrition and food shortages;
- 'improves' food (in terms of flavour, storage, fruiting etc);
- is subject to human error;
- poses unacceptable unforeseen risks;
- is handled by trustworthy institutions (governments, corporations, universities);
- affects democratic decision making;
- advances the power of multinational corporations at the expense of small farmer independence;
- furthers US economic ascendancy;
- has military applications (Genewatch UK 1999, 2000);
- is ethical;
- (for the religious) usurps divine power (Deane-Drummond et al. 2001);
- is aesthetic[1].

The debate thus draws together many different discourses in the sociological sense (Foucault 1974), many different genres (Swales 1990), and many different registers of language use (Halliday, McIntosh and Strevens 1964). As people with different interests in the debate attempt to communicate across previously less permeable discoursal boundaries, new hybrid genres appear, and with them enormous potential for misunderstanding.

Anyone entering the debate has thus the option of engaging with the heteroglossia of voices within it or of keeping it more or less monologic (Bakhtin 1968) by engaging with only one, or one type, of argument. Our findings reflect the degree to which the "experts" interviewed engage with the range of perspectives in the wider debate, and understand the different ways in which argumentation and language are used within them.

3. METHODS

3.1 Discourse Analytic Perspectives.

Our research analysed the data from both a sociological and an applied linguistic point of view.

[1] Genetically modified trees, for example, may have "straighter trunks and less branches" (Genewatch UK 2001)

3.1.1 Sociological perspectives

Of these two, the sociological perspective, is for many the more familiar and the more obviously relevant. Much current cultural sociology focuses on the ways in which power can be "demythologised", thus contributing to wider processes of social democratisation. In particular, Beck's (1992) thesis about the risk society examines the breakdown of trust in institutions organized to ensure safety, and the role of reflexive modernization in producing new relationships between the public, science and technology. Our own research contributes to this perspective by interrogating scientific constructions of the public as well as non-expert perceptions of scientific findings. It also throws light on what Adorno and Horkheimer (1979) described as the "dialectic of enlightenment", the extent to which the liberation proffered by science can also create new and novel forms of subjugation.

3.1.2 Applied Linguistics perspectives

It is, however, the applied linguistic dimension which distinguishes our project from other comparable studies of scientists' perceptions of themselves and their work (e.g.Wynne et al 2000). Applied Linguistics has been defined as the empirical and theoretical study of "real-world problems in which language is a central issue" (Brumfit 1995:27). As the "real world problem" of decision making about GM is one in which language is increasingly central, it forms a valid and fruitful area for applied linguistic research. All sides in the GM debate are seeking to put their case as clearly and persuasively as possible, in the belief that outcomes may be influenced as much by the manner as the content of communication. Within the national debate, language choices are increasingly seen as important (AEBC 2001: recommendation 2), and our interviews with both Reading scientists, and with "external commentators", confirmed a growing if tentative awareness of the importance of wording in the battle for support. Our investigation has the potential to contribute both to applied linguistic understanding of language use in public controversy over technology, and to the conduct of the GM debate itself.

3.1.3 Discourse Analysis: a combined sociological and linguistic approach

The premise of our research has been that the social relations between the GM science community and others will be reflected in, and even caused by, rhetorical choices, including those at the micro levels of grammar and lexis. By combining sociological and linguistic perspectives, and by focusing upon the relationship between uses of language and the social relations which they perpetuate or create, our research draws both upon critical discourse analysis, seeing discourse 'as a form of social practice [in which] the discursive event is shaped by situations, institutions and social structures, but also shapes them.' (Fairclough and Wodak 1997), and upon discursive psychology in which discourse is studied as the accomplishment of social action (Edwards and Potter 1992). The idea that language use is a social practice is also employed in the Foucaultian discourse analysis used by sociologists to look at relationships between

discourse and power, examining, for example, the construction of “regimes of truth” and their effects on social action (Foucault 1980).

3.2.Data collection and treatment

We collected two datasets. The first consists of material about GM crop research produced within Reading University for non-specialist consumption. The second is elicited, and consists of transcriptions of interviews with GM scientists and with non specialists from within the university, as well with "external commentators" from outside.

3.2.1 Dataset one: material produced by the University of Reading

The first dataset aimed to census all the material produced within Reading University to explain and/or justify GM crop research to ‘non-experts’ between 1997 and June 2002.

Given the extent of GM research activity in the university, we had expected to see a considerable amount of effort put into communicating this work to the wider University community, and to collect many documents. The amount of written material, however, proved smaller than we had anticipated, and, in the period prior to and during the project, it even declined. To a degree, this change was determined by local matters particular to our university, where an anticipated controversy failed to materialise when the university did not, as had been expected, conduct one of the government-sponsored national farm-scale trials. The decline in output may also reflect a change in strategy on the part of GM scientists, both inside and outside the university, from pro-action to retreat.

There was also written material to which access was limited. Thus while we were allowed by the university's Safety Sub-Committee for Genetic Modification to read the "lay summaries" of research projects submitted to them for approval, we were not allowed, for reasons of confidentiality, to include these in our dataset.

The smaller-than-anticipated size of this first dataset, and its generally bland and uncontroversial nature encouraged us to supplement it with transcripts of talks and seminars, and also to concentrate upon the interviews in dataset two.

3.2.1.1 Dataset One: written texts

Those written texts which we did collect include minutes, memos and official communications, safety information and guidelines for non-expert audiences, policy statements for internal University use (e.g. for catering services), web pages and press releases, and articles from the *University of Reading Bulletin,* (which is published fortnightly and distributed throughout the university), as well as the less frequent *Reading Reading, Research & Development* and *Reading University Alumni*. Relevant documents and articles have been scanned and stored in electronic format for corpus analysis using WordSmith software.

3.2.1.2 Dataset One: transcripts

The second type of material is transcripts of GM-related seminars and talks given at the University, either by University staff or by invited speakers. Of these, some were open to the general public, some to students and staff in all departments, and some to students on specific courses only.

Some important material we had anticipated in our proposal, however, was not available. We were unable to obtain lecture notes, overheads, or written versions of papers from a series of SCR seminars on the GM debate held in 1999. Pages from an educational website for schools produced within the university by the NCBE (National Centre for Biotechnology Education) were not included for copyright reasons. Although not included in our dataset, these two sources have been taken into account in our findings.

As with the written part, the material here is very diverse, ranging from speeches at The Reading University Bio-Centre opening (spring 2002) to seminars on GM given to international students to increase their exposure to academic English. Also included, is the "Syngenta module", a 10-week course concerned with giving an insight into the GM industry, jointly organised by Syngenta and the University of Reading for MSc students of Plant Biotechnology. This module was attended mainly by overseas students with mixed academic backgrounds (i.e. Botany, Food Biotech).

Transcripts have been stored in electronic format for a content and corpus-linguistic analysis.

3.2.2 Dataset two: elicited material

The second dataset is a collection of interviews conducted with GM scientists and non-experts from the University of Reading, and with external commentators working in the GM industry (Syngenta and Monsanto) or in anti-GM NGOs (GeneWatch UK, Friends of the Earth and Greenpeace).

3.3 Interviewees

Interviewees are grouped in three categories.

3.3.1 GM Scientists

Our 18 interviewees were selected from a variety of schools and departments - Agriculture, Agricultural Botany, Horticulture and Landscape, Food Biosciences, Animal Microbial Sciences, Soil Science, the Centre for Agricultural Strategy, Agricultural and Food Economics, NCBE (National Centre for Biotechnology Education). They represent a variety of expertise, roles and levels of seniority, and include heads of schools, departments, and centres, a safety officer, postdoctoral scientists, and postgraduate students.

3.3.2 Non-specialists

Our 13 interviewees were either working or studying at the University of Reading. They include students, a student journalist, and a student union official, lecturers, technicians, canteen staff, administrative staff at various levels of seniority, and senior management (the Pro-Vice Chancellor for Research and the Vice-Chancellor).

3.3.3 External commentators.

The third set of interviewees were a smaller group (10 interviewees listed in Annex 1) from outside the university whose work gives them insight into the communication of GM, though from different points of views. This group consisted of senior personnel from the biotechnology industry (Syngenta and Monsanto), and from anti-GM NGOs (GeneWatch UK, Friends of the Earth and Greenpeace UK) and academics from other institutions. The interviews in this set are significantly longer (up to 3-hour-long recordings in some cases) than the average interview of between 60 and 90 minutes.

3. 4 Interviews

Interviews were semi-structured, and in two sections (Annex 2). In the first section interviewees were asked a number of general questions about their own attitudes to the technology, and how GM issues are communicated to non-expert audiences. We aimed to elicit also their opinions on the links between industry and university research, and on other larger topics including the future of plant biotechnology, and reasons for public reactions to GM. The main aim of the first section was to uncover the social dynamic between expert and non-expert constructions of GM.

The second section focused more specifically upon language. Interviewees were asked to read and answer questions on a short text (Annex 3): the first three paragraphs of a press release which had been produced – though never actually released – by the University in anticipation of outside interest in two research projects[1]. This text was chosen for a number of reasons in preference to the wider range of texts initially envisaged in the research proposal. Firstly, it provided consistency and comparability of subject matter across interviews. Secondly, as a potential public statement by the university to rebut opposition, it had been circulated among relevant parties, and can be regarded as a joint statement by the university's GM plant scientists. Thirdly, it is of discoursal and linguistic interest. The argument typifies a certain approach to the justification of GM, seeking first to explain the technology, secondly to argue for its benefits, and thirdly to discount fears of adverse consequences. It is an example of a hybrid genre, combining features of the scientific report (such as clausal complexity, nominalization, impersonal constructions, absence of explicit agency, and emphasis on the definition of terms) with an attempt to be accessible to the non-specialist. It provides also, in context, examples of the use of technical terms ('organism', 'GM',

[1] The first examined whether, when cows are fed GM fodder, transgenic DNA might enter their milk and thus the human food chain (Phipps, Beever and Humphries 2002); the second, conducted by the Rothamsted Research Institute, but using Reading University land, investigated the impact of GM crops on biodiversity

'hybrid', 'gene') and emotive words and phrases ('traditional', 'escape', 'colonise', 'designer organisms', 'improved plants').

Interviewees were first asked about their general impressions of the style and effectiveness of the text, secondly to reflect upon specific words and phrases. Interviewees were invited to speculate on the intentions of the authors, on the intended audience and its reactions, as well as upon some specific arguments put forward in the text (e.g. that GM technology is a development of traditional agriculture rather than qualitatively different), specific wording and phrasing (e.g. 'genetic engineering' vs 'genetic modification', 'designer organisms', 'theoretical risk') and the ideas that these might evoke for GM 'experts', on the one hand, and for the intended non-specialists readers on the other.

Interviewees were then asked to compare the first text with a second version (Annex 4) drafted for use in the interviews. In this text, while the propositional content remained almost identical to the first text, clause structure was simpler and sentences shorter, the subject of every sentence was a human agent (with a consequent reduction in nominals and impersonal constructions), and there were fewer definitions of terms. This second version while being admittedly textually weak - lacking in textual cohesion for instance, and therefore producing what many interviewees called 'a staccato effect'- had a number of advantages for the research. It overcame some of the difficulty inherent in asking non-linguists to focus upon grammatical as well as lexical choice. It provided a concrete example of 'saying the same thing in different words', and encouraged reflection upon the relative merits of a traditional academic style (in the original) and a more 'plain English' effect (in the reworking). It thus provided an effective springboard for relevant metalinguistic remarks, and for poignant discussions of wider issues (e.g. the rights of citizens, scientific accountability, and the role of scientists in society today).

3.4.1 Coding of Interviews

The interviews were transcribed in normal orthography, though with pause marks rather than punctuation, to allow a possible future conversation analysis correlating fluency with topic or other factors. The identities and distinguishing features of informants' responses in sets one and two were (with one exception) disguised to protect confidentiality. The names of the external commentators were (again with one exception) not altered in this way, as the interviewees were talking in their public capacity.

Transcripts have been stored in electronic format, allowing the two types of analysis. Firstly, all transcripts have been stored in text-only form for corpus linguistic analysis using Wordsmith tools. Secondly, for content analysis, the interviews in sets one and seven of the interviews in set two, and extracts from the interviews in set three[1], were

[1] For the interviews in set three, which are much longer, a one-hour sample has thus been extracted from five of them - half an hour from the first part of the interview schedule, and the other half an hour from the second part of the schedule

all coded for analysis with Atlas.it (a software for qualitative analysis allowing a constant comparative approach). The main coding categories were agreed after an analysis of the first 10 interviews, and then collapsed or expanded through analysis of the rest of the dataset. For the framework of codes used, see Annex 5.

4. RESULTS

This research did not set out to be a quantitative analysis or a survey. What follows are qualitative findings informed by the more objective evidence of the corpus linguistic analysis and coded content analysis and a correlation of the two. The space allowed for this report does not allow extensive illustration, although certain words and concepts are discussed in order to focus the discussion. Further discussion of the findings will be found in the publications and conference proceedings from the project.

We deal with these findings under three headings: categorisation of participants in the GM debate; views of communication and the use of language; types of argument. Our main conclusions concern the views of the GM scientists, using dataset one, and the interviews with non-specialists and outside commentators as reference points/data. In our analysis, we focus primarily on the scientists' framing device of empirical objectivity, and the extent to which the scientists accept this relatively uncritically. The loss of authority of the scientific framing device in modern culture, through increasing clashes with moral and aesthetic frames, which we explore through interviews with non-experts and outsiders, means that science becomes a medium for contesting claims (Eder 1996). We have found that, rather than transforming scientists, it produces in them a sense of being under siege. The implications of our study are that the socially unreflexive nature of scientists' perceptions of non-experts and opponents in the GM debate may undermine wider discussions about new technologies, which, some claim, must be based on democratic decision making to be effective (Kleinman 2000).

It should be emphasised that our conclusions depict general, recurrent or majority tendencies among our interviewees. There were individuals, and particular responses, which were at odds with these general tendencies, questioning or criticising, for example, the rigid categorisation which characterises the GM debate.

4.1. Categorising the players

Our interview data strongly suggest that the experts we interviewed group participants in three discrete categories: GM scientists; the public; and opponents of GM (including the Press).

4.1.1. Scientists

A corpus linguistic analysis of the GM scientist interview data confirms a strong general sense of bounded identity of the GM scientific community. The use of "we" normally means GM scientists, whether this is with reference to the university or to

the national or international stage. The word "scientists" usually occurs alone in the expert interviews rather than in coordinate constructions with other players (even industrial or academic sponsors), whereas in the non-expert interviews it is linked with other groups, for example "scientists and politicians" which reflects perhaps a sense of isolation and a tightening of ranks.

There is little awareness of scientific competence outside the narrowly defined "scientific community". Scientific method and principles are assumed to be known and used in the natural sciences only. The general assumption is that the basics of the scientific method (simply conceived as induction from observation and experiment) are unfamiliar to outsiders and therefore in need of explanation.

Our data suggests that the scientists' own sense of belonging to a community has been enhanced by their feeling of embattlement, whether as members of the GM scientific community, or more broadly of scientists in general. When asked to account for hostile public reactions to GM food in the UK, frequent reference is made to the BSE and other food crises, with the claim that GM research has suffered by association. There is little sense that with GM technology, the increasingly heated debate over food has moved beyond 'scientistic' issues of safety and calculation of risk, into areas of ethical, political and other concerns (Wynne 2002).

4.1.2. The public

Concordance and collocation analysis of the word "public" suggest its conception by most GM scientists as a homogeneous body. No allowance is made for other relevant expertise outside of the scientific community, nor for any intermediate degrees of scientific knowledge or understanding. Typically the word "public" occupies a semantically passive role (unlike words referring to either proponents or opponents). When the word is used in agentive role it typically governs verbs of feeling or emotion such as "is concerned about", "feel", "believes".

The content analysis shows that the public are typically categorised as emotional rather than rational, and vulnerable to manipulation by self-interested opponents: including politicians, press, and NGOs. The GM scientists also frequently characterise the public as uniformly ignorant (of GM science rather than other relevant dimensions of the debate), and attribute opposition to GM to this ignorance. This characterisation of the public is often achieved through anecdotes of some farcical encounter with a particularly 'uninformed' member of the public: a commonly voiced one concerns people who are worried that they may be 'eating genes'. There is also a frequent claim that the public has no understanding of risk, and naively believes in, and foolishly demands reassurances of, 'zero risk' (a claim which is contradicted by studies showing that people are, in certain contexts, generally ready to acknowledge and 'live with' uncertainty and the lack of control that it entails (Wynne 2002a: 466).)

In their emphasis on public ignorance our expert informants generally subscribe to a "Deficit Model" (Gregory and Miller 1998), in which opposition to new technology is attributed wholly to ignorance and can consequently be 'remedied' by education. In this they echo research such as the EuroBarometer reports, where knowledge is reduced to knowledge of the technology itself, and correlated with negative attitudes

to GMOs (BEPCAG 1997, INRA 2000). There is, however, other research suggesting that knowledge of GM technicalities does not lead to increased acceptance of GMOs (Bucchi and Neresini 2002).

This claim that the public lack knowledge and can only engage on an emotional level with the issues, is then key to a further argumentative twist, allowing scientists to describe public opposition as entirely created by the media and NGOs, rather than as ever being a spontaneous, considered, or autonomous response. This characterisation of public opinion thus frees scientists from having to engage with the public on equal terms. When asked directly, many of the GM scientists we interviewed spoke favourably of the increased emphasis on communicating with non-experts, although it seems that by this they mean a one-way 'debate' in which members of the public would be 'educated'. This apparent readiness to open the GM debate to the public is thus deceptive, as it conceals strongly held beliefs that members of the public are interfering when they ask to be heard and to be actors in (instead of spectators of) the decision-making processes.

4.1.3. Opponents

As already indicated, opposition to GM is seen as emanating from self-interested individuals and organisations acting upon a malleable and passive public, rather than from the public itself. The two main sources of opposition are seen as campaigning NGOs and the Press and to a lesser extent supermarkets and politicians, all of whom are judged to be acting in their own interests and making decisions without authority on the public's behalf.

Very noticeably, there is a marked focus upon certain sources of opposition and types of argument, with little attempt to understand the range and types of opposition, or to respond to serious and scientifically informed arguments against GM. Over half of the references to the press, for example, focus upon the phrase "Frankenstein foods" used in the Daily Mail, while there are virtually no references to more thoughtful expressions of doubt or opposition. References to anti-GM NGOs are almost entirely to Greenpeace, while Friends of the Earth and GeneWatch UK are mentioned much less frequently and only in conjunction with Greenpeace (except in one specific reference to a meeting organised by Friends of the Earth). NGOs are characterised as launching campaigns in order to maintain membership and finance their organisation and salaries. Journalists are seen as fickle, unconcerned with truth, and motivated only by the need for a "good story". Anti-GM protestors and activists, are less frequently mentioned, though when they are it is in condemnatory terms. (On one occasion they are equated with terrorists and fascists.) Opposition is thus generally discredited by a very selective description, the assertion that motives are self-seeking rather than genuine, and by highly emotive language.

4.2 Views and practice of Communication

Scientific enquiry and methodology quite properly omit certain aspects of experience from account, although these may enter into analysis of the same subject matter when viewed from other perspectives or represented in non-scientific genres. Scientists, like anyone else, are inevitably familiar with the genre shifts entailed in moving between

different discourses, audiences, situations, modes and purposes. They are for example aware that the same material should be presented differently in a journal article, a popular science journal, or in an article for the press (Myers 1990). Such adaptation to new discourses and non-scientific genres is in part a process of simplification; yet it is also simultaneously one of complexification, as factors usually excluded from scientific analysis (such the assessment of political and ethical implications, or personal reactions to the research) and omitted in scientific genres, become legitimate and expected aspects of the discourse.

However, the GM scientists' answers to interview questions about communication in general, and more specifically about general impressions of the two passages presented to them for close analysis, suggest that they, unlike the non-specialists we interviewed, view the genre shifts entailed in communicating their work to non-specialists as a problem of simplification only. The unfamiliar genres entailed in that communication are perceived as remaining wholly within the discourse of science, and are distinguished from other scientific genres only by their lesser complexity.

4.2.1 Attitudes to language

Both scientist and non-specialist interviewees showed a surprising uniformity in their responses to questions about language use in general, about the two alternative texts, and in answer to questions about specific words. There was a general vague awareness, and approval of, a 'scientific style' even if this was felt, in particular instances, to be inappropriate for the 'general public' or (as revealed in comments about the original version of the text) to be out-of-date, muddled, or wrong. Where word choices were discussed, there was a general concentration on denotations rather than connotations, little awareness of ways in which word meaning might be contextually variable and determined, and no willingness to tolerate vague or semantically fuzzy uses of language. Notably, however, many of the precise definitions given of words (for example 'theoretical risk') contradicted each other.

4.3 Arguments addressed

A striking aspect of the interviews with GM scientists, in contrast to those with non-specialists, is the general dearth of reference to major arguments in the wider national and international debate. Decisions about the introduction of GM technology are perceived as almost entirely safety oriented, based on a rational choice model. In other words, if people have enough information, they can make a ‘rational choice’ for GM. There is an almost exclusive focus on a cost benefit analysis based on assessable safety issues relating to health and the environment. There is no reference to unforeseen risks, bounded rationality and the need to ‘satisfice’ (make one’s best judgement) in situations of imperfect knowledge, although this has recently featured prominently in expressions of doubt about GM technology. As far as other types of argument are concerned, there is some vague awareness of ethical objections to GM technology, but these are generally considered to be religious, and/or caricatured as beyond the reach of reasoned argument. Most striking of all is the virtual absence of reference to concerns about the political and economic implications of GM, how policy decisions are made about it, the nature and speed of its implementation, or accusations of improper influence being exerted by governments, corporations or scientific bodies - even though these arguments all feature prominently in the anti-GM

literature. There is also some considerable contradiction between the claims that opinions should be based upon impartial and rational assessment of evidence, and the scientists' own descriptions and assessments of the opponents of GM and their arguments. Particularly ironic is the highly emotive language often used to criticise the irrational nature of the opposition, and the highly selective use of examples to characterise its causes and motives - both apparently in defence of science.

5. ACTIVITIES

Papers based on the project have been or will be given at the British Association for Applied Linguistics 18th annual meeting; the Reading University Applied Linguistics Circle; the Reading University Plant Sciences Seminar Series; the British Sociological Association 2003 annual meeting; the Ecological Justice and Global Citizenship Conference in Copenhagen; and the International Institute of Sociology meeting in Beijing. The project will also form the basis for the keynote address given by Dr Robbins at the 5th Goodenough-Chevening Conference . During the course of the project we have developed numerous new cross-disciplinary contacts both within Reading University, Cranfield University and outside. Notably, we now have active links for future research with: the Lancaster University Institute for Environment, Philosophy and Public Policy; the UEA Institute of Food Research; and researchers in the 2002 ESRC Science in Society Programme. Within Reading University our project has helped to stimulate new cross-faculty links between Life Science, Social Sciences, and Arts and Humanities.

6. OUTPUTS

An article by all three researchers is in preparation for submission to *Discourse and Society*. (An earlier plan to submit an article to *Applied Linguistics* will not now be appropriate as Professor Cook is to be that journal's new editor.) An article by Cook and Pieri has been submitted for publication in *British Studies in Applied Linguistics*, and further papers by Pieri and Robbins will be submitted to the proceedings of conferences listed in Section 4 above. Professor Cook and Dr Robbins are independently preparing books under contract for major academic publishers: Professor Cook on the language of the GM debate; Dr Robbins on the social construction of genetic modification and its links with globalizing imperatives. These two books, while broader in scope than this project, will nevertheless draw substantially upon its findings.

7. IMPACTS

Considerable interest has already been expressed in this project by academics (in applied linguistics, sociology, science studies, and plant sciences) and by non-academics, including representatives of both the biotech industry and anti-GM NGOs, and members of the ABC and AEBC. We hope also to draw the attention of government and the press to our work.

8. FUTURE RESEARCH PRIORITIES

This project is a case study focusing upon one type of player in the GM debate, and upon particular type of communication. We are already now embarked upon a further research project (RES-000-22-0132) looking at the discourse of the wider government-initiated debate. The project described in this report will form a basis for this development. As implied here, we believe that a major priority for future research into this debate is to consider how to integrate and reconcile the wide variety of discoursal perspectives from which it is approached. Further detailed linguistic and sociological analysis of how language is used in these discussions can be a major contribution to understanding of disagreements, and to future policy decisions.

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Annex One: External Commentators

1 Campaigner, Friends of the Earth (anonymous)

2. Dr Andrew Cockburn, Director, Scientific Affairs, Monsanto

3. Dr Andy Greenland, Senior Research Scientist, Syngenta

4. Dr. Sue Mayer, Director, Genewatch UK

5. Dr. Doug Parr, Chief Scientific Advisor, GreenPeace

6 .Professor Phil Warner, Head of Institute of Bioscience and Technology, Cranfield University (not transcribed)

7. Dr Ian Weatherhead, Public Relations, Syngenta

8. Professor Robin Grove-White, Institute for Environment, Philosophy and Public Policy, University of Lancaster Chair of Greenpeace, member of the AEBC (Agriculture and Environment Biotechnology Commission) (not recorded)

9. Professor Brian Wynne, Institute for Environment, Philosophy and Public Policy, University of Lancaster (not recorded)

10. Dr. Phil Mcnaghten, Institute for Environment, Philosophy and Public Policy, University of Lancaster (not recorded)

ANNEX TWO: INTERVIEW SCHEDULE

FIRST PART OF INTERVIEW - Questions for scientists at University of Reading

First a brief introduction on our project, and then:

1. What in your opinion accounts for the public response to GM in Britain? [Probe the link with the idea of breakdown of trust, and the issue of risk.]

2. What do you see as the best strategy to convey information on GM research/ products?

3. What are the key themes/components that you wish to communicate about GM research? Do you have different strategies you use with different audiences?

4. How are communications with the public produced? In the form of adverts/ press releases? Who participates in their production?

5. Do you see room for improvements in the link between industry and research?

6. Are sustainable business growth and good/quality science linked? If so, how?

7. If you walk in a US supermarket the shelves are full of GM food. What is going to take for the same to happen in the UK? [Probe the future of the industry.]

(8. Drawing on something that they'll have said, paint a scenario for their personal everyday life where they have to explain/justify their work.)

SECOND PART OF INTERVIEW SCHEDULE – Text-related questions

In this section we are interested in your thoughts about the use of the following words and expressions in the text you have just read. Please comment on them in relation to:

a) their factual accuracy;
b) their connotations or ideas they evoke;
c) their appropriateness to what you perceive are the purposes of this text;
d) their likely effect on a reader open to arguments both for and against;

List of words and expressions for comment:

1) genetic modification/ GM/ genetic engineering (line 1[1])

2) basic biological knowledge (line 3) / basic scientific knowledge (line 13)/ fundamental studies (line 20)/ pure and applied science (line 13)

3) organism (line 4)

4) traditional breeding processes (line 6) / traditional breeding programmes (line 8)

5) improvement of crop plants (line 7)/ improved nutritional qualities (line 17)/ to improve the storage properties of fruit (line 18)

6) designer organisms (line 15)

7) toxic pollutants (line 16)

8) pharmaceutical drugs (line 16)

9) the workers engaged in the techniques themselves (line 24)

10) theoretical risks (line 25)

11) [a plant could] escape (line 27).. colonise (line 28).. kill (line 28)..

12) existing plants (line 28)

13) practical experience (line 29)

14) little basis in reality (line 30)

15) in accordance with the relevant legislation (line 31)

[1] Line numbers refer to the original press release text that was being shown to the interviewees.

ANNEX THREE:
EXTRACT FROM DRAFT PRESS RELEASE ON GM

THE UNIVERSITY OF READING
Press Release on Genetic Modification

Introduction

Genetic modification or 'GM', sometimes referred to by the earlier term of 'genetic engineering, is a key technique in modern biological research that underpins many of the recent advances in basic biological knowledge. In simple terms, it involves the isolation of one or a few genes from an organism, and their insertion into another organism in such a way that all the descendants of that organism inherit the genes. This offers the opportunity to study the function of those genes in other organisms, and also to speed up traditional breeding processes, in a highly targeted manner especially in the improvement of crop plants. Only specific genes are introduced into the new hybrid, unlike traditional breeding programmes, where the whole genetic make-up of the organism is involved. Organisms that have undergone genetic modification are commonly referred to as 'genetically modified organisms' or 'GMOs'.

Applications

The possible applications of the technique in the biological world are almost without limit, and there are a multitude of potential benefits in areas such as Medicine and in both pure and applied science. In Biology, for example, GM techniques help to provide basic scientific knowledge of the biological world. In Biotechnology (where use is made of biological organisms), GM techniques offer the prospect of 'designer organisms', for example, able to clean up toxic pollutants or able to produce chemical or pharmaceutical drugs more effectively. In the specialised area of food biotechnology, improved nutritional qualities can be introduced into foods, and over-ripening delayed to improve the storage properties of fruit. In Medicine, the use of GM techniques offers the prospect of greatly improved methods for controlling diseases such as diabetes, cancer or infections caused by bacteria of viruses. Fundamental studies on how organisms cause disease hold out the prospect of designing drugs to specifically prevent such diseases.

Risks

Because genetic modification is such a powerful technique, it is important that it is used safely, and in a way that represents no hazard either to the workers engaged in the techniques themselves, to the general human population, or to the environment around us. Theoretical risks include the possibility that a novel microorganism could be created that caused a new or unusual disease: alternatively, it has been suggested that a genetically modified plant could 'escape' and colonise the surrounding countryside, where it could kill or displace existing plants, or be uncontrollable by existing control methods. However, practical experience with GM technology has

shown that many of the theoretical risks have little basis in reality, when the work is conducted in accordance with the relevant legislation.

Annex Four: University of Reading Draft Press Release - Alternative Version

Introduction

1. By modifying the genes in plants, modern researchers have greatly advanced their knowledge of botany. 2. They first isolate some of the genes in one plant, and then insert them into another one. 3. By doing this, they ensure that the modified plant will transmit the new genes to its descendants. 4. The researchers can then study the effect of the genes. 5. They can breed new plants faster than before. 6. They no longer need to change the whole plant as breeders did in the past. 7. Instead, they can improve crops quickly by giving them specific characteristics.

Applications

8. There is virtually no limit to the uses people can make of these achievements. 9. Biologists and medical researchers can do their work better. 10. Their understanding of their subject increases. 11. They are able to use improved plants to clean up poisons, produce useful chemicals, and make medicines. 12. Practitioners also benefit. 13. People in the food industry can make their products more nutritious. 14. They can store fruit longer because the researchers have developed techniques to stop it ripening too quickly. 15. Doctors are able to improve their treatment of patients with infections, and with diseases such as diabetes and cancer. 16. In future, the researchers who modify the genes in plants may be able to design new drugs to prevent patients from ever developing such diseases.

Risks

17. Researchers involved in this work have a great deal of power. 18. They must be careful not to harm themselves, the public, or the environment. 19. Some people have said that they might create a new plant which spreads a new or unusual disease, or that they might let one of their 'improved plants' spread uncontrollably, causing other plants to die or retreat. 20 In the light of their experience, however, the researchers believe that this is very unlikely indeed - and more related to fiction than fact. 21. In addition, the government has limited what they can do by introducing new laws.

Annex Five: Atlas.it Codes

LIST OF THE CODES USED - ABBREVIATED	IN FULL
acad in other disc	academics in other disciplines
activists	
all people	
anecdotes: non-e. ignorance	anecdotes: ignorance of non-experts
butterfly	Monarch Butterfly
campaigners	
confidentiality	
consumers	
contingent rep	contingent repertoire
cost ¦ price	
decision-m-pr ¦ commer driven	decision-making process: commercially driven
decision-m-pr ¦ demo-participation	decision-making process: democracy & participation
decision-m-pr ¦ US-EU trade	decision-making process: US-EU trade
deficit m	deficit model
emo wds	emotional words
emo wds ¦ designer O	emotional words: designer organism
emo wds ¦ esc/colon/kill	emotional words: escape/ colonise/ kill
emo wds ¦ impr	emotional words: improve
emo wds ¦ trad	emotional words: traditional
emo/ratio	emotional/ rational
enviro	environment
enviro ¦ herbic/pest	environment: herbicides/ pesticides
ethical	
ethical ¦ holistic	
Europe	
Europe ¦ UK	
farmers	
feeding the poor? ¦ y-inc	feeding the poor? : yield increase
food qlty	food quality
health	
health ¦ functional f	health: functional foods
industry	
knlg-respo	knowledge – response
label	labelling
lang	language
lesser of 2 e.	lesser of the two evil argument
media	
media language	
metaf/analog	metaphor / analogy

metaf/analog ¦ other, by scient	metaphor / analogy not in the text
no benefits	
no polaris.	no polarisation
organic	
other countries	
own lang	own language
politicians / gov	politicians / government
press rel ¦ accuracy	press release: accuracy
press rel ¦ lang	press release: language
press rel ¦ vs 2nd version	press release: a comparison of the two versions
public	
retail/superm	retailers / supermarkets
rheto strat	rhetorical strategies
risk	
risk ¦ accept	risk: acceptance
risk ¦ assessment	
risk ¦ no risk	
risk ¦ quantif	risk: quantifiable
risk ¦ theor	risk: theoretical
role of scie	role of science
scientific lang	scientific language
scientists	
self-image	
students	
tech wds	technical words
tech wds ¦ g eng/ma/mod	technical words: genetic engineering / manipulation / modification
tech wds ¦ hybrid	
tech wds ¦ org	technical words: organism
tips on commu	tips on communication
trad breeding	traditional breeding
trust	
uncertainty	
universities	
US	

Annex Six: Codes of Ethics

1. The British Association for Applied Linguistics: Recommendations on Good Practice in Applied Linguistics. http://www.baal.org.uk/goodprac.htm

2. The British Sociological Association: Statement of Ethical Practice, http://www.britsoc.co.uk/index.php?link_id=14&area=item1

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