Cultivating Science: The Farm-Laboratory in Practice

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BA (Hons.), University of Cambridge, 2000

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DEPARTMENT OF GEOGRAPHY

We accept this thesis as conforming to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA
AUGUST 2002

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Department of GEOGRAPHY

The University of British Columbia
Vancouver, Canada

Date 27th August, 2002
Abstract

This study examines spaces of the English farm in practice, as presented by organic farmers and veterinary surgeons in Dorset and other prominent agricultural spokespersons in England. These interviewees reveal different farming experiences and practices of science, which constitute different configurations of farm space and different networks of farming activity. British agriculture has been changing as targets for food production volumes have been reduced and replaced by regulations that demand, in particular, a more environmentally astute and sustainable set of farming practices. Organic farming is emblematic of these new initiatives. British agriculture has also been disrupted by disease over the last 15 years, most recently foot and mouth disease, which has influenced farming practices. I have studied 18 organic farms in Dorset in the southwest of England between 1999 and 2001 in order to view endogenous changes as they relate to the contexts outside of the farm premises. By arranging interviews on the farm premises, I have also been able to witness and systematically analyse sciences of food production in action.

The analogy of a working ‘laboratory’ is used to illuminate this science as it is practiced and delivered. In particular, this idea draws on the work of Bruno Latour in science studies. He has showed that the laboratory as a place of science is so important because of the way scale is reversed, and so the distinction of what lies outside and inside the laboratory is blurred by the movements of elements constantly between. I set these ideas in conversation with Michel Foucault’s ideas of the ‘normalisation’ of the individual through processes of surveillance and the workings of ‘disciplinary power’. Foucault’s ideas help us understand the way the farmer is often made to work in a particular manner. I show that sciences cannot be viewed in isolation from each other and their context, but that they are interlinked and controlled from different places. By combining this critical theoretical conversation with an appreciation of how agriculture is restructuring, I reveal the space of ‘the farm’ in practice as a product of the interaction of different sciences. I also reveal the merits of engaging with Latour and Foucault in tandem.
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<tr>
<td>AAPS</td>
<td>Arable Area Payments Scheme</td>
<td></td>
</tr>
<tr>
<td>ADAS</td>
<td>Agricultural Development and Advisory Service</td>
<td></td>
</tr>
<tr>
<td>APS</td>
<td>Assured Food Standards</td>
<td></td>
</tr>
<tr>
<td>BFS</td>
<td>British Farm Standard</td>
<td></td>
</tr>
<tr>
<td>BSE</td>
<td>Bovine Spongiform Encephalopathy</td>
<td></td>
</tr>
<tr>
<td>BSPS</td>
<td>Beef Special Premium Scheme</td>
<td></td>
</tr>
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<td>BTO</td>
<td>British Ornithological Society</td>
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<td>BVD</td>
<td>Bovine Virus Diarrhoea</td>
<td></td>
</tr>
<tr>
<td>CAP</td>
<td>Common Agricultural Policy</td>
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<td>CJD</td>
<td>Creutzfeldt-Jakob disease</td>
<td></td>
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<tr>
<td>DEFRA</td>
<td>Department for Environment, Food and Rural Affairs</td>
<td></td>
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<tr>
<td>E. coli</td>
<td>Escherichia coli</td>
<td></td>
</tr>
<tr>
<td>EEC</td>
<td>European Economic Community</td>
<td></td>
</tr>
<tr>
<td>EPS</td>
<td>Extensification Payment Scheme</td>
<td></td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
<td></td>
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<tr>
<td>FABBL</td>
<td>Farm Assured British Beef and Lamb</td>
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<td>FMD</td>
<td>Foot and Mouth Disease</td>
<td></td>
</tr>
<tr>
<td>GMO</td>
<td>Genetically Modified Organisms</td>
<td></td>
</tr>
<tr>
<td>IACS</td>
<td>Integrated Administration and Control System</td>
<td></td>
</tr>
<tr>
<td>IFOAM</td>
<td>International Federation of Organic Agriculture Movements</td>
<td></td>
</tr>
<tr>
<td>MAFF</td>
<td>Ministry of Agriculture, Fisheries and Food (changed to DEFRA 1999)</td>
<td></td>
</tr>
<tr>
<td>NFU</td>
<td>National Farmers Union</td>
<td></td>
</tr>
<tr>
<td>OAS</td>
<td>Organic Aid Scheme</td>
<td></td>
</tr>
<tr>
<td>OF&amp;G</td>
<td>Organic Farmers and Growers</td>
<td></td>
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<tr>
<td>OLMC</td>
<td>Organic Livestock Marketing Co-operative</td>
<td></td>
</tr>
<tr>
<td>RDR</td>
<td>Rural Development Regulation</td>
<td></td>
</tr>
<tr>
<td>SA</td>
<td>Soil Association</td>
<td></td>
</tr>
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<td>SCPS</td>
<td>Suckler Cow Premium Scheme</td>
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<td>SEAC</td>
<td>Spongiform Encephalopathy Advisory Committee</td>
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<tr>
<td>TSE</td>
<td>Transmissible Spongiform Encephalopathy</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
<td></td>
</tr>
<tr>
<td>UKROFS</td>
<td>United Kingdom Register of Organic Farming Standards</td>
<td></td>
</tr>
<tr>
<td>WTO</td>
<td>World Trade Organisation</td>
<td></td>
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Acknowledgements

Firstly, I would like to express my sincerest gratitude to Derek Gregory for the supervision that he has given me over the past two years. In addition, I would like to thank Trevor Barnes for all of his helpful direction over the same period.

Secondly, I am very grateful to all of the participants in this study whose names must remain anonymous. I really enjoyed visiting their farms and conducting the interviews. Their hospitality was always exceptional. I also must thank The Kingcombe Centre in Dorchester where I was able to stay during interviewing periods.

Finally, I would like to thank my family and friends – on both sides of the Atlantic – for all their moral support and enthusiasm. Vince deserves a special mention for his technical support at the last moment.
CHAPTER ONE

Introduction:
Sowing the Seeds and Priming the Pump

Map of Chapter

This chapter first introduces the empirical context of English farming and explains how this relates to the way this investigation has been undertaken. I have only been able to view farms and converse with interviewees at one moment along a long and complex history of agricultural changes. I focus discussions next on the work of Bruno Latour to show how he has been canonical in the rise of science studies debates, and more specifically to show how his ideas are so useful for engaging with the context of English farming. I then propose to identify similarly those parts of Michel Foucault’s extensive works that can illuminate the way farming is practiced in space. Finally, this chapter will illustrate how I plan to bring Latour and Foucault into conversation ‘on the farm’ by learning from the similarities and contradictions in each.

1.1 Framing Farming: A Snapshot of a Space in Motion

I engage with ‘the farm’ as a laboratory. This is a space of conversations of science and of scientists at work. Since the farmers I spoke to in this study identified farming as ‘science’, they were (as many agreed) effectively labelling themselves as ‘scientists’. The laboratory is the place where scientists work. What becomes so interesting in the case of English agriculture is that who constitutes a ‘scientist’, and how those scientists then ‘work’, are at different stages of construction. At no time during my investigations am I a fly on the wall of the laboratory, an inside/outside observer. I overtly bring my own conception of a working farm and a working farmer to each comparative judgement that I make. My mindset and body have been moulded through 23 years of growing up on a family farming practice in Warwickshire, England, and I undoubtedly look through a particular lens at each other farm I experience. I make assumptions, have expectations, and take various practices for granted, and recognising this intervention does not erase it. And yet, it is this same experience that enables me to ‘get close’ and interact with the
community that I study. Both interviewer and interviewee could comfortably and mostly informally hold a conversation about farming.

Dorset county in the southwest of England offered an appropriate location for analysis: an abundance of organic livestock practices (up to 2000 acres in area); legacies of some of the founders of the organic movement; and its detachment from my experience and contacts. Indeed, 18.5 per cent of Dorset farmers are involved in an organic farming scheme, which is well above the national average of 2.5 per cent (West Dorset Food and Land Trust, 1999). I visited a total of eighteen farms in West Dorset, fifteen of which were family businesses, and interviewed between one and three family-farming members at each field-site (Table 1). In most instances, interviewing took place both in August 2000 and November 2001; I could witness the way the farm and its practice of science had developed over that period. Each farm was analysed as a consortium of interdependent and complementary productive sectors, including livestock, arable and horticulture. In addition, I interviewed four veterinarians in Dorset, three members of the Soil Association at Bristol, and five people categorised as prominent agricultural spokespersons with respect to their specialist advisory capacity or extensive industrial experience (Table 2).

Undertaking the interview in the most comfortable and convenient manner for the farmers presented logistical challenges as most farmers preferred to continue with the pending management tasks. In 1999, most farmer interviews were conducted on foot on a one-on-one basis during the morning checking of livestock. In 2001, the farm interviews were more farmhouse based. I have not used personal names or farm names or subject photographs or provided farm location maps in order to preserve the anonymity of the respondents (as they requested). Interviewees are represented by fictitious names. However, in an attempt to maintain coherence, I have allied farm and farmer names alphabetically (for example, Andrew at Applesham Farm), and I have grouped the other interviewees alphabetically according to their contribution to this inquiry.
Table 1: Details of interviewee farmers and farms

<table>
<thead>
<tr>
<th>Fictitious Names</th>
<th>Fictitious Farms</th>
<th>‘Farmer’ age(s)</th>
<th>Farm specialisms</th>
<th>Certifying organisation</th>
<th>‘Organic’ area (acres)</th>
<th>Years since conversion initiated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrew</td>
<td>Applesham Farm</td>
<td>38</td>
<td>M, B, V, L, Ce</td>
<td>SA</td>
<td>2000</td>
<td>14</td>
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<tr>
<td>Brian &amp; Brenda</td>
<td>Broadleaves Farm</td>
<td>42 &amp; 39</td>
<td>P, B, L</td>
<td>Demeter</td>
<td>62</td>
<td>5.5</td>
</tr>
<tr>
<td>Charles</td>
<td>Chase Farm</td>
<td>53</td>
<td>M, L, Ce</td>
<td>SA</td>
<td>250</td>
<td>16</td>
</tr>
<tr>
<td>Dennis</td>
<td>Dinglewell Farm</td>
<td>42</td>
<td>M, B</td>
<td>OF&amp;G</td>
<td>250</td>
<td>2.5</td>
</tr>
<tr>
<td>Eric</td>
<td>Eves Farm</td>
<td>55</td>
<td>B, L</td>
<td>SA</td>
<td>98</td>
<td>12</td>
</tr>
<tr>
<td>Fred</td>
<td>Fairbanks Farm</td>
<td>38</td>
<td>M, L, Ce</td>
<td>SA</td>
<td>190</td>
<td>3</td>
</tr>
<tr>
<td>Geoffrey</td>
<td>Grandview Farm</td>
<td>55</td>
<td>B, L</td>
<td>SA</td>
<td>420</td>
<td>18</td>
</tr>
<tr>
<td>Harry &amp; Helen</td>
<td>Hillside Farm</td>
<td>40 &amp; 42</td>
<td>B</td>
<td>OF&amp;G</td>
<td>120</td>
<td>2.5</td>
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<tr>
<td>Irene</td>
<td>Ivyfield Farm</td>
<td>39</td>
<td>Vg, B</td>
<td>SA</td>
<td>54</td>
<td>14</td>
</tr>
<tr>
<td>Jack &amp; Jill</td>
<td>Jersey Farm</td>
<td>45 &amp; 43</td>
<td>L, B, Ce</td>
<td>SA</td>
<td>80</td>
<td>12</td>
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<td>Ken</td>
<td>Kestrel Farm</td>
<td>62</td>
<td>L</td>
<td>SA</td>
<td>21</td>
<td>2</td>
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<tr>
<td>Louise</td>
<td>Longbottom Farm</td>
<td>41</td>
<td>L, B</td>
<td>SA</td>
<td>98</td>
<td>2</td>
</tr>
<tr>
<td>Mike</td>
<td>Merrydown Farm</td>
<td>31</td>
<td>P, B, V, C, Ce</td>
<td>SA</td>
<td>182</td>
<td>11</td>
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<tr>
<td>Norman &amp; Natalie</td>
<td>Narrowlane Farm</td>
<td>62 &amp; 61</td>
<td>B, L</td>
<td>SA</td>
<td>100</td>
<td>12</td>
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<tr>
<td>Oliver, Olivia, &amp; Olav</td>
<td>Oaker’s Farm</td>
<td>56, 54 &amp; 20</td>
<td>M, L, Ce</td>
<td>SA</td>
<td>170</td>
<td>3.5</td>
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<td>Pat</td>
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<td>B, L</td>
<td>SA</td>
<td>66</td>
<td>3.5</td>
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<td>Queenie</td>
<td>Quaker’s Farm</td>
<td>41</td>
<td>Vg, B, L, Ce</td>
<td>SA</td>
<td>245</td>
<td>42</td>
</tr>
<tr>
<td>Richard</td>
<td>Raddington Farm</td>
<td>43</td>
<td>M, B, L, P, Vg, Ce</td>
<td>SA</td>
<td>1080</td>
<td>16</td>
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</table>

Key: M = Milk; B = Beef; V = Veal; L = Lamb; P = Pork; C = Chicken; Vg = Vegetables; Ce = Cereals. SA = Soil Association; OF&G = Organic Farmers and Growers.

Table 2: Names of interviewees who were not farmers

<table>
<thead>
<tr>
<th>Interviewee Description</th>
<th>Fictitious Interviewee Names</th>
</tr>
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<tbody>
<tr>
<td>Veterinary surgeon</td>
<td>Stanley, Sam, Sarah, Simon</td>
</tr>
<tr>
<td>Soil Association employee</td>
<td>Trisha, Tim, Teresa</td>
</tr>
<tr>
<td>Other spokesperson</td>
<td>William, Wallace, Wilfred, Wesley, Walter</td>
</tr>
</tbody>
</table>

Analysing the farm space entails a great deal more than merely interrogating the farmer, as table 2 suggests. This cross-section of agents comprises the core of my research material, supplemented by articles and images of the farm as an institution of policy interest and science. During interviews, a flexible but sequential list of topics was discussed, and yet opportunity for self-expression of ideas was endorsed. My questions were designed to elicit responses and attitudes to practicing agriculture as shaped both by humans (governmental and independent advisory/consulting agencies and informal networks of communication) and non-humans (manifested in the proliferation of food scares and subsequent de-industrialization of farming). But both the 60 to 100 minutes of
recorded ethnographic interview and up to 10 hours of immersion at the field-site of each interviewee introduces a host of other agents and their accompanying storylines. Certainly interviewee experiences, practices and associations in negotiating the internal, external, and intermediary spaces of the farm were delivered to me, the audience, as a performance. As a tour guide, the farmer chose the route we should take across the fields and through the buildings. Our conversation exposed the farmers' own beliefs, but it was also modified to what I was hoping to hear. It is my project to untangle these various associations embroiled and manifest in the space English farm, to trace the movements of human and non-human agents as recounted by multi-sited ethnographies, and to make certain connections, spaces and cultures of science more visible.

I must clarify and establish the boundaries – and hence present inevitable limitations of – this study. The understanding of 'the farm' space that this investigation aims to provide is limited to the characteristics of the specific farms that I studied in Dorset, England, and so must be considered an idealised space. Similarly, 'the farm' that I treat in this study is captured at but one moment on its temporal axis. I slice through histories of farmers (interrupted or uninterrupted generations), of farms (separation and amalgamation in part or whole), and of farming (in terms of paradigmatic approaches). An appreciation of historical perspective is critical. Farms as they appear today are a complex product of previous eras of different food demands and farming expectations. Although the fundamental task of farming is to produce food, the form, volume, and quality of that food has varied appreciably over time.

Figures 1 and 2, suggest something of these changes that have taken place in the recent past. These simple yet striking images are emblematic of a period in British agriculture known as the ‘productivist’ era: the “intensive development of agriculture ... as part of a shift towards a mass consumption economy and greater dependency on domestic food supply, for strategic reasons linked to the UK’s declining military and economic strength” (Marsden et al., 1993: 44).

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1 The term 'performance' best describes the way the farmer conducts himself and his actions towards an intended audience, whether that audience is the interviewer (myself) or another visitor to the farm.
MAXICROP-
Foliar feeds for all crops

"You mean to say you don't use Maxicrop?"

Write for information to:

FREEPPOST, HOLDENBY,
NORTHAMPTON NN6 8BR
Tel.: East Haddon 227 (STD 060 125)

(Don't use a stamp—we'll pay the postage)

(Source: British Farmer and Stockbreeder, 1974: 61)
Plan now for top quality silage for next winter. This way you'll reduce your reliance on high-cost feed. And for certain results, use Sylade—the silage maker that makes sure.

- Sylade improves the feeding value of silage particularly protein.
- Sylade increases silage intake.
- Sylade reduces secondary fermentation.
- Sylade silage is sweet smelling, pleasant to handle and produces less effluent.
- Sylade is economical—normally just ½ gallon per ton of grass ensures success.
- Sylade is available in 5 or 45 gallon containers. There is a Sylade application system for you.

Cash in on grass with Sylade

- Standard recommendation ½ gallon per ton of grass.

(Source: British Farmer and Stockbreeder, 1974: 2)
The heyday of this high-input agro-chemical agriculture was the late 1970s. This continuous modernization and industrialization of farming with a unidirectional emphasis on raising farm output dominated national agricultural policy-making. This is a ‘remote’ farming because the goal of food production was *national* and each farm was treated as a component in this national project with little appreciation of its specific location and character. Guaranteed payments for produce by government and booming chemical industries were “encouraging super production by any means possible” (Elworthy and McCulloch, 1996: 739). Farmers were regimented into line with this narrative, this agro-chemical ‘convention’. As one of my informants recalled:

When I look back it was quite interesting to see how most of my agriculture textbooks had 'ICI' written in the corner or some other large company which really influenced us very strongly.... That's brainwashing. I was always uneasy with a lot of the practices that were regarded as standard in conventional farming. I applied a lot of chemicals myself and felt very uneasy with it - there were unknown effects and the long-term consequences were not understood.... A lot of it is this sort of quest for progress.... Agri-business is colossal and makes more and more money. Agriculture, farming, makes less and less and somehow the equation does not look right and it certainly does not look very healthy. There are all the unknowns sourced from outside of the farm. And at the same time a lot of things go back out from the farm - not just in terms of food but in terms of the pollution and everything else. The externalities and the real cost of so-called conventional farming remains fully hidden. [Richard, Raddington Farm]²

To be a conventional farmer you just need to understand what you're told — you can use this chemical for that and you know it'll work. [Norman, Narrowlane Farm]

Since the 1980s, however, a new convention, a new standard of practice, has been emerging. This is largely a response to the detrimental impacts of what became an over-productive productivist system, as revealed by butter mountains and milk lakes in the 1980s (Plumb, 2001). These initiatives have been labelled as ‘agri-environmental’, in contrast to ‘agro-chemical’, and are bound up with the progressive withdrawal of state food production subsidies, an increasingly competitive global market for food production, and the growing environmental regulation of agriculture (Ilbery *et al*., 1997; Lowe *et al*., 1993; Shucksmith, 1993; Wilson, 2001). As much precedence is awarded to countryside as to commodity food production, and this is how food quality issues — issues of authenticity, ethics, aesthetics, and nutritional content — become paramount and also

² Quotations will be used to be illustrative rather than exhaustive. Quotations are taken from interview transcripts from 2001, unless otherwise marked as 1999.
increasingly localised (and so less 'remote'). The fate of English agriculture is also embroiled in wider British and European debates.

The closing years of the twentieth century were among the most difficult for agriculture in Europe, particularly in the United Kingdom. For not only had the sector to deal with the myriad structural challenges in a period of profound changes, there was also the totally unforeseen catastrophe of BSE ('mad cow disease'), followed by swine fever and the disastrous outbreak of foot-and-mouth disease – and, a drama at perhaps a lower level but nevertheless a grave problem for the industry, there was the deteriorating relationship with the public over such issues as genetically modified (GM) products. (Plumb, 2001: 237)

The transition has been led: firstly, by farmers, as they have become disillusioned by the (monocultural) landscapes and economics of intensive chemical farming; secondly, by consumers, who have been made increasingly aware of the risks associated with large-scale industrial farming and its use of synthetic drugs and reconstituted feedstuffs; and finally by the national government, whose rural aid and funding for sustainable agriculture frames itself around this ‘agri-environmental’ discourse. The rhetoric of ‘modulation’ accounts for the funding:

Pillar I is the stream of funding within the CAP that subsidises production. Pillar II supports rural development and environmental protection. Modulation moves funding from Pillar I to Pillar II. (Curry, 2002: 22)

This funding can be vital. All this change is occurring at a time when the fortunes of British farming continue to plummet:

The latest figures show the average UK farmer earned just £10,000 for the financial year to February 2002, way below the minimum wage. Current indications suggest that this will fall further in the coming year.

Livestock sectors are contracting at an alarming rate with over half a million breeding cows, over 4 million breeding ewes and almost 200,000 breeding pigs lost since December 1998.

Foot and mouth has cost farmers over £900 million after compensation, while losses to crops and farm buildings from flooding in recent years have been estimated at half a billion pounds.3

Closely allied to the agri-environmental movement, and even exemplary of it as a guiding policy framework, is organic farming (Figure 3).

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Figure 3: Advertisement for organic farming by the Soil Association

“Standards are at the heart of sustainable agriculture, transforming the Soil Association’s philosophy and principles into practical action”

(Source: Soil Association, 2001: 15)

Figure 3 illustrates that the advertising for this type of farming is based on an image of environmental sustainability and living animals, and not on the intensive application of
chemicals apparent in Figures 1 and 2. Organic farms form the focus of the study for this reason. The number of organic farms in Britain has risen from 848 in 1996 to 3,563 in August 2001.\footnote{http://www.bbc.co.uk - Richard Bilton, \textit{Seeking an Organic Future}, August 31 2001.} All farms in this study can be described by the generic term ‘organic’ because they all subscribe to one of three organic licensing bodies (Table I).

Proponents of organic farming define it “as an approach to agriculture where the aim is to create integrated, humane, environmentally and economically sustainable agricultural production systems” (Lampkin and Measures, 1999: 3). Pat, another informant, therefore contrasted organic and (agro-chemical) conventional beef production systems:

\begin{quote}
An organic animal for beef doesn’t come out of a dairy cow, suck its mother for a day, be put onto a bucket for three days, go to a market, be sold, go onto another farm and be reared on buckets and concentrates. And then be weaned off milk at six weeks and then concentrates and concentrates. And wormed and brought in to be treated for routine worming. The whole life of conventional beef done like that – I think if you compare that to a calf that’s born and sucks its mother from birth until it’s nine months of age and then caries on eating grass. The two lives are I feel are so different and if you were able to ask them which they prefer.... [Pat, Partridge Farm]
\end{quote}

But the distinction between regimes is not always clear. Agri-environmentalism is a partial and ongoing ideological and policy shift that builds on the previous approaches. Therefore each organic study farm possesses the relics of the agro-chemical era and the buds of new management routines. At Narrowlane Farm, for example, the space of farming practice has been transformed. Over 12 years, an organic farming practice has been superimposed over a 100-acre plot of agro-chemical legacies. Although this looks like the creation of a new farm space, the space is in fact the product of interaction between a number of different spatial practices and devices, of varying horizons of experience.

Inevitably, any attempt at framing the farm is artificial and its borders are likely to be both porous and impermanent. I aim to focus discussions on the debating of sciences – the conversations and processes of decision-making – that are taking place, and constructing space, on the farm. The distribution of agency is complex and not easy to unravel in a linear narrative. Gieryn (1999: 337) remarks on this competitive environment of science: “science wars are credibility contests in which rival parties
manipulate the boundaries of science in order to legitimate their beliefs about reality and
secure for their knowledge making a provisional epistemic authority that carries with it
influence, prestige, and material resources.” The way sciences interrelate results in a
multitude of actions and inactions, a multitude of inclusions and exclusions. The debate
that unfolds in the following passage exemplifies science in action from the heart of the
laboratory: sitting around the table in the farmhouse kitchen of a mixed practice in West
Dorset run by a middle-aged couple, Oliver and Olivia, and their 20 year-old son, Olaf.

[JS]: *Do you use homoeopathy when treating sick animals on the farm?*

[Oliver]: We use the homoeopathy...

[Olaf]: ...it’s a load of rubbish – it doesn’t do anything.

[Olivia]: Yes it does – some of it. [clearly a difference of scientific opinion]

[Olaf]: *(turns to his mother)* Nothing you do on the sheep ever works. You killed all
my lambs last year when they had watery mouth and you gave them some bloody crap
that never worked. And the calves with the scours – you gave them all that crap and
they died.

[Olivia]: And why did they have the scours? ‘Cos it was the feed that was doing it. It’s
doing it now to them.

[Oliver]: Is it? [the head manager at Oaker’s Farm is notified of a new problem]

[Olivia]: Yes, because it’s too strong.

[Oliver]: I didn’t know that...

[Olivia]: Yes – they should be having the proper stuff... *(turns to look at her son with
a stern glance)*

[Oliver]: How much do you feed? *(...goes unanswered...)*

[Olivia]: *(she turns to face me)* We do that aloe vera for the mastitis for the cows. *(she
points to a potted-plant on the table and her son picks off a leafy stem)*

[Oliver]: It doesn’t always work... [the debate of science resumes]

[Olivia]: ...not always, but then homoeopathy doesn’t always work.

[Olaf]: It doesn’t ever work...

[Olivia]: *(pretends to ignore her son’s comment)* ... So we use that and if that doesn’t
work then they have to have antibiotics. But he can tell whether it will work or
whether you’ve got to do it with antibiotics. *(looks at her husband)* In the end you can
tell.

[Olaf]: *(son holds the leafy stem skywards)* Last year we cured a hell of a lot with this –
marvellous. This year it only helped one. We’ve had quite a few cases.

[Oliver]: Yes, we’ve had the same cow. You know one or two re-occurring, that’s all.

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5 This is a type of preventative medicine comprising nosodes and remedies administered to sick animals. I
expand on this complementary medicine in section 3.2.2.
[Olivia]: Well, if you get a cow like that, after three times you can't sell that milk on as organic. [the rule book is quoted in defence of her statement]

[Oliver]: Well we aren't. We've been feeding it to the calves since June.

This exchange sharpens a vital point: that the events that unfurl in any farm are a result of a combination of contingencies, possibilities and moments in different axis of space-time where different networks are potentially mobilised. This is how 'the farm' space, amongst its transitions within the agri-environmental movement, will be investigated. I shall now illustrate that this substantive account has been framed by two sets of ideas: those of Bruno Latour and Michel Foucault.

1.2 Engaging with Bruno Latour

Bruno Latour describes the laboratory as “the place where scientists work” (Latour, 1987: 64; author’s emphasis) and as a space for experimentation. His canonical works in science studies have stimulated wide-ranging debate: in Laboratory Life (Latour and Woolgar, 1979) he witnesses a laboratory in practice; in The Pasteurization of France (1988) and Give me a Laboratory and I will Raise the World (1983) he traces the work of Pasteur and microbes in France; and in Science in Action (1987), We Have Never Been Modern (1993a) and Pandora’s Hope (1999), he addresses debates on nature-culture relations and in this way has been a key protagonist in projecting what is known as actor-network theory (ANT). Unfortunately it is beyond the scope of this thesis to introduce all of Latour’s ideas. Instead, I want to focus on the ideas and concepts he introduces to the study of the laboratory through his discussions of Louis Pasteur and of soil science in the Amazon.

Latour’s account of Pasteur’s science is of particular importance because of the systematic way he considers this in terms of laboratories and because it also deals with a farm context. In June 1881, ‘Louis Pasteur’ waged war on the anthrax bacillus in sheep and cattle and ‘defeated’ this microbe on the historic battlefield of the French village of
Pouilly-le-Fort. Latour's approach is to follow the "network of associations that slowly make up this Pasteurian world" (Latour, 1988: 12), and he insists that we cannot say whether these associations "are human or natural, made up of microbes or surplus value, but only that they are strong or weak" (ibid: 43). Tracing this science of associations leads Latour through 'obligatory points of passage' in which the microbe links all the points together in a connected fashion (ibid: 46). "The whole chain has now been described: at one end, France; at the other, those who in their laboratories make the microbes visible; in the middle, the hygienists who translate the data from the laboratories into the precepts of hygiene; a little further on, the public authorities who legislate on the basis of advice given by this new profession, scientific hygienism, which must now be taken into account" (ibid: 56).

In Latour's rendering of the Pasteurian research program, the microbe that was 'invisible' in the context of the farm was taken into a laboratory where it could be made visible through cultures. By taking animals into his laboratory, the course of the illness, the possibility of inoculation, and variations in virulence could be simulated. These movements of disease inside and outside of the farm space are 'translations' and each entails the recruitment of allies and the exclusion of agents that do not help in making his science visible. "Moving from the farm to the laboratory, we do not move from the social to the scientific or from the material to the intellectual. The difference comes from the fact that the world of the pipette, the culture medium, and the guinea pig is a world-to-grow-the-microbe, just as that of the farm is a world-to-rear-cows. Indeed, the laboratory itself is constructed only out of the movement and displacement of other places and skills" (ibid: 81).

The way scale can be reversed – between the inside and the outside, between the micro-scale of a sample of anthrax and the macro-scale of French agriculture – is the most important characteristic of the laboratory. "Pasteur and his assistants ... learn from the field, translating each item of veterinary science into their own terms so that working on

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6 Latour portrays Pasteur's position satirically – the idea of a 'great man' alone in his laboratory, revolutionizing society around him with the power of his mind alone. Pasteur did not 'move a mountain' all by himself, which is why his name appears in quotation marks.
their terms is also working on the field” (Latour, 1983: 145). The *impression* of a ‘miracle’ at Pouilly-le-Fort, where inoculated sheep lived but unvaccinated members of the flock died, “is provided by the great break between the ‘laboratory’, in which scientific facts were made, and the ‘outside’, where these facts were verified” (Latour, 1988: 88). Bringing components into a laboratory constitutes a new configuration of power because it strengthens the position of those inside *but only in relation to those outside*. “The change of scale makes possible a reversal of the actors’ strengths; ‘outside’ animals, farmers and veterinarians were *weaker* than the invisible anthrax bacillus; inside Pasteur’s lab, man becomes stronger than the bacillus, and as a corollary, the scientist in his lab gets the edge over the local, devoted, experienced veterinarian. ... Pasteur succeeds because he works on a small scale.” (Latour, 1983: 147-9).

The laboratory first moved to a farm in order to capture the bacillus (first stage). Then in the central laboratory the bacilli cultures were moved, purified, and inoculated on an entire experimental farmyard; there, too, the bacterium was weakened and animals’ bodies were strengthened by vaccination (second stage). Lastly, after the transformation of a farm in such a way that it partly obeyed the conditions of a laboratory experiment and maintained the reversal of the balance of power, the experiments carried out in the central laboratory were repeated (third stage). The whole of the Pasteurian arc is indeed dazzling, but the experiment of Pouilly-le-Fort in the context of the arc is not miraculous. ... Just as some elements of the field were taken to the laboratory, so certain elements of the laboratory were taken to the field. (Latour, 1988: 89)

Many of the collections of agents (‘machines’) brought into action when experimenting in the laboratory are ‘black boxes’. This is because the linkages that compose them have become attenuated to such an extent that they are unrecognisable on the face of the machine: “two things are needed in order to build a black box: first it is necessary to *enrol* others so that they believe it, buy it and disseminate it across time and space; second, it is necessary to *control* them so that what they borrow and spread remains more or less the same” (Latour, 1987: 121). In black boxes, the associations are so durable that on the face of it they are not questioned. That is what has become of Pasteur’s science: only some of the agents in the Pasteurian collective are recognised. Whenever an anthrax vaccination is used, its context and content is often forgotten. There is a focus only on outputs and inputs and not on internal complexity, the science of its making. This idea of black boxes is so important because it explains why things that are brought into a
laboratory space are not self-contained but in fact rely on a multitude of other associations that may not be obvious or visible.

We can bring these processes into sharper focus by following Latour in a subsequent foray, this time into the Amazon rain forest (Latour, 1999: 24-79). He follows the details of ‘scientific practice’ enacted in the sampling of soil. In this task, Latour is himself part of the scene. He is a ‘French anthropologist’ familiar with laboratories but now observing a field expedition, accompanying a botanist, a pedologist and a geographer. His account of the ‘circulating reference’ characteristic of the ‘jungle of scientific practice’ includes a collection of photographs to translate the scene along with the text. The ‘scientists’ whom he accompanies are intent on assessing the advance or retreat of the Boa Vista forest. The ‘science’ of the Boa Vista is in the process of compartmentalisation and classification. Latour accompanied a photograph of a tree labelled with the number 234 with the comment:

I thought I was deep in the forest, but the implication of this sign, ‘234’, is that we are in a laboratory, albeit a minimalist one, traced by the grid of coordinates. The forest, divided into squares, has already lent itself to the collection of information on paper that likewise takes a quadrilateral form. ... One science always hides another. (Latour, 1999: 32)

The three scientists are different specialists and so enrol different agents to support their claims to knowledge. A translation is enacted as soon as these scientists move from the microcosm of the ‘field’ and to the ‘camp’. The balance of power in relation to the forest is switched. They are no longer standing at the forest boundary in the midday sun. Now they can leisurely point with their fingers to phenomena on a map of that space. Latour refers to these documented records as ‘immutable mobiles’. The scientists have passed from ignorance to certainty, from weakness to strength, from inferiority in the face of the world to the domination of the world by the human eye. This assurance in their knowledge claims is surprising if one considers that they are quite distant from the forest. But herein lies the strength of translation. And this strength is the result of the successive layering or ‘sedimentation’ of different networks of agents supporting this configuration:

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7 ‘Chapter 2: Circulating Reference: sampling the soil in the Amazon Forest’ (Latour, 1999: 24-79).
8 ‘Figure 2.3’ (Latour, 1999: 31).
Laboratories are excellent sites in which to understand the production of certainty, ... but ... they have the major disadvantage of relying on the indefinite sedimentation of other disciplines, instruments, languages, and practices. One no longer sees science stammer, making its debut, creating itself from nothing in direct confrontation with the world. In the laboratory there is always a preconstructed universe that is miraculously similar to that of the sciences. (Latour, 1999: 30)

Latour has shown us that it is only through a series of transformations, or translations, that science is made to work: “since laboratory practices lead us constantly inside/outside and upside/down, we should be faithful to our field and follow our objects throughout all their transformations” (Latour, 1983: 160). Firstly, we have seen how he unfolds a network that starts with a flask of anthrax and a Parisian laboratory and finishes with a transformed space of French agriculture. Secondly, he shows that different scientists and sciences in the Amazon forest have worked to transform space in a way predicated on a series of organised translations. Latour’s ideas – particularly of ‘translation’, ‘actor-networks’, ‘obligatory points of passage’, and ‘black boxes’ – and his systematic approach have important consequences for how the space of the farm as a laboratory can be investigated. It is Latour who has encouraged the use of term laboratory as both a concept and analogy in science studies. For one farmer, ‘laboratory conjures up ideas of chemical analysis. But I have never really viewed it as such.... For me very often the farm is the laboratory’ (Simon). The laboratory is indeed a constructed space and to understand this it is necessary to follow the ‘networks of associations’ of the ‘farm collective’ as they pass through ‘obligatory points of passage’ linking both the ‘inside’ and the ‘outside’. The processes of restructuring English farming will be investigated similarly to see how different scientists with different specialisms construct spaces ‘inside’ and ‘outside’ the farm. The idea of the actor-network – of how all of the agents interact in networks – is important because in this way agency – the capacity to act or have effect – is relational.

I want to clarify Latour’s idea of interactive ‘symmetry’ because it has only been implicitly discussed so far. In Science in Action (1987), Latour suggests that we should consider symmetrically the efforts to enrol and to control human and non-human resources. These appear as ‘hybrids’ – natures-cultures – as mixtures of nonhumans and humans. This is also the basis for how he addressed the interactions between Pasteur and
the anthrax microbe. In is in this way that I hope to work with the space of the farm. This symmetry is especially important to discussions of disease when nonhuman pathogens have invaded and infected the farm space. The idea of 'black boxing' is interesting because it helps us understand how many of the practices of farming have become so routinised that they are rarely scrutinized. Introduced to a farm are black boxes of policy knowledge, black boxed chemicals, and a host of other elements whose relations to other networks are not interrogated. Similarly, the processes of making science and producing food on the farm are co-dependent and have also often become black-boxed. Uncovering the space of the farm entails unpacking these black boxes.

As I see it, Latour's argument is a cogent one: agency is relational, so that a multitude of agents have the capacity to act or to have an effect. But I also believe that Latour's presentation is inadequate. Latour engages with active language to offer a convincing way to consider usually neglected agents, especially non-human agents, and to encourage a way of thinking of their contributions in association as symmetrical to those of (particularly) human agents. Referring to 'actants' as opposed to agents is a way to facilitate this logical transition of thought, to embed all constituents on the same plane of reasoning. But when Latour is identifying all these agents, he is undertaking a selective process: only what are highlighted as key facilitators and disseminators and the routes through which they mobilise and are mobilised are acknowledged. His principle of interactive symmetry aims to give consideration to nonhuman and human entities equally, with no prior assumption of privilege, rank or order, but this is difficult to do.

The Latour approach produces concrete universals from abstract ones: first, turn each property of an individual into relations in which the individual stands to other individuals; second, turn all the aforementioned into nodes of a common network that bears the name of the original property; third, distribute responsibility for maintaining the network equally across the nodes; fourth, conclude that the property exists only to the extent that the network is maintained. (Fuller, 1996: 175)

In this way, the abstract terms and carefully constructed case studies are artfully engineered. There is a tendency to over-simplify, over-activate and over-theorise the agency of the non-human.
I also hope to respond to Latour’s tendency to breeze over the muddied complexity of an empirical context and to pluck out *only* those components that give strength to his argument. This is another reason why I shall learn from his concepts without applying them directly to the empirical farm context. I have been able to visit the farm spaces myself and witness – rather than select from – the complexity of science in practice. But in his examination of the Pasteurian research program, Latour chooses not to tackle the local spaces of the farms on which Pasteur’s ‘miracles’ were conducted, or does he assess the contributions of farmer and veterinary knowledge to the way Pasteur’s science was enacted. Did farmers really just sit back and let Pasteur come onto their farms? The way Latour configures his networks is therefore about processes of inclusion and this is often at the expense of understanding equivalent processes of exclusion and of marginalization, erasure and suppression.

A similar criticism can be offered to the way he addresses history:

> I use history as a brain scientist uses a rat, cutting through it in order to follow the mechanisms that may allow me to understand at once the content of a science and its context. For this reason the presentation of the documentary materials does not follow the historical path but rather the network of associations that slowly make up the Pasteurian world. (Latour, 1988: 12)

In the eighteenth-century case of Pasteur’s experiments, Latour is not personally witnessing the experiments taking place – nor can he. With hindsight it is indeed possible to identify the influence of Pasteur in the space of the French farm, but we must question how much control Pasteur or the anthrax bacillus had over that space at that time. What is inside and outside the laboratory cannot be easily controlled, nor can its full contribution to experimentation be fully appreciated. In the way science and scientists work, the trajectories of objects can be disrupted, histories neglected, and the relics of previous legacies can be excluded. So the weakness of Latour’s approach lies with the way that certain agents are identified, named and processed through the network, and other altogether excluded, *by the author*, whereas its strength lies in this ontological approach to breaking the divide of humans and nonhumans, of nature and culture.
1.3 Engaging with Michel Foucault

Unlike Latour, Michel Foucault’s works are not directly associated with science studies, but his discussions of how power and knowledge are dispersed and exercised are illuminating. *The Birth of the Clinic* (1963) and *Discipline and Punish* (1977) represent many of Foucault’s ideas on the subject, power and knowledge, and are the two of his texts that deal more comprehensively with an analysis of space. The way he discusses the spaces of the clinic and the prison helps to clarify the ways in which the space of the farm is constructed. I want to focus on his ideas on the distribution of power, the idea of the ‘panopticon’, and ‘normalization’ through surveillance.

In *The Birth of the Clinic*, Foucault argues that for clinical experience to become possible as a form of knowledge, a reorganization and redefinition of space took place. The ‘patient’ has to be enveloped in a collective, homogenous space (Foucault, 1963: 196), and yet is, in a sense, at the same time, constituted and produced. Spaces become knowable and then *controllable* once an apparatus of knowledge and of power has been established. These processes rest in part on Foucault’s ideas of surveillance and the ‘gaze’: “The clinic was probably the first attempt to order a science on the exercise and decisions of the gaze” (*ibid*: 89). The clinical gaze was specifically the gaze of the *doctor*, supported and justified by an institution and confined by a code of knowledge: “The gaze that sees is a gaze that dominates; and although it also knows how to subject itself, it dominates its masters” (*ibid*: 39). By prising open the black boxes of the body – equivalent to opening-up and penetrating black boxes of knowledge, as identified by Latour (1987) – “the majestic violence of light, which is in itself supreme, brings to an end the bounded, dark kingdom of privileged knowledge and establishes the unimpeded empire of the gaze” (*ibid*: 39). Foucault also emphasises the inherently *collective* phenomenon of the ‘clinic’ insofar as it requires a *multiple gaze* (multi-perceptual description) through a cross-checking of viewpoints and repeated information. “One began to conceive of a generalized presence of doctors *whose intersecting gazes form a network* and exercise at every point in space, and at every moment in time, a constant, mobile, differentiated supervision.” (*ibid*: 31; my emphasis). In this way, medicine was becoming a closed profession, the clinic its concrete solution.
In *Discipline and Punish*, Foucault explores the changing techniques of punishment in 'modern' (post-Revolutionary) France in terms of a new economy of power. He conveys the transition from the inflicting of penalties (the violent spectacle) to the more efficient imposition of surveillance (incarceration). The criminal, in the carceral society, is assigned to another network, formalized as the 'prison': "The prison is not a workshop; it is, it must be of itself, a *machine* whose convict-workers are both the cogs and the products" (Foucault, 1977: 242; my emphasis). Therefore, that individual is isolated and excluded from the body politic; the act of inclusion in the prison network parallels the process of exclusion from the liberal network outside. Once incarcerated, the criminal is transformed and corrected, requiring an apparatus of training and exercise regimes. Indeed, Foucault argues that the prison should not be seen as an inert institution but rather part of an *active field* in which projects, improvements, experiments, theoretical statements, personal evidence and investigations have proliferated (*ibid*: 233).

Just as the criminal is enrolled in a new network to bring about change, Foucault shows how the soldier of the late eighteenth century was 'made'. The soldier's body, as an object and target of power, was manipulated, shaped and trained by a host of commands, weapons and tactics. The anatomico-metaphysical and the technico-political, the 'useful' and the 'intelligible', were united under the pretext of 'docility'. The rifle conjoined with the soldier to form the marksman – just as the scalpel conjoined with the clinician to constitute the surgeon. The marksman constituted a disciplined 'body-machine complex' and a number of simple gestures correlate the parts of the body with the parts of the object manipulated; the 'obligatory syntax' of the *manoeuvre*. With the rifle, unlike the musket, the whole battalion was suddenly equally at risk. The collective was rearranged from that of the masses in favour of a geometry that distributed units and men along extended, relatively flexible, mobile lines. In order to work, all the elementary parts had to be articulated as a composite force. Therefore, Foucault's 'discipline and detail' is about extending and refining the network as well as about controlling behaviour and conduct – *it is fundamentally a process of normalization*. 
Foucault’s (local) capillary mechanism of power, a ‘disciplinary power’ (as opposed to sovereign power), expresses the point where power reaches into the very grain of individuals, touches their bodies and inserts itself into their actions and attitudes, their discourses, learning processes and everyday lives. Power is not ‘held’ but is instead localised, dispersed, diffused and typically disguised through the social system (beyond the prison walls), and operates at a micro, local and covert level through sets of specific practices.

[Disciplinary power is] organized as a multiple, automatic and anonymous power; for although surveillance rests on individuals, its functioning is that of a network of relations from top to bottom, but also to a certain extent from bottom to top and laterally; this network ‘holds’ the whole together and traverses it in its entirety with effects of power that derive from one another: supervisors, perpetually supervised. The power in the hierarchized surveillance of the disciplines is not possessed as a thing, or transferred as a property; it functions like a piece of machinery. (Foucault, 1977: 176-77)

This relational power is so important in its ability to normalize: “The perpetual penality that traverses all points and supervises every instant in the disciplinary institutions compares, differentiates, hierarchizes, homogenizes, excludes. In short, it normalizes” (ibid: 183). Disciplinary power is exercised through its invisibility (permanent but ‘discreet’), while at the same time it imposes on those whom it subjects a principle of compulsory visibility (indiscreet but everywhere alert). This power is positive in its effect:

What makes power hold good, what makes it accepted, is simply the fact that it doesn’t only weigh on us as a force that says no, but that it traverses and produces things, it induces pleasure, forms knowledge, produces discourse. It needs to be considered as a productive network which runs through the whole social body, much more than as a negative instance whose function is repression. (Foucault, 1980: 119)

The body had become precisely docile and legible: what was important was less the body’s internal character and more the signs and exercises embedded into it by processes of training, correction, supervision, and control. A ‘political anatomy’ was born predicated on a detailed ‘micro-physics’ of control and a technico-economic rationality – meticulous regulations, fussy inspectors, the supervision of the smallest fragment of life and body.
Foucault (1977) describes that the perfect disciplinary apparatus would make it possible for a single gaze to see everything constantly, and yet this possibility of mobilising such a gaze at will means that there is no need to see anything at all. Bentham’s *panopticon* epitomizes this configuration and consists of a tower and a ring-like building enclosing it. Those who can ‘see’ (from the tower) the individuals in confinement (in the ring) are themselves invisible. This arrangement gives rise to a state of a *permanent potential surveillance* of those in the surrounding ring and induces a state of consciousness and permanent visibility, the automatic functioning of an absolute power. Foucault actually describes the panopticon as a ‘*laboratory*’ of power, observation and training (*ibid*: 204): the perfect eye operating through exact geometry and revealing how surveillance becomes a decisive economic operator. ‘Perfect surveillance’ in this way reduces structural requirements and simplifies the network. Foucault’s account of ‘panopticism’ is to be read as a model of a disciplinary programme, not as a description of actual disciplinary institutions (see Driver, 1994). The panopticon becomes the new political anatomy for the relations of subtle discipline predicated on a particular configuration of bodies in space. The prisoner in the panopticon and the patient at the end of the stethoscope both remain silent as the techniques of surveillance sweep over them.

The way Foucault illustrates the rise and constitution of a ‘disciplinary society’ through ‘*techniques of power*’ as systematically witnessed here can help to understand the process, forces and powers at work in the space of the farm as the farming industry restructures. The way control is organised constructs space: “The disciplinary institutions secreted a machinery of control that functioned like a microscope of conduct; the fine, analytical divisions that they created formed around men an apparatus of observation, recording and training” (Foucault, 1977: 173). And although the historical setting is not the same, Foucault’s ideas of the way a relational, capillary and *productive* power is dispersed in bodies in space is a particularly important mechanism to help understand how the actions of farmers on their farms are becoming increasing *regulated* and the processes of power *embedded*. Agricultural institutions that aim to re-organise farm space can adopt such regulation and mobilise this through processes of *normalization* and
surveillance. Similar processes to Foucault’s ideas of ‘docility’ and ‘legibility’ become embedded in the space of the farm and fabricate a particularly ‘normal’ space.

However, whereas ‘the prisoner in the panopticon and the patient at the end of the stethoscope both remain silent as the techniques of surveillance sweep over them’, I want to show that farmers do have their own ‘techniques of power’ on the farm. A problem with working too closely with Foucault’s ideas is a tendency to privilege the processes of normalisation at the expense of identifying heterogeneity both implicit and explicit to an empirical context. I aim to avoid this tendency by acknowledging the diversity of farms and farmer experiences witnessed in this study. Mainly because Foucault does not address questions of science directly, his ideas are often focused on humans and he does not help us understand the important of non-human agency. But Latour, as we have seen, does assist in this understanding through his ideas of symmetrical agency.

1.4 Getting Conversation Started on the Farm

I want to bring Latour and Foucault into conversation on the farm in order to show how the farm space is constructed. Joseph Rouse helps to start this conversation because he (1996: 405-6) suggests similarities between Foucault’s central themes of power and how we can understand (local) scientific knowledge. He offers a Foucauldian reading of the laboratory and shows how scientific laboratories offer analogues to many of the power relations that Foucault discovers in prisons, hospitals, barracks, factories, churches, and schools (1987: xiv). He summarises:

Objects and substances created in or for the lab are introduced into other settings. Partitions and enclosures are built to prevent unwanted or unaccountable mixtures. Actions and events are more carefully sequenced and timed. Instruments to register and interpret the signs first elicited from objects in labs become standard equipment elsewhere. Measurements become a more constant feature of everyday practice, while the units of measure and their application are increasingly standardized across widely variant contexts. The extension and commensuration of measures is by itself an enormous ongoing effort to sustain the wider extension of scientific practices and understanding. Meanwhile, all these transformations are supported by more extensive and careful surveillance and tracking of their outcomes and by elaborate documentation and accounting. (Rouse, 1996a: 131)
The power relations that traverse scientific practices themselves are also extended outside the laboratory.

Laboratories can no longer be regarded as merely incidental to the achievement and assessment of referential success. Reference to the world is achieved only through the mediation of the constructed world of the laboratory. And even this mediation cannot be conceived as the transfer of scientific knowledge outside the laboratory. Rather, as I shall suggest ... that this involves transferring the conditions of the laboratory itself out into the world. ... A laboratory on this view is not just a building or room housing the work space of scientists. Physical enclosure is a common and often useful characteristic of laboratories, but it is not essential. (Rouse, 1987: 101)

Rouse's observations that the “laboratory is a carefully structured space” (Rouse, 1987: 221) are illustrative by making connections between Foucauldian power and scientific knowledge, but he does not link the projects of Latour and Foucault directly. What I have shown through the preceding discussions is that both Latour and Foucault refer to the idea of a relational collective: for Latour, the collective describes the way the agents are related to each other in a network; and for Foucault the collective is configuration of disciplinary power which links everyone together by surveillance. Both are emphasising relations of connection rather than of causation.

Power must be analysed as something which circulates, or rather as something which only functions in the form of a chain. It is never localised here or there, never in anybody's hands, never appropriated as a commodity or piece of wealth. Power is employed and exercised through a net-like organisation. (Foucault, 1980: 98)

And just as Foucault's capillary power is productive, Latour's idea of agency is constitutive. The approaches are both systematic and shared metaphors of 'networks' and 'machines'. Latour may also be more indebted to Foucault's work than he is willing to recognise, especially since most of Foucault's work pre-dates his own: “I have used Foucault and read him a lot, so he might be absorbed into my thinking probably much more than I recognize, but I still think he is a much more traditional thinker than he at first appears” (Latour, 1993b: 252). But while these similarities are important by starting the conversation, I am neither 'applying' their ideas to the farm nor trying to 'integrate' the two theorists together. The two approaches illuminate one another but cannot be brought together in some grand synthesis. Instead, I want to learn from this interaction by looking at process more than form. An eclectic project informed by both authors offers the scope for an understanding of agency, space and place in the context of science.
And in a rich and grounded empirical context the strengths and weaknesses of both perspectives can come together.

In addition to the different contexts that Foucault and Latour work with, there are contradictions and tensions between the projects. Foucault offers genealogies and focuses on the body and the individual, whereas Latour tends towards simultaneity in his description of events and concentrates on 'hybrids' to confer the symmetry of human and nonhumans. Latour (1993b: 251) suggests that Foucault is, within his native French context, a rather 'traditional thinker': "So his work is limited, to me." By avoiding the hard sciences, Latour contends that Foucault has shunned the 'hard cases' and that his work is asymmetrical by virtue of its confinement to the 'soft' social sciences. The contradictions between the two projects are as important as the similarities because they reveal to each other another way to view the space of the farm.

Now I hope to show, through the way the following chapters are arranged, that these two projects - their weaknesses and strengths, tensions and similarities - help us understand the space of the farm as a laboratory - the 'farm-laboratory'. I have learnt from this theory to fashion a methodology tailored to fit the mobile and polyvalent space of the farm and the components lying inside, outside and around it. To augment some of the following discussions, I have selected a real farm space to illustrate - but not to re-enact - events and practices I witnessed on farms in Dorset. Photograph 1 is an aerial view of the centre of this working mixed farm - referred to as Talltrees Farm - and Figure 4 shows the major features in this photograph. The numbers on Figure 4 refer to the location from which some of the other photographs presented in this thesis were taken. These photographs are designed to inform the reader of farming practices and not to represent a generic farm space.

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9 I would like to add that Foucault does branch into natural (hard) science discourse through the analysis of medicine, particularly (as I have shown) in The Birth of the Clinic.

10 I took all of the photographs in this thesis myself.
Photograph 1: An aerial photograph of Talltrees Farm

Figure 4: A plan to explain the major features in Photograph 1

Key: ~~~ Gateway
      dashed Field boundary
   # ▼ Photograph number (as it appears in thesis) and direction

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Each chapter follows a different actor-network and tracing each gives rise to a different configuration of the farm space. These chapters are all interconnected and pieces of the composite of farming science.

Chapter 2 follows the network of agents and relations associated with institutions that aim to control the farm space from outside. The configuration of power implicit to the processes of agricultural restructuring operates in a way similar to Foucault's description of normalisation and surveillance. I analyse the formal channels of materials, knowledge and power that in combination describe a regimented and documented performance of the inhabitant of the working space of a farm – the normal farmer – which is overseen by governmental and non-governmental bodies whose rules and regulations demand adherence to a particular configuration – the standard farm. The concepts of 'standard' and 'normal' are similar because: “Standardization plays a normalizing role in scientific practice” (Rouse, 1987: 224). Learning from Foucault in this way helps to conceptualise asymmetries of social power. Because the normal farmer is the subject of 'the panopticon', s/he is not able to change the direction of the capillary power and must accept what is set. But rather than a single panopticon, the farm-laboratory is administered by different panopticons – different central surveillance and control institutions – constituting different domains and associated with each different policy code. A Latourian perspective would not address these processes in the same way and would over-simplify the distribution of power: the 'Pasteurian research program' showed us how scales could be reversed, but to do so the engineer or coordinator of the laboratory needs to be in control of what is included and excluded, mobilised and immobilised.

Chapter 3 concerns the configuration of the space as constituted by the work of the farmer as a scientist in his/her farm-laboratory. The constructs of the normal farmer and the standard farm cannot be realised in a normalised form alone. Instead, a proliferation of other networks spread between the inside, outside and intermediary spaces of a farm and 'muddy' this construction. The standard farm cannot be replicated in whole and is muddled with more informal methodologies and practices of science. In this way, this chapter will contrast the idea of normative science with the idea of multiple-networks and
place-specificities of science in action where different points of reference and different configurations of apparatus are arranged. This configuration of space captures the idea of a collective of scientists, engineers, and technicians who enrol a host of instruments and machines into their experimentation and practice of science. But it also goes beyond this Latourian project to entertain the muddied conversations about science and those convoluted distractions that often become erased in a conventional historical narrative. Focusing on the conversations of sciences on the farm aims to redress a tendency to simplify apparent in Latour's case study of Pasteur: when systematically narrating on Pasteur's success at experimenting with anthrax, Latour does little to recognise the work of non-Pasteurians, the spaces outside of anthrax, and the locational specificities of the farms where the experiences were conducted.

Chapter 4 address the problems of disease as they relate to the space of the farm and the experiences of scientists, focusing on Bovine Spongiform Encephalopathy (BSE) and Foot-and-Mouth Disease (FMD). Since 1881 and Pasteur, a whole host of similar 'translations' involving microbes and other agents have helped to configure farm space. The movements of nonhuman agents largely constitute this configuration of farm-laboratory space. Farms have been invaded and infected by these microbes through the way they take on hybrid forms with animals and even humans. The trajectories of these agents may be covert or overlooked, but their implications for English agriculture and its sciences can be both devastating and enlightening. Britain has been subjected to a series of these events in the last 15 years. What this chapter reveals is that Foucault's concept of the panopticon is insufficient as a tool to describe the way diseases and their agents take form and organise space. Therefore, we learn from Latour how to conceptualise human and nonhuman agency symmetrically.
CHAPTER TWO

Standardized Experiments:
Observing the Practice

Map of Chapter

This chapter interrogates the way the ‘normal farmer’ and the ‘standard farm’ are constructed and controlled by formal processes prescribed, organised and subsidised by agricultural institutions. Complementary processes of experimentation, documentation and supervision pursue different networks of farming activity and these networks intersect as a grid to describe these farm and farmer constructs. Farmers are disciplined by these various protocols and discourses into following procedures and rules, into organising a ‘standard farm’ space, and into producing themselves as ‘normal farmers’. In this way, the same constructs have been made real and visible to different extents. Therefore the institutional power is productive and farmers’ descriptions of institutional controls on their farms reveal this power. This chapter consists of three main sections: firstly, I shall introduce ‘the farmer’ and his/her actions and suggest how s/he is normalized; secondly, I build on this idea by revealing the proliferation of documents and the process of documenting on farms; and finally, I shall illustrate how farm inspectors police the ‘standard farm’ rules.

2.1 Norms and Procedures

2.1.1 Presenting the Farmer

At each farm site, many voices contributed to my understanding of farming practices: introducing ‘the farmer’ therefore requires recognising an entire stage crew. On each of the farms visited, there was at least one ‘farmer’ or ‘farm manager’ present, but there were also others who either put farming into practice or who were themselves in training to take up that role. Statistically, the average age of the English farmer is 58. As this age
has increased, so have the numbers of farmers dwindled from 5 per cent of England’s workforce in 1972 to just 1.5 per cent in 2001 (Curry, 2002).¹

We’ve now got an age structure where the average age of a British farmer is around fifty-eight. Irrespective of any government policy, irrespective of any WTO or CAP reform or anything like that, we are in the next twenty years going to have a huge turn over in the farming population. Now some might regard that as a serious problem and others might see it as a real opportunity to get some young blood into the industry and so on. The danger is of course that you just get amalgamation. [Wallace]²

Fifteen of the eighteen farms surveyed in this project can be termed ‘family farms’ and in these cases a spouse and/or their progeny were all involved in the operation of the farm in some part. Therefore, it is necessary to acknowledge the reality of a multitude of ‘farmers’ committing different proportions of their time to farming and non-farming activities.

We run it as a family and make sort of joint decisions. My dad is more or less retired now so I have most of the say gradually. I do most of the work – my brother helps me weekends and that. [Dennis, Dinglewell Farm]

These different people work in combination and in relation to one another as a business, a composite, a collective. Raddington Farm was managed as a corporate business, although it still maintained close family-based ties. Here, an interesting division of labour was apparent where a company of humans were allied into one enterprise:

We directly employ seven on the farm. Me [the self-entitled ‘farm manager’], arable foreman, head tractor driver, dairy herdsman, shepherd stockman for beef and sheep, relief milkers and vegetable worker, and another general farm worker. Then we have another couple who are self-employed but get most of their employment from this farm who run the box scheme and some of the hand work with the vegetables. We then have the chap with the pigs – he employs one. So that’s eleven people on the land altogether. [Richard]

At his family-farm, Wilfred accepted the proficiency of corporate agricultural businesses but had his own impression of what was a well-run farm – a ‘manageable project’:

I guess you get two sorts of farmers. Those who farm his own land and it’s an extension of himself, but you do get others which are vast and very big commercial farms where there are managers and employees and you get the feeling that they are different. But a smaller farmer – a chap who runs his own land…. Farms of thousands of acres must be less personal. You can’t understand it all and the vagaries of different fields and areas – how can you? Whereas a chap who has farmed a small area for a while can hopefully understand it and how it works – different soils and fields. [Wilfred]

¹This trend is in common with, for example, France, which has experienced a more severe decrease from 18 per cent to 4 per cent over the same period.
²Wallace is referring to World Trade Organisation (WTO) talks and Common Agricultural Policy (CAP) changes.
Farming policy and protocols discipline and domesticate these differences through the production of the ‘normal farmer’ and the ‘standard farm’ constructs. Therefore, although these profiles and portraits of ‘farmers’ differ from one farm site to another, they are all disciplined according to the ‘normal farmer’. This is because they have been organised by a particular formal farming network. This network is arranged by strategists in policy-making and policy-implementing who impose their directives into the farm space. In so doing, the normal farmer can be reduced to a fictional average that inevitably glosses over or even erases heterogeneity. At the same time, it is through the operation of these formal networks that farmers are made to look similar by being forced to operate to the same rules. Also, normal farmers gradually internalise the protocols and in effect normalise themselves. They tend to follow prescribed procedures rather than conduct experiments. To be sure, the ‘normal farmer’ is entitled to a degree of variance within this framework, but this differentiation is also scrutinized and disciplined by the centralised and formalised farming institutions. This means that although a normal farmer can be more or less than 58 years of age, can be farming a family enterprise or a managerial business, and can be farming with different specialisms, s/he is not considered to have a significantly wider base of skills outside of farming, or to be running another business in tandem with the farm, or to be significantly involved in non-farming networks.

Just as farmers are a composite of human agents and their interactions, so are farm spaces a collection of multiple technologies and actions. The ‘standard farm’ describes the space of the farm that is – similarly to the ‘normal farmer’ – fashioned by the over-layering of the different policy frameworks – different networks or grids. As Table 1 showed, the farms in this study have different configurations of livestock, arable and pasture, different acreages and locations, and have been run as organic farms for different periods of time. But the way policy works to organise and control these spaces gives rise to similar practices that all operate to an enforced standard. They are all places where the normal farmer operates.
These circulating references, the normal farmer and the standard farm, the occupation and its working place, comprise a farming unit as defined by public policy. Together, the normal-farmer-standard-farm (NFSF) construct is therefore an ordered sequence of policy rules and a prescribed model. This system of points of reference is programmed for the farm space. And this NFSF framework is accompanied by a disciplinary power to enforce this sequence, to control the practice of farming, and to help configure the farm space. The normal farmer, as owner or tenant, works on a tract of farmland and applies a standardized system of production in that space. The protocols delivered to the normal farmer result in what was commonly referred to by interviewee farmers as a particular ‘farming philosophy’ and ‘mindset’. Some farmers had not been born into the practical culture of farming and had switched from a previous occupation. But their reactions, actions, and proactions could all be channelled according to the NFSF model. In this way the farmer can become blind – or, rather, is made blind – to other views and so this helps to sustain the policy-specific configuration of the ‘normal farmer’. The protocols being delivered to the normal farmer are modified as new models and discourses are introduced to the planning table. And the discourses giving these directives form lie mostly outside of the farm-site and so the normal farmers do not set the standards themselves.

The NFSF programme arranges the normal farmer as the key implementer of standard science in the laboratory space of the standard farm. The farm in turn comprises the living and working place of the farmer – the laboratory – where the farmer ‘ties’ everything together to ‘make ends meet’. As Walter put it:

You've got the farmer lives on the farm, all his worldly possessions are tied into the farm, and basically he's got to try and make ends meet.... He's basically there seven days a week, three-hundred and sixty-five days a year. They say you never see a poor farmer. On paper they're not poor. They're asset rich and cash poor. He's at work twenty-four hours a day really. [Walter]

I was reminded that a divorcing of the living and working space meant for difficult management: 'If he ends up in a cottage a mile away is not the same as being able to look out the window' (Ken, Kestrel Farm). Accordingly, respondents used the terms ‘farm’ and ‘farmer’ interchangeably. To them, to have visited Applesham Farm meant to have met Andrew, and vice versa. Charles summarised this idea: 'As a farmer, you don't have a career; you have a farm and your farm is your self-expression'. In this way the superimposition of the
normal farmer and the standard farm over each topographical location in practice ties the NFSF sequence together in space. And this balance is fairly steady and slow to change: ‘A farm is a very personal thing and it takes a while to change the system’ (Wilfred).

The interviewee farmers did ‘leave their minds on the farm’ at all times and so appeared deeply rooted to the practicing of their science:

> Every waking moment is concerned with farm issues — things which need to be done on a practical level, things which need to be thought through ‘cos we’re breeding, rearing and finishing our livestock. But the equations are complex and many-fold and it’s sheer commitment. You immerse yourself in the environment. Most of my time spent away from the farm is spent dealing with the products of the farm. The farm is constantly on your mind, wherever you are going or whatever your purpose. The mind is still back at the farm as to what needs to be done on a practical level and what needs to be thought about in the future to put in train. [Brian, Broadleaves Farm]

In the most part, the normal farmer is ordered to be a sedentary field scientist within the standard farm space. Any transience and mobility relates back to the activity of farming that space and so the normal farmer is effectively tied back to that space as a point of reference. It is rare for all the operating agents to leave a farm premises simultaneously. And even when they left the farm temporally they were usually always as labelled ‘farmers’.

> The label is quite strong – it does go with you. People ask or bring things up as they see appropriate to a farmer. It is strong, although in some situations I actively keep away from it. [Queenie, Quaker’s Farm]

By being so rooted to his/her farm-laboratory, the normal farmer is surprisingly isolated from others of the same description. At the same time, a culture of competition has arisen at times to the detriment of a related culture of collaboration. Figure 1 suggested this in the way one farmer was depicted as jealously looking over the fence at his neighbour’s booming crop. This competition relates to the fact that normal farmers may have to compete for funding from the institutions in control. The standard farm is supported by this (mostly now ‘agri-environmental’) funding from the policy institutions and from sales of farm products. But the competitiveness is also a reflection of the visibility of the farm as a business: economic pressures become translated into the whole of the practice, from the maintenance of gateways and fencing to the propensity to purchase new machinery. Public footpath access and even just potential surveillance
from public vantage points such as roads opens the farm-laboratory to scrutiny. The ‘agricultural show’ is, in this way, an everyday spectacle. The farm-laboratory is not closed by its perimeter but is made transparent. Farmers wanted to be proud of their business and amongst the farming community there was an ethos of being a ‘good farmer’, a good herdsman, shepherd, ploughman. This also exhibits a normative function and disciplines the farmers towards similar goals.

2.1.2 Performing the Laboratory Space

As I was taken on first-hand tours of so many farms, I soon noticed the similarities in the way the location was described and exhibited. On my tour of Dinglewell Farm, Dennis immediately walked me away from the buildings up to the highest point on the farm for surveillance (Photograph 2).

Photograph 2: The view over Dinglewell Farm

He traced the perimeter of the farm with his index finger and provided a commentary of where each farm component existed and how they linked together. Indeed Dennis did
know Dinglewell Farm like the back of his hand, hands that had always toiled these particular soils. Key landmarks and boundaries were sighted. Sheep appeared like dots on the landscape. On at least a twice-daily basis, Dennis could oversee his farm-laboratory in operation in this way. Both Andrew’s and Brian’s tours had required the use of a Landrover to move swiftly between reference points. Pat could observe most of his farm simply from the glass conservatory-style wall to his living room. But whatever the chosen vehicle or apparatus of surveillance, all interviewee farmers had memorized and routinized a route consisting of important sighting points. So there Dennis and I stood gazing at Dinglewell’s dairy cows grazing down on the stream meadowlands. In that one extensive panorama, a host of farm-laboratories could be viewed in part or whole, but Dennis could delineate his from this ensemble. He had expressed his viewpoint and shown me where he stood in relation to Dinglewell Farm.

This is an example of normal farming practice. The normal farmer is constructed to configure the standard farm according to its indoctrinated methodology. S/he is integral to the laboratory set-up rather than merely a constituent element. The normal farmer is acting out the standard farm space as required by the audience of standardized policy. The term ‘performance’ aptly describes how convention becomes translated into practice whilst still remaining faithful to this script. This was relayed to me in two ways: firstly, when touring the farm, I witnessed the farmer performing the standard farm as part of his/her daily routine; and, secondly, for those components of his practice that I was not able to witness there and then, the farmer described his/her normal performances to me. The spaces through which the normal farmer is expected to perform are those inside, outside, and on the border of the standard farm.

**Inside**

The normal farmer focuses most resources to the set of performances played out inside the farm-laboratory. This act has many scenes. The normal farmer aims to configure the laboratory space and the instruments within according to his chosen mode of production and their associated rules. S/he needs allies to practice farming. For activities such as directing rotational management, policing the farm gate and border, and maintaining the
health of the livestock, the farmer *enrolls* a host of nonhumans into the farm collective in a particular arrangement—field cultivation machinery, fencing, farm buildings, and so on—and also relies on services and knowledges provided by humans. In the two-year interlude between interviews, Jersey and Quaker’s Farms had taken on new farmland and so they had been particularly active in enrolling new nonhumans. In this way, the normal farmer is what Latour would call a *persuader* because s/he enrolls other agents as allies with merged interests. The performances consist of gestures and manipulations and reveal the collaboration of humans and nonhumans under the normal farmer’s direction and in his/her pursuit of profit. In this way, the production and performance of the standard farm involves the recurrent organisation of a locus for human and nonhuman transparency in which the agenda to be worked towards is set.

The milking parlour is one such space where the apparatus must be carefully arranged and allied: ‘You need the whole dairy set up to milk them—you can’t just walk up to a cow in a field and milk it. A system has to be devised in a more or less scientific manner’ (Fred). And the machinery also needs to be repaired and sometimes updated to a newer model, processes that introduce new agents all the time: ‘The tractor’s got a bit more technical like computerised over the last five years. Whereas you used to be able to get a spanner on a tractor to mend it, you now need a soldering iron and another big computer to work it all out’ (Walter). Photograph 3 and Figure 5 suggest that the tractor has become an increasingly complex machine that demands technical skill to work and maintain.

It is interesting to consider how these machines become normalized as part of the standard farm arrangement. Farmers made it clear that the apparatus is in fact integral to rather than merely an adjunct of the practice of farming, and organic farming was no exception. All the farmers in this study adopted new machinery and technology on their farms. But they emphasised the importance of *knowing* what they were working with. As important as these inclusions, the normal farmer operates processes of *exclusion* for particular humans and nonhumans, whether these are sheep-rustlers or stray dogs, although these processes are not always effective. *I have high netting with Southdowns [sheep]*
because it's the public I've got to keep under control and they'll do the silliest things imaginable without thinking - chase the sheep around with their dog' (Ken, Kestrel Farm).

In this carefully configured space, 'observation' and 'attention to detail' seemed to be essential to the whole practice of farming and was at the root of its science. Brian and Louise confirmed this and showed that this 'microscopic' detail was combined with a wider visualization and ability to 'direct' their farm's activity:

In a sense I am a bit of a scientist around the farm because I'm constantly observing, changing my working practices or my methods of care to suit what I am observing. And that takes into account the whole farm – or more than the farm – the whole thing because my eyes are open and I am outside of that microscopic world. [Brian, Broadleaves Farm]

I think being a [film] director's about observation and it's about watching when something's going on in an actor that actually perhaps deserves a close up because there's something very interesting happening. And farming is about making those judgements too. It's standing back and just observing and watching. [Louise, Longsbottom Farm]

Photograph 3: The modern tractor as seen on Talltrees Farm in 2002
Figure 5: The mechanics of a tractor as shown in 1943

Key to Numbers on Diagram
1. P.T.O. Unit (shown detached) incorporating—
   (a) pulley;
   (b) spline shaft;
   (c) hydraulic pump cam-shaft;
   (d) dog-clutch and control lever;
   (e) hydraulic pump for power lift (see also inset).
2. hydraulic ram connection.
3. implement connection.
4. standard P.T.O.
5. differential brakes (R.H.).
6. final drive.
7. clutch pedal.
8. change-gear lever.
10. R.H. brake pedal.
11. governor control.
12. T.V.O. tank.
13. starting petrol tank (incorporated in top hood).
14. air intake.
15. exhaust.
16. oil filter.
17. engine temperature gauge.
18. oil-pressure gauge.
19. oil filter.
20. governor.
21. 4-cyl. O.H.V. engine.

Key to Inset (Hydraulic Pump for Power Lift)
A. cam.
B. roller cam followers.
C. oil reservoir.
D. oil inlet.
E. pump plunger.
F. pressure oil delivery.
G. dog-clutch control.
H. hydraulic lift control.
I. hydraulic ram.

(Source: Robinson, 1943: 90)
Most of the farmer’s work involves his hands and eyes. It is simultaneously manual and ocular work. This applies to working with livestock, working to ensure that they are functioning properly:

You can gain a lot by just looking at an animal. I teach the people who work here to when they look round the animals during the day, to just stay and observe what they’re doing – you can generally pick up problems if you do that. But if you tear around counting them and saying, ‘yes, they’re alright’, you don’t spot anything. I never mind people spending a bit of time looking at the animals. [Geoffrey, Grandview Farm]

Common to all of the livestock farmers interviewed was a once or twice daily circumnavigation of the farm space to observe the livestock and monitor their health and welfare. The ability to perform this action is largely what determines the maximum area of farmland to be successfully managed by one livestock farmer: *If you can’t look at all your livestock in the morning, and you’re still looking at them in the afternoon, you’ve got too many livestock because there’s never any time to do anything health-wise to the livestock. You’re just running around saying – oh, dead* (Ken, Kestrel Farm).

Again the analogy of the laboratory is valorised: to successfully conduct their procedures, the farmer-scientists have to keep their place of work ordered and controlled. Indeed, the farm-laboratory is a set-up of instruments that enables controlled manipulation according to an economically efficient ratio of human labour. In the same way, the space inside the farm is constituted through daily, seasonal, and annual management practices. This temporal conditioning and scheduling of practices is acknowledged in the guidelines for the standardized procedures. It is possible to refer to an annual management cycle linked to seasonal growth patterns where a routinised performance of space is undertaken. Another of my informants, Walter, presented what he described as a *typical* scheme for a mixed livestock and arable farm:

From May to July, you’re getting the grass in – the silage, round bale silage, square bale silage, pitched silage. And then your hay in July and August, and then you probably do a bit of second silage cut for your early boys. And then end of July, August, you start the combining and finish it, depending on the year end of August, and you’ve started drilling then as well. But basically from May ‘til November is taken up with groundwork – drilling, getting the feeding for the winter – and then the winter goes quiet. It’s just the lambing in January if you do early lambing or March, and then your calving. It is seasonal and that and every year like. The only thing you don’t do is like set aside and it’s only the hedging you could leave – you couldn’t leave anything else really ‘cos else you’re mismanaging your farm. [Walter]
The farmhouse forms the central axis of the spectacle of farm management, as Photograph 1 reveals. The farm gate is the official point of access for flows of information, commodities, animals, humans, and so on. Being the most significant point on the interface of the farm, this gate is invariably observable from the farmhouse lookout. The entrance may also have a cattle grid to prevent stray animals entering or leaving. Farm buildings and livestock handling facilities were usually located adjacent to the farmhouse so that animals and machines could be closely monitored (Photograph 4).

Photograph 4: Sheep handling facilities next to the farmhouse at Talltrees Farm

Although the normal farmer is controlled and conditioned by the processes outside the farm, the level of control s/he has over the events on the farm is variable. This is both in terms of what is included and excluded into the standard farm space. No doubt, during interviews with me, the farmers preferred to describe experimental precision and to erase the inevitable mishaps and inconsistencies. The lack of control over the weather was described by Charles as a 'bane' at times; the problems of disruptive public footpath and bridleway users another; and despite the use of a host of devices and even legislative and
statutory support, farmers conceded that for the most part they possessed managerial control rather than authoritative power.

I think you have power when you've got animals that are in the yard — you have power over them in the crush and everything. You have a control. Which you could call power. And you have control over where you put your animals too — like fencing — and how long they're in the water meadows for. But I don't really see it as power — I see it as a management. [Norman, Narrowlane Farm]

When you are trying to get [the animals] through a gateway and you're on your own and they decide to scatter and go the other way, I wouldn't look upon it as having power over them. We as farmers need to control them but we control them by fences. We control them also by driving them to where we want them to be. But all the time we know that physically they are much stronger than we are... [Pat, Partridge Farm]

Farmers had to maintain open footpath and bridleway access and they often explicitly labelled these route-ways to encourage people not to meander or trespass (Photograph 5).

**Photograph 5: The use of labels on a footpath and bridleway on Talltrees Farm**

The performances that take place outside of the space of the farm are related to those taking form within: 'Most of my time spent away from the farm is spent dealing with the products of the farm' (Brian, Broadleaves Farm). The normal farmer rearing livestock is expected to
source breeding and replacement livestock from dealers and markets outside of their premises. Livestock markets are often the point of interchange for this activity, and they are also a place where production and consumption networks overlap because hired livestock haulers – or sometimes farmers themselves – take livestock to market for slaughter. These activities are all traced and monitored. Sales of livestock dictate the profitability of such a set-up. But the normal farmer must decide on the balance between maximising this output and maintaining a sustainable rotation of feedstuffs and animal housing on the premises.

I think we’re at the right number [of cows] – enough silage and grazing as well. You’ve got to be able to manage it in a good and a bad year of grass growth. We seem to have the balance just right. We’re not allowed to buy in silage unless it’s organic silage – which proves an expensive exercise – so we produce enough off the amount of acres we’ve got and also give the cows enough grazing so we’re not always looking for feed for them. [Dennis, Dinglewell Farm]

The standard farm does not dictate what the exact stocking densities should be but the design of quotas and the imposition of strict welfare rules establish an approximate annual steady-state on that farmland acreage. This may be manifest in the scientific protocols on feeding rations:

What we don’t like is when they say we’ve got to work out all these rations. We had to get somebody to do it for us. The Jersey cows, the Fresians, the heifers all have different things. And the calves. I mean, we know how to feed cows. I mean what percentage and how many kilos and stuff – well he’s been bloody doing it for forty years. He doesn’t poison his cows, he doesn’t over-feed them or under-feed them. He feeds them what’s right. It’s not just kilos. They want to know the dry matter and the metabolisable energy and the megajoules per kilogram. All that kind of stuff. [Olivia, Oaker’s Farm]

Once the normal farmer leaves the space of the standard farm, s/he exits the space of circulating reference that gives him/her form. This is because the NFSF sequence pertains to a collective network located in a particular configuration of the farm space. The process of normalization confines the normal farmer to the standard farm, to the site of production. This recalls Latour’s observation that the strength of Pasteur’s position as holder of knowledge was always weakened when he exited from the laboratory. However, the products of the standard farm – animals, meat, milk, and cereals – do circulate outside the space of their production. This network of product circulation soon becomes disparate and unrecognisable because of extensive food transport and processing.
practices. In this way it is difficult to follow the production-consumption pathways and the normal farmer is unaware of the movements of his/her products. For example, through the act of eating a hamburger in New York, a whole series of absent actors, remote in time and space yet active and present, are constituted, from the cattle breeder in France to the pasture in Dorset. These are the routes through which the standard farm makes connections beyond its perimeter fences. In combination, these standard farms, as sites of normal science, are therefore defining a whole set of procedural norms that are embedded into objects moving around in the space outside.

The way the objects of the regime of production perform the space of the farm, as they move along the ‘conveyor belt’ from animal-on-farm to meat-off-farm, is illustrative of this circulation. For example, beef cattle are sold at between 20 and 30 months of age for slaughter and lambs at 5 or 6 months of age. Between my visits, many of the same individual breeding stock and dairy cows were grazing and moving around the farms, and the land was in same production cycle although often at a different stage in the rotation. But different inputs, especially feedstuffs, were being sourced from outside the premises. All the farms required inputs for their production cycles to function, and this was either bulk or concentrated feeds. In the centralised NFSF model, the majority of meat is sold to a wholesaler and so circulates in the wider network beyond. The normal farmer’s autonomy in marketing – in linking production and consumption networks together – is constrained by the normalisation process since the NFSF programme demands a centralised and standardized marketing and sourcing system. And once the product leaves the farm-laboratory, it is subjected to a whole new set of norms, expectations, and standards also controlled by the same centralised institutions.

 Bord er

Finally, I turn to performances at the intermediary. Farmers expressed the vigilance with which they policed the border of their premises: ‘We have some intensive arable farming bordering our land but we have adequate barriers like a wall, a hedge, a track and a grass margin – hopefully enough to take us away from the problem’ (Richard, Raddington Farm). The normal farmer also enlists

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3 To be self-sufficient in inputs would require a very large standard farm area and one contiguous area.
an assortment of signs to specify the presence and nature of the border, similar to those shown in Photograph 5. All standard farms have a border, which signifies the threshold and limits of the farmer's jurisdiction and often also his authority. The neighbouring land use can be similar or radically different but it is always outside of the normal farmer's control. Considering these border controls, the standard farm appears to be an insular, isolated and insulated space. But if not policed at all, the border would cease to exist. And besides, the standard farm border is porous and receptive to commodity and information flows. The permeability of this border to penetration by unwanted agents and vectors of disease was conveyed in several narratives, particularly at Narrowlane Farm (and shall be expanded on in chapter 4):

In very early spring they [neighbouring farmers] were putting some dumpy bags of fertiliser onto their land to get a little growth of something. And they had this trailer and one of the bags was ripped open on the gatepost so they left a mountain of this white granular stuff on the lay-by one Thursday afternoon. And they just left it there to melt in the rain across the main road and run onto our land. [Norman, Narrowlane Farm]

2.2 Documents, Documenter, Documenting...

2.2.1 'Enigma Standards': Deciphering Policy Codes

A proliferation of documents, texts and diagrams exist, all allied to the same discourse of the farm standard and all instructing and disciplining – or what Tim referred to as 'brainwashing' – the normal farmer as to what actions must be performed.

Cognitive boundaries envelope the new way of thinking ... [so that] many options potentially open to farmers (including many unusual forms of diversification) may never be seriously considered because they are literally 'unthinkable'. (Shucksmith, 1993: 468)

This section reveals a series of procedural norms as they constitute and are constituted by the normal farmer and the standard farm.

Farmers are told how to farm, when to plant, when to spray, what varieties to use, what drugs to use, and when to use this drug to prevent all your animals dropping down then. They have not been encouraged to think for themselves. Particularly I think my father's generation of farming and the environment he grew up in – it was the government and the chemical companies providing the information for people on how to farm and relying on that, and then the government buying the animals off them. They haven't had to be their own business managers in a way. [Tim]
These are effectively processes aiming to clone standard farms and replicate normative science. The normal farmer is hardly a ‘free agent’ but is instead applying a science modelled by outside of the standard farm. The management philosophy of the normal farmer can reflect this: *You know the saying that the best farmers are those whose best returns come in the post* (Charles, Chase Farm).

At the time of my study, what was available ‘through the post’ included, centrally, *The Report of the Policy Commission on the Future of Farming and Food*, chaired by Sir Donald Curry (and referred to by farmers as the ‘Curry Report’) and released on 25th January 2002. It merits particular mention here because it is the government’s most contemporary and broad-based assessment of English agriculture. This report is an exemplar of the setting of standardized procedures by the government to be inculcated in the standard farm through the imposition of formalised policy. Each different programme has a different funding allocation:

Estimated RDR [Rural Development Regulation] grant funding in England for 2001-2 was £189.4m. The majority of that sum is divided between two large schemes. The Countryside Stewardship Scheme is the larger (£51m), followed by the Environmentally Sensitive Areas scheme (£48m). The Hill Farm Allowance Scheme (£27m), the Organic Farming Scheme (£18m), and the Woodland Grant Scheme (£16.6m) take much of the rest. The remainder is divided into small schemes: the Farm Woodland Premium Scheme (£9m); the Rural Enterprise Scheme (£8.3m); the Energy Crops Scheme (£4m); the Processing and Marketing Grant (£4m); the Vocational Training Scheme (£2m) and the Organic Conversion Information Service (£1.5m). (Curry, 2002: 78)

In this equation, the normal farmer becomes de facto the sponsored scientist:

Scientists have got to find someone to sponsor them and some of the things they come out with are biased by that finance. It’s a pity because really they should have money available to them to carry out their research and their business is research – that’s what they were trained for – not to find sponsors. Their business is science. [Oliver, Oaker’s Farm]

Oliver is talking here about scientists as a generic group. But the same comment is relevant to his own situation. His farm is enlisted into the process of formal policy documentation largely for the purpose of becoming eligible for the grant and subsidy schemes. Their various rules both regulate and instruct the normal farmer: in effect, s/he is disciplined.
All English farming premises are subjected to the policing, policies and politics of the government’s Department for Environment, Food and Rural Affairs (DEFRA). Their principal policy tool for administering farm quota and subsidy allocations is the Integrated Administration and Control System (IACS). A mandatory national census of agriculture was also orchestrated by DEFRA in June 2000. Governments have the power to manipulate farmers as what one farmer called their ‘puppets in the countryside’ because government payments comprise the majority of many farming incomes. “Farming is so stiff with subsidies and price fixing that, to all intents and purposes, it is a nationalised industry” (Hobson, 1999: 660). It is also ‘nationalised’ because it is so nationally monitored:

At the farm level, DEFRA ... collects large amounts of data through a variety of means, including IACS (the system through which CAP payments are administered), the annual farm census, and the Farm Business Survey. (Curry, 2002: 26)

As Figure 6 suggests, the whole system is becoming – sometimes overwhelmingly – bureaucratised.

Figure 6: A popular farming cartoon suggesting intense bureaucratisation

... not a word to anybody ... but I reckon we’ve had 0.02 acres rent-free for the last twenty-seven years!

(Source: Brewis, 1994: 31)
But it is also becoming computerised. Geoffrey remarked that when he submitted his IACS application online, information on Grandview farm down to the detail of each individually numbered field was relayed directly to Whitehall, DEFRA’s headquarters.

The ‘Curry Report’ also acknowledges the multiplication of farm assurance schemes, of which organic farming is exemplary. Different policy bodies all accountable to the government have drafted standard farm protocols and have subsequently released these policy codes into the British farming community with variable success rates. The principles are similar: to isolate a particular food product, to design an associated image often based on the quality of that product, and then to niche market this package on its integrity, accountability, and ultimately inculcation to a documented standard. I shall now focus on two of the most influential and well-subscribed schemes – the British Farm Standard and the Soil Association’s organic standard – to illustrate how standards are formatted for the standard farm.

The British Farm Standard (BFS) was launched by the National Farmers Union (NFU) in close conjunction with major British food retailers and is identified by a red tractor logo (Figure 7).

Figure 7: The British Farm Standard (BFS) logo

The introduction of this logo was partly a response to consumer anxiety produced by news reports that meat products labelled simply as ‘British’ could have been reared abroad; the animal might be South American, for example, but if its meat was ‘processed’ from a whole carcase in Britain then it could legally be labelled ‘British’. It is now a heavily regulated policy framework:

The Red Tractor mark is one of the more successful initiatives in this area [of regulated standards] – although it clearly has a long way to go before it achieves the
market penetration required for an industry-wide baseline scheme. The mark, which is the public face of a range of separate assurance schemes for various products, was created by the National Farmers' Union in association with the Government. The assurance schemes that underpin it are co-ordinated by a non-profit company called Assured Food Standards (AFS). The Red Tractor was launched in June 2000. (Curry, 2002: 39)

The BFS comprises a set of standards linked to different farming industries, such as a Farm Assured British Beef and Lamb (FABBL) standard also developed by the NFU. Oliver suggested that supermarkets were really the impetus behind the BFS scheme and were able to twist it to their own sales pitch:

Say you brought in meat from abroad – if you process it here it becomes British and the logo can go on. Its origin doesn’t come into it. Which is very wrong. ... Supermarkets say go onto FABBL and you’ve got to be examined and inspected and conform to certain standards but that don’t stop them still going off and buying from Argentina, Thailand or wherever where there’s little or no welfare standards. [Oliver, Oaker's Farm]

The increasingly centralised and integrated system of British food retailing means that: “The ‘consumer’ is often an institutional buyer operating under severe cash restraints” (Elworthy and McCulloch, 1996: 738). The corporate retailers have representatives – what Stanley called ‘livestock dealers’ – who actually go to farm premises and select the livestock they require for their outlet and hence select what makes it to the retailer’s shelves.

The majority of farmers are hooked increasingly into the vertically organized food chain which is dominated by the power of the corporate retailers and manufacturers (Marsden, 1998: 109-110).

These are the agents with the decision-making power over what food is available to eat. They should be distinguished from the group who purchase from these outlets in order to eat the product, the ‘consumer-purchasers’. At the same time, corporate retailers have significantly increased their grip upon the coordination and provision of food supply, quality and choice (Marsden, Flynn and Harrison, 2000). Some farmers and vets were frustrated by the way in which some supermarkets and consumer-purchasers treated British standard food labels:

You’ve got the advertising in the supermarkets whereby you’ve got the British tractor and that – the British standard. Fine. To me it seems that the supermarket wants to

4 The term ‘consumer-purchasers’ refers to what the farmers described generically as ‘consumers’; as simply the people who ate what they produced.
say that British farms are to this particular standard. But on the very next shelf you’ve got chicken from Taiwan — what they haven’t labelled — but they’re insisting that the British farmer rears to a certain standard and then they just import everything else! [Stanley]

I think supermarkets are a bane. The link between the consumer and the farmer has been totally severed. [Brian, 1999]

Supermarkets demand replication of carcass size, conformation and fattiness to make processing and marketing easier. The BFS is therefore responding to this supermarket monopoly of food sales. And another level of bureaucracy, the Food Standards Agency (FSA), was launched in April 2000 to monitor all such schemes.

Consumer-purchaser choice in what they eat is therefore limited, unless they buy outside of these channels. And yet these alternative channels are rare because of hegemony of supermarket retailers. The NFU largely has to work to an agenda set by these retailers. It is then up to the farmer to re-define quality and product expectations to entice a share of this market which is difficult under the NFSF programme. Quality is linked to superiority of taste, uniqueness of location and breeding, and a holistic package of environmental attributes.

It's now mainly driven by retailers because all the supermarket companies in the UK now have retail standards and they insist that the producers that supply them follow the standards - standards relating to human health, animal welfare, and impact on the environment. And that is having a very substantial effect on how people are actually operating on farms because if you can't sell your product to Tesco's or Sainsbury's because they don't like the way you are keeping those animals or they say it's producing too much pollution or there's too much risk to some human health problems, then the farmer has to change very fast. So that's had a faster impact than legislation has. Labelling is a part of it. It started by specialist labels saying if you want to buy free-range eggs, here they are and it was a small part of the market and free-range eggs got up to about twelve per cent in the UK market.... But also there has been legislation on labelling. A lot of this is now driven by EU directives rather than UK legislation. [Sam]

But a DEFRA spokesperson claimed that farmers are not aware of what happens to their food once it passes outside the farm gate. The normal farmer is rarely a marketer:

The first question I often ask farmers is - do you know what happens to your food? And of course ninety per cent of them don't - or ninety-nine per cent. Do you know what the supply chain is and ninety-nine per cent of them don't. Do you know what happens to your food - when you produce wheat or beef or whatever, what happens to it at the farm gate? [Wallace]
We have seen how the supermarkets drive the normal farmer towards production replicability because it facilitates handling and processing. Through the NFSF programme, most farmers have become accustomed to producing food for circulation outside of the farm without knowing where it goes. They lack marketing knowledge and knowledge of what happens to their food outside the farm gate. The NFSF model tailors the science for this purpose. As a result, it is difficult for farmers to break with this programme because they do not know how to develop their production system to produce food as it is required outside.

I want to bring these points into sharper focus by illustrating a second documented scheme – organic farming – which has developed differently from the BFS. The organic food and farming standard has had wide press coverage as an alternative to industrial food products because its marketing imagery has been one of wholesomeness, health, and welfare. The Soil Association (SA) certifies about 80 per cent of British organic food producers (Soil Association, 1999: 1), imposing a strict licensing agreement to accompany the farm’s legal status as bearer of the organic symbol. This non-governmental organisation is responsible for setting the organic standard and ensuring the integrity of the organic symbol and hence the compliance of farmers. Therefore there is a particular laboratory protocol, a particular organic normal farmer and organic standard farm, which is to be ‘done by the book’ and translated into practice. The Government’s Organic Aid Scheme (OAS) – superseded by the Organic Farming Scheme in 1999 – is linked to the Soil Association’s endeavours by helping to fund the processes of instating a new organic standard on a farm. Organic farming typically precludes mass overproduction, contributes to environmental protection, and is market orientated: it arguably justifies a degree of policy support (Lampkin, 1990). Payments are front-loaded in order to financially support the inevitably difficult, costly, and time-consuming process of converting to an organic standard farm (Table 3). Although this funding assists with the two-year period of ‘conversion’ of the land, farmers argued that the more critical conversion is often that of the farmer’s mindset to the new approach.
Table 3: Conversion payments available through MAFF’s Organic Farming Scheme

<table>
<thead>
<tr>
<th>Type of Land (all figures for 1999)</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eligible for AAPS* and permanent crops (£/ha)</td>
<td>225</td>
<td>135</td>
<td>50</td>
<td>20</td>
<td>20</td>
<td>450</td>
</tr>
<tr>
<td>Improved land not eligible for AAPS (£/ha)</td>
<td>175</td>
<td>105</td>
<td>40</td>
<td>15</td>
<td>15</td>
<td>350</td>
</tr>
<tr>
<td>Unimproved land (£/ha)</td>
<td>25</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>50</td>
</tr>
</tbody>
</table>

* = Arable Area Payments Scheme.

All farmers in this study subscribed to an organic scheme and 83 per cent of these were Soil Association licensees. Therefore, the standard farm and normal farmer that are the subjects of this chapter incorporate this organic dimension into their make-up and so the same nomenclature will remain. The list of rules and regulations is extensive and exhaustive and certainly prescriptive:

[JS]: How would you define organic farming?

[Charles, 1999]: I suppose the answer is I wouldn’t. I allow the Soil Association standards to define it for me, because in a sense it doesn’t matter what your own ideas are because if you’re going to call the stuff ‘organic’, it’s got to be certified and if it’s certified, you’ve got to farm according to the rules.

The organic normal farmer is to follow these by the letter, however difficult that may prove to be in practice:

You’re allowed to feed ten per cent non-organic feed per day. Now how do you feed ten per cent of big round bales per day? Say you’ve got a group of eighteen cows or something and they’re eating one bale a day. In practice what you do is feed one non-organic bale every tenth day. But strictly speaking that is not allowed under the Soil Association regulations. You should be splitting that non-organic bale up and putting a tenth of it in everyday. And I think things like that are stupid. [Geoffrey, Grandview Farm]

And the standard farm of the future is planned into the standard farm of the present: By 2005, we’ll have to feed all organic. We just hope there’ll be more arable farmers coming in by then’ (Fred, Fairbanks Farm). But accurate planning and prediction is not always easy because the rules and regulations are liable to change:

They keep changing all the time. When we built that barn it was big enough for twelve cows. But now 'cos they’ve changed the room needed for each cow, it's only big enough for eight. Or nine. So we’ll either have to extend it or leave three out. [Jack, Jersey Farm]

The popularity of the organic movement has grown since the early 1990s: "ORGANIC FARMING WITH REALISM COULD BECOME GODSEND FOR INDUSTRY" (Farmers Weekly magazine, 12th February, 1999; author’s emphasis). This reflects the increasingly allied interests of some farmers, consumers and government alike. But this is not a complete coalition of interests because the costs of organic produce and its production can be higher than non-organic. A premium exists on organic produce and so consumers are effectively ‘paying for quality’: ‘Organic is not the magic wand to bring in profitability. It means you’ve got an extra advantage in selling’ (Ken, Kestrel Farm). He hastened to add that: ‘I think the way the costs are going, people that are high intensive chemical farmers will be very lucky if they survive. Because the inputs are getting more and more expensive.’ But Oliver reminded me how this premium had been wavering recently, especially in the milk sector, as his bulk milk sale price had been reduced from 29 to 25 pence per litre 1999-2001.

2.2.2 ‘Paper Empire’: Scripting the Farm

The process of documentation normalizes the farm-laboratory space and is constitutive of it.

Like the multiple surveillances Foucault sees investing our social interactions, surveillance in the laboratory brings with it an expanded field of writing. (Rouse, 1987: 222)

In the same way, the normal farmer enacts the standard scripts into the standard farm space. Paper is worked through the farm: it arrives at the farmhouse mailbox, is invited into the farmer’s office, is decoded, and then joins in with the processing of a host of other documents. The normal farmer negotiates many forms of knowledge and information as they arrive at the standard farm gate. Enveloped correspondence deposited by the postman comprises the majority of this. And they may include new standards to be incorporated. But these documents are supported by telephone conversations and, increasingly, internet access to web pages, and may be supplemented by material from agricultural shows, farm material suppliers, and regional policy offices brought onto the premises by the normal farmer himself. The standard farm is in this way a melting pot for all this information. But although the normal farmer is the chef, s/he does not write the recipes. He or she is organised to transform the prescriptions of the
documents into practice. In effect, paperwork imposes grids on the standard farm space, moulds the behaviour of the normal farmer, and in this way contributes to the constitution of the standard farm and the normal farmer.

A proliferation of documentation is endemic to the conduct of the standard farm. Commodities arriving at the standard farm gate are accompanied by documentation that can be interrogated by the normal farmer. This may be the ‘directions for use’ of a particular medicine, the constituents of an encased animal feed product, or the particulars of new animals joining the premises. Some form of paper-work also accompanies almost every piece of manual-work. This extract is taken from Extensification Payment Scheme 2002: Notes for Guidance and it exemplifies the complicated documentation procedures characteristic of the NFSF sequence:

1.1: Producers receiving Beef Special Premium Scheme (BSPS) and/or Suckler Cow Premium Scheme (SCPS) payments for 2002, who also wish to receive an extensification payment, should state that they wish to participate in EPS [Extensification Payment Scheme] for 2002 on their 2002 IACS [Integrated Administration and Control System] Area Aid Application. Producers must tick the relevant boxes in the EPS section of their IACS 2 or IACS 2(F) form. (RPA, 2002: 2)

Similarly, filling out forms for livestock movement licenses forms the corresponding processes for selling and buying new farm animals.

Like all laboratories, precise and recorded observations are necessary to make sense of and legitimate the results of experimentation. Records form a copy of the procedures undertaken and so the scientist’s code of conduct can be referenced by many other scientists. Recording the events in the standard farm collective is of paramount importance. The ensuing paperwork demands an increasing proportion of his/her time – the normal farmer is forced to become an efficient secretary, librarian and archivist (just as Figure 6 implied):

The records are quite tight and detailed. We have a movement book, a vet treatments record book and all the rest you have to keep – passports for each animal and now all the sheep are tagged as well. [Jack, Jersey Farm]

This handbook can be accessed by both the normal farmer and an official at any stage – it is a circulating reference. But although it is mobile in this way, it is changeable because at each point of reference, it is interpreted differently and is taken into different contexts.
The normal farmer also relies on inscription devices for the practice of farming. The Bray chart, as described by Fred at Fairbanks Farm, is one of the dairyman’s most important daily references. A numbered metal cube represents each dairy cow. A different colour on each face of the cube corresponds to the cow’s lactation and calving cycles. These are then plotted on a magnetic board that represents the annual dairy cycle.

The beauty of it is as I say you can just look at it and within a few minutes you can have a fair idea basically what the whole herd’s doing. And the other beauty is that you can use it for a fifty-cow herd or a two-hundred-, three-hundred-, cow herd. I mean obviously it would get a bit congested but it is possible. A very useful tool. [Fred, Fairbanks Farm]

At one glance, Fred could ascertain when to artificially inseminate each cow over each year to ensure a steady flow of milk output and a steady cash flow. Replacement heifers would be slotted into the herd pattern to occupy those spaces left vacant by aging cows at the end of their lactations. This Bray chart was located on the milking parlour wall and the supporting documents of cow numbers and breeding histories were back at the farmhouse.

The process of documentation suggests the stabilization of farmer actions as farm facts. The chain of associations becomes increasingly variegated, long, and disparate. The normal farmer is decoding the standard farm protocols as they arrive in formal documents (as ‘textbooks’), putting these into practice (as ‘fieldnotes’), and then re-encoding and inscribing these practices into a farm-laboratory diary written in a particular language (as ‘manuscript’). In this exercise, the normal farmer is expected to reduce and to re-present all of the events of the farm-laboratory in the report. As Louise infers, this is a grand scientific task indeed requiring the sacrifice of considerable resources.

I have had to take someone else on purely because – and this is what really pisses me off – there is so much paperwork from DEFRA, the Soil Association, etcetera. I mean I understand Health and Safety, Trading Standards, it’s all there. I mean I’m sure they don’t have to suffer this in a French village, but we have to. I mean I understand why but we have to – our sausages have non-organic spices so we have to keep them separately from the cuts of meat that are organic. This is zero-point-one per cent of the sausage mix – it’s like – oh, come on give me a break.... [Louise, Longsbottom Farm]

The place where documentation was undertaken was a designated ‘office’ within the farmhouse. This office often doubled up as an observatory lookout. What was
noteworthy when interviewing farmers inside the farmhouse was the positioning of windows, typically from either the ‘office’ or the kitchen, in order to oversee the farm gate, the farm yard, and sometimes a enable a view as far as one point of the farm border. But not all recording takes place inside the farmhouse. The normal farmer is further assisted in the process of field-noting through the use of probes established around the farm space. These probes are essentially recording devices – often embedded in the landscape image itself – which give testimony to the farmer’s actions. Consider the eutrophication of water reservoirs, the diversity of the grass sward, and the age and condition of trees on field margins. The soil itself can be shown to document the activities of the normal farmer if an agent knows how to read it.

I did some soil tests the other day and the potassium, phosphate, magnesium were all much higher than they were years ago. They’d come up under the organic system, even though we don’t buy them to grow on the land. [Charles]

And the condition of the livestock similarly records their experiences: for example, the seasonal practices in sheep of shearing, dipping and drenching.

Every farmer agreed that the level of documentation has increased in tandem with the switch from the agro-chemical and towards the agri-environmental regime. A situation of ‘burgeoning paperwork’ was widely reported:

The Soil Association seem to be much more into paperwork. They used to come and inspect the farm every year and we’d walk round the farm and then do half-an-hour's paperwork. But now it's more like three hours at the computer and they might have a quick walk…. [Jack, Jersey Farm]

Many saw paperwork as a ‘necessary inconvenience’, a vital component to the network’s integrity, although in reality some level of recording is a pre-requisite for any successful management:

I think there is a bit more but once you've got the system set up it's not really too bad. You need to keep field records whether you're organic or conventional. It's almost diary type material but it needs to be kept in an ordered way for your organic inspection, so people can trace your activities. [Richard, Raddington Farm]

In the standard farm, performing paperwork is as much a practice of farming as is tending to the livestock. The normal farmer’s daily practice revolves strongly around observations and then documenting these in a common script. But others felt that the time burden of maintaining paperwork had become oppressive, just as Figure 6 also suggested:
You have to keep grazing records of where everything goes – each field. We have to keep feed records also. I am supposed to say what the animals are eating per day, every day, through the season, right through the year. In the winter you're supposed to say how much silage they are each eating; what group is eating how much in weight, and which are eating how much every day. I think that's just over the top quite honestly. That's unnecessary paperwork. [Geoffrey, Grandview Farm]

In addition to documenting the present, and thereby recording the events of the standard farm since its inception, the normal farmer is expected to plan how the farm practices will be executed in the future. This detailed scientific prediction has become part of the normal farmer's job description, to strategise the use of each field over the subsequent year from the comfort of his farmhouse office. This process is aimed at identifying those allies that need to be persuaded and enrolled and also those adversaries that must be controlled and expelled. Using data on the numbers of livestock, field acreage, and cost-benefit analysis, the normal livestock farmer must plan how much animal feedstuffs are needed and whether these are to be imported or home-grown, he must project the straw bedding and housing requirements for over-wintering the animals, and also fine-tune all of the other components of the farm-laboratory into a profitable and productive arrangement. This idea of prediction is at the root of experimenting and the confidence with which this is performed correlates with experience. The accuracy of these predictions will be discussed in section 3.1.

2.3 Supervised, Supervisors, Supervising...

2.3.1 Certifying Truth: the genuine organic article

So far it appears that, on the standard farm, the normal farmer is a keen performer and mostly his own director even though he has a strict script to adhere to. But the normal farmers activities do have an audience and his/her documents do not remain in isolation. This is a characteristic of this controlled farm-laboratory arrangement. An associated inspectorate verifies the symbols and assurance schemes. Marsden (1998) notes a recent trend in British agriculture is an increasing abundance of privately regulated food assurance schemes in addition to the government-led directives. Here a focus on the work of the Soil Association’s (SA) inspectorate – as experienced by 83 per cent of
farmers in this study – will clarify how surveillance operates on the organic standard farm. The SA’s organic farming standards have to be both read and performed in a certain fashion. As Charles noted, the integrity of the organic food label is predicated on the effectiveness and efficiency of a band of well-trained and keen-eyed inspectors who ensure this replication. The adjoining legislation with the SA confirms that it is a legal term and so the organic normal farmer is legally bound into recording the events of the laboratory through the organic licensing and certification agreement. If they do not comply with these rules, they will have the organic symbol removed from their farm and its produce. In this way, the normal farmer really has to farm ‘by the book’, translate the manual into manual-work and more paper-work.

All SA licensees have to arrange an annual visitation by an inspector. This lasts for one day for all but the biggest operations. The inspector is authorised to interrogate all of the farm livestock movement records, accounts, veterinary records, the current state of the livestock, arable and pasture, and so on. If the normal farmer has strayed from these rules, he will be issued with a ‘non-compliance’ by the inspector and this will be added to his records for future reference. Further incursions may result in the removal of the organic standard from his produce and even his farm. The inspector can rely on the presences or absences of different nonhumans, to interpret the adherence to rules on the standard farm by investigating these chemical, trace element or infrastructural indicators. For example, a meat sample from a farm can be chemically analysed to ascertain for residues of conventional veterinary drugs. Such drugs often remain in circulation in the animal for a period longer than the stated ‘resolving time’. But if it is shown to be clear, the carcass is awarded with a stamp across its hunches to verify its organic status.

The form of the inspection process has been changing lately. Jack told me how the SA inspectors spent a greater proportion of the time inside the farmhouse looking through the farm records and less time actually outside on the farm with the animals. It seems as if the inspectors are testing the ability to perform paper-work as much as to perform manual-work. Tim, who worked with the certification department but also with
inspections, suggested that paperwork reveals the normal farmer’s obedience to the code without having to tramp across his whole laboratory. And yet this could be problematic:

You get a lot of people who are really good farmers and really nice people but rubbish at paperwork – which is very difficult for us because we are supposed to be applying rules and laws to them that require them to keep paperwork and that’s a shame when you think you are catching somebody out. [Tim]

But ultimately, as Tim later suggested, the role of the inspector is indeed to ‘catch out’ those who are not applying the standards to the farm and hence are not replicating the organic image:

I create what is called a compliance report which then goes out to the farmer to sign and agree to – essentially telling them what’s wrong and what’s right. It’s also telephone-based – farmers always need help with the rules and regulations. My job basically is applying the standards to the farm. [Tim]

To be sure, each inspector brings a different emphasis. Inspectors are rotated every two years to prevent them becoming over-familiarised with a farm premises.

When asked if this certification process allowed for any flexibility for trial and error for the organic normal farmer, Tim remarked: ‘I think we do. I think if people want to try stuff out then we generally try to support that as much as we can. But they have to consult us first.’ Therefore, although the organic normal farmer can adopt different practices, he must seek ‘approval’ first because some practices and procedures are forbidden. But farmers tended to view the process of making inquiries and consulting with the certifier as an additional pressure on their time rather than as a daunting exercise: ‘If you need help, we’ve always found they do the best for you. And the inspectors are not unreasonable. We phone them when there’s a problem. I give the producer number and it goes up on the machine’ (Olivia, Oaker’s Farm). When Olivia phones the help-line, someone answers her at Producer Services or Certification in the Bristol office. Using her name and license number, the SA agent accesses the records of Oaker’s Farm including compliance (and non-compliance) reports, histories of important telephone conversations, and the farm’s statistics. The agent in Bristol can therefore make associations, assumptions, and assessments about Oaker’s Farm even though he or she may have never visited the premises.

The way it is recorded on our system is that each farm has an entry on the computer which has their basic farm address details, details of what’s on their licence, a specific record for every inspection that has been carried out so that will contain the full inspection report and the compliance form that they were then sent and a
correspondence list which is every letter that we send them, every letter they send us, and a record of any important phone calls we have had with them. So if we have discussed an issue which we think may become an issue later on, we always make a note of it. Any veterinary permission that’s given for example. So there should be a fairly comprehensive correspondence history with any farm. [Tim]

Again the farm is equated directly with the farmer, the laboratory with the scientist.

But a farmer may subscribe to an even more strict and rigorous inspection process if he farms biodynamically with the Demeter symbol. The Soil Association’s organic standards comprise only the baseline for this methodology. It more closely examines the farm and its animals:

It’s a very thorough inspection. Even the pasture is examined minutely – these people really understand. They’ll look at the different grasses that are growing, and the health of those grasses, and what herbage exists, and they sample from the stream to check. They can actually test the meat product to find any residues – I think that’s almost unique to the biodynamic association. [Brian, Broadleaves Farm]

The inspector has the resources and connections entitling him to the stature of scientific authority and the final adjudicator. He or she can execute microscopic analysis on site. This is a more detailed assessment than what is available to the consumer-purchaser to see and witness, even if he or she purchases from the premises through a farmshop or at the farmgate. Through appropriating the label, the scientific claims become increasingly abstracted and the networks of associations are elongated. The idea of scientific expertise that is transmitted to the consumer-purchaser by the food label is powerful and yet also fragile. It would take only one major blunder on the part of the inspectors to destroy the credibility of the science under whose sign they work. But as it stands, the label remains superior in its statement of truth when meeting the gaze of the consumer-purchaser than what the consumer-purchaser can determine from a visit to the premises and a face-to-face conversation with the normal farmer involved. Rarely are the associations truly local and visible between producer and consumer-purchaser. On the farm, the consumer-purchaser’s view usually remains macroscopic.

What the Soil Association’s label is signifying is that food produce passing the consumer’s gaze on the retailer’s shelf has also been interrogated by the gaze of the farmer and authorized by the gaze of the inspector. By setting and enforcing the
standards, the Soil Association is transacting between the space of production and the space of consumption. Appended to the food product, and signified by the label, is a unique ensemble of farm-laboratory procedural norms. The label also carries a set of environmental values and welfare codes. The organic food market uses these associations, known as ‘certification’, to justify the price premium attached to its produce. Certification transacts the distance between production and consumption and therefore appends the stigma of ‘trust’ to the in-between stages and their associated bodies and spaces. The translations use the mobile logos for this purpose. These logos testify to the soil chemistry, feedstuffs, pesticides, and medicines linked to the product. It is as much the process as the place that is being certified as authentic. It is reconstructing a local place in the eyes of the consumer – that is how it sells. The organic label explicitly links the food product with the standard farm place. In everyday shopping forays, the consumer demands a regular minimum standard in terms of fattiness, size, and conformation. Any product falling below these expectations is liable to discourage the consumer-purchaser from making that choice again. The whole marketing drive is predicated on this re-embedding, linking images of contented beasts in idyllic countryside to the label and hence the food product. Figure 3 illustrated this image. As Geoffrey remarks, ‘when somebody buys something that’s organic, what they actually buy is an image. And the reality is sometimes rather different.’ In this way, for the consumer-purchaser, the food article is traceable to the organic standard farm. It can be traced to a particular premises only if the consumer purchases through non-centralised outlets, such as farmshops, farmgates, or farmers’ markets.

The same certified logos are carried on substances entering the organic standard farm. Mole Valley Feeds supply the majority of organic producers in West Dorset. Their bags of animal feed carry the same logo and hence verify the same truths. This bag can therefore enter the standard farm premises in its black box. The integrity of the organic food chain is maintained by such obligatory passage points. A package of steak on a supermarket shelf with the organic label attached refers not only to the organic standard farm from where it was harvested, but also can be traced back to some of the organic standard feedstuffs that the beef animal consumed and to the organic standard abattoir.
and butcher that cut-up the carcass. The Soil Association therefore interrogates more than the normal farmer alone. Norman at Narrowlane Farm highlighted the logistical difficulties and costs associated with maintaining the integrity of the organic chain as required:

Our meat is organic reared, organic slaughtered, but the butcher happens to cut with a knife that the Soil Association doesn’t inspect. They argue that if it is hanging in the same space as non-organic meat then it might be contaminated. How I don't know. [Norman, Narrowlane Farm]

It is as if you had to write every day that you hadn’t put chemicals on or they’ll assume you have! Keeping feed records which say ‘stock at grass’, ‘stock at grass’. It is just mad. They don’t seem to trust us. [Queenie, Quaker’s Farm]

2.3.2 Policing Policy: networks of grazing, networks of gazing

The standardized laboratory is as much as place where scientists are observed as where they work. Once the organic rules have been delivered, the Soil Association’s role becomes one of policing:

We are only there to record, to explain the rules, and police them.... Every management operation, application, cutting, harvesting, that sort of thing.... Fields are numbered – you could see what happened on any field at any time. That’s really what is required under the regulation – if a farmer tops his fields, we need to know what day that happened on each year and in each field when that happened. [Tim]

This is an example of centralised surveillance. The farmer must arrange a date for an annual inspection by an officer so that the Soil Association symbol can be accredited to the premises and its produce for the following year. However, a ‘threat’ is made of an unannounced drop-in inspection at any time. The statistic of 10 per cent of premises having such a ‘police-raid’ each year is enough to subject the farm and farmer to what may feel like a perpetual gaze. The farmer is not merely the scientist, the observer, the gate-keeper, the border control officer patrolling the farm premises. He or she also becomes the observed, the policed, the inspected. The space of the farm may at first glance appear a long way from Foucault’s prison or clinic, but broadly similar processes of surveillance and discipline are taking place there. Farmers espoused a binary between the inspectors as agents of the urban space and themselves as operatives of the rural place. To them, rural and urban geographies overlap.

We in this country are bloody brilliant at policing pieces of paper and we do it to the nth degree until we’re totally anally retentive about it! [Eric, Eves Farm, 1999]
Broadleaves Farm exemplifies just how many onlookers there can be. This farm is run bio-dynamically and so has thorough annual inspections by a Demeter representative. It is under a ten-year tenancy contract from the National Trust and so has ties and obligations to follow over public access and conservation management. And DEFRA and other government departments like Health and Safety monitor the welfare of livestock, employees and farm infrastructure. The autonomy of Brian and Brenda, the ‘normal farmers’ at this site, to lead decision-making on Broadleaves Farm is ultimately in question. Their actions and records are watched: they become performances. The standard farm laboratory is predicated on replication and observation. These performances under the scrutinising eyes of the inspectors are different from those rehearsed to me during interviews: I was there to witness science in action in whatever form it took.

The normal farmer’s relationship with his/her organic certifying organisation, and its band of disseminators, advisers, administrators and inspectors, is echoed in associations with the government. Just as the organic protocols are adopted to justify a premium price, so the government directives are followed to obtain funds from grants and subsidies. Policy is a way of steering the course of the standard farm. And policing is the way of monitoring and enforcing this trajectory if payments are to be issued: *I write a report after each [farm] visit which is fifteen to twenty pages each time*. And I do follow up each farm visit *with a phone call* (William – an agricultural advisor). In this way, we can now observe networks of grazing that are simultaneously networks of gazing. The normal farmer is again allied to the standard farm is this process. Each phase of the British and European levels of government drafting new standards brings a new methodology to be embedded in the standard farm and a re-shaping of the normal farmer. There are many different protocols, methodologies, guidelines that can be followed in the farm. The government’s recent agri-environmental initiatives offer sponsored bilateral custodianship of designated countryside areas. This emphasis has brought with it, amongst others, the popular Countryside Stewardship scheme – a ten-year grant to improve and maintain the space for wildlife – and the Environmentally Sensitive Areas scheme – a similar bilateral
countryside custodianship available on farmland in particularly regions of Britain. Norman and Natalie had decided to opt out of subscribing to these particular schemes to avoid the associated paperwork, but the consensus amongst the rest of the interviewee farmers was ‘to get as much money out of the government as possible’ because of the financial difficulties they were in.

If financially supported, the changes to the farm itself during the transition to a registered organic practice are not always disruptive. As Harry commented, he had been farming more or less organically anyway for years and only put on a bit of fertiliser when it needed greening up a bit. Therefore, Harry’s Hillside Farm might have been described as ‘pseudo-organic’ prior to gaining full certification. Other farmers can farm according to a management philosophy allied to the published organic principles but chose not to take up the organic niche market with their produce. Both types of unregistered organic farms made networks of grazing comparable to the organic method, but do not also possess the related networks of gazing so imperative to the organic label. For this reason, ‘conversion’ could be depicted as enrolling into a policing system and an administrative code without a significant change in the production regime.

Discussions of the SA standards take place outside of the farm-laboratory, but the knowledges of experts are consulted to link the policy initiative to the field. A whole network of agents is entrained, as depicted in Figure 8. The scope is international through the accreditation of the International Federation of Organic Agriculture Movements (IFOAM). Ideas may also be generated at the biennial national conference where new research is presented to the farming core. The Certification Department also run popular farm open days around the country where farmers are invited to come together. Once a new rule is instated, the farmer is the agent who is responsible for translating it into the farm-laboratory practice. This is, however, not the first point of translation of these rules: they have been passed down from the European Commission in

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6 I comment at length on these schemes in section 3.3.2.
7 It must be added here that organisations such as the Soil Association do provide essential political lobbying and public campaigning services on behalf of their members and the organic movement, in addition to the surveillance network.
Brussels, to the United Kingdom Register of Organic Food Standards (UKROFS) in London, to the Soil Association certification department in Bristol who operate their own complicated process of screening and fixing standards, before finally arriving all neatly packaged in the farmer’s mailbox as ‘The Guide to Rules and Certification’. This is the organic farmer’s key handbook.

Figure 8: The procedures involved in setting SA standards as Teresa suggested

But ultimately, as Trisha who worked for the SA noted, ‘there is not a sort of whole research department here and I do think that although we have some research papers and some science here, we do need to get a lot better at that.’ I questioned the idea of ‘applying standards’ when these are being imposed on a changing and changeable context. The farm-laboratory itself is distanced from the standard-setting process.

[JS]: Are these standards experimental when they are initially applied to a farm? It seems an oxymoron.

[Teresa]: I hope it’s not … [laughs] I hope it is all worked out before we implement standards.

[JS]: It has to be learnt from somewhere?
[Teresa]: Yeah, it does. And that is why we have all those so-called experts on standards committees to provide their input. Yeah, it might be.... What I mean is that we are not using licensee organic farms as an experiment for new standards as such.

As Figure 8 suggests, the bureaucratic processes though which a particular piece of organic legislation and experience has passed delays its implementation possibly to the extent that it becomes out-dated and refers only weakly to real farm-laboratory practice. Farmers also agreed that they rarely had the time or were they asked to input suggestions. It was always the SA Council that had the final say.

The Soil Association has to be so vigilant in its surveillance because it must prevent loopholes appearing. If one organic normal farmer disregards the rules and so defects, they can only free-ride on the wider movement for so long before the violation is made public and the credibility of all organic products tarnished.

I think that the administration to cope with the enormous wide interest and people perhaps not very suited to organic farming has got to be improved all the time. ... The certification and the policing of it has got to be really strict. Our annual inspections have got to be really thorough. [Norman, Narrowlane Farm, 1999]

But not all interviewee farmers ultimately trusted the judgments of the inspectors:

I don't always trust their judgement. They've got guidelines to look towards and I think it's a bit like reading the manual, whereas a more practical person would read it in a different sort of way I think and sort of the practicalities of doing certain things that they say in the manual which you might have to modify slightly to suit your needs. [Geoffrey, Grandview Farm]

The Soil Association is occasionally itself inspected and monitored by the British government. Therefore, the farmer is observing and working in the space of the farm, and is being policed and inspected by the organic certification body, but both are then being monitored and policed by the government at a British and European level.

UKROFS audit us – a number of our inspections each year. So they'll go out to the farm with that inspection report.... There are restricted practices that we also have to inform UKROFS of. So they are fairly strict. Although our rules are stricter than their – the Soil Association rules go beyond UKROFS rules – they are quite strict in seeing that we apply our rules and we are policed by them to quite a large extent. [Tim, SA]

Farmers reminded me that in addition to the inspectorate associated with policing the organic label, each organic premises is also subjected to the rules imposed by the government that pertain to all types of farming in Britain. These can be just as rigorous, as this description of 'on-farm checks' and Geoffrey's experiences illustrate:
9.1: We will check to make sure you comply with the conditions of the Scheme. You must allow us to check your farm records, count your animals and inspect your forage area at any reasonable time. Inspection visits may occur without notice and more than once. If you refuse to allow an inspection, or if you obstruct an inspecting officer or fail to give reasonable assistance, this will lead to loss of payment and we might prosecute you.

9.2: Keeping accurate and up-to-date farm records is a legal obligation. If your records do not support your current or previous claims, you may be excluded from the Scheme for the current Scheme year and have to re-pay the aid already paid, plus interest. (RPA, 2002: 8)

We had DEFRA come at 8am to check ear-tags once. There was one tag that was wrong on the invoice when we brought some animals and they saw this and said they were taking it off my suckler cow premium and reducing my claim by ten per cent across the board. [Geoffrey]

DEFRA’s Integrated Administration and Control System (IACS) of monitoring presently operates “with farmers largely self-regulating but with random visits to a proportion of farms and heavy penalties for those found to be failing to meet their requirements” (Curry, 2002: 83).

Plans are afoot for a new system of surveillance which would reduce the need – and hence the associated costs – of inspectors visiting premises. This system offers the potential for never-ending surveillance and is depicted in Figure 9:

Compliance ideally would be measurable remotely as far as possible reducing the need for inspections. As satellite technology becomes available this should be used where it is cost-effective as a means of reducing time-consuming site visits. (Curry, 2002: 80)

Members of the general public themselves may also be onlookers, adding to the sense of a panopticon configuration: ‘I mean they told us that coming here they know that it’s done how it is supposed to be done, but they have people who they watch. The public often inform and they’re the people that they watch all the time’ (Oliver, Oaker’s Farm). And this subjection to all-pervading eyes can impinge on daily management decision-making:

We do keep to the rules of the Soil Association. When it says three days we do the full thing and do a fortnight because we dare not get caught out on it. Because if we sent on milk with antibiotics, you are suspended for a month or so and you’ve got no one to take your milk unless you get the conventional to take it. Then you’ve got to be inspected again and pay for all the costs – you just dare not. We’ve got a machine to test the milk to see if there’s any antibiotics residues, if we ever think we’ve made a mistake. Well it’s a high-tech chemical test – I can’t understand…. But we’ve got to be so careful. [Olivia, Oaker’s Farm]

But from the inspector’s point of view, the whole process can be equally difficult:
Often the inspections that I go on are actually unannounced and it's where we've got suspicions that there's something untoward going on. And so you are in a situation where you are not allowed to say to somebody you think that what they are doing is wrong but you are almost indirectly accusing them through the questions that you are asking. And the way that you are interrogating them – I find that situation very difficult.... We sort of despair a bit when farmers have to pull out because of rules that we legally have to apply to them. Because there isn't a way round that from an UKROFS point of view. We can't reduce. We have to inspect an abattoir and it costs us a certain amount to do that and we have to inspect to at least UKROFS standards and we can't be flexible over UKROFS standards. [Tim]

Figure 9: A popular farming cartoon suggesting constant surveillance

‗... don't be silly ... they'll just be EEC spies checkin' on your oilseed rape acreage ‗

(Source: Brewis, 1994: 35)

Summary of Chapter

This Foucauldian reading of the space of the farm as it is constructed by the NFSF programme is similar, in part, to one of Rouse's observations of the laboratory:

We have seen the laboratory as a space of stringently enforced enclosures and separations, of strict surveillance and tracking, of carefully controlled interventions and manipulations. ... Laboratory practice imposes a detailed discipline upon those
who engage in it. This discipline is not normally noticed, because it becomes routine
and engrained in scientists and technicians, who have long since internalised it.
(Rouse, 1987: 237)

But, critically, the farm-laboratory is disciplined from outside. This was specifically a
controlled laboratory arrangement, a standardized and normalized space, imposed from
outside. Policy programmes rely on processes of documentation and surveillance, which
together discipline the normal farmer and in this way standardize the standard farm space.
The way agents and practices are configured in this network of relations therefore enables
the farm space to be manipulated and controlled. Through a focus of discussions on the
organic label, it appears that ‘disciplining’ and cultivating organic food are inseparable
processes and to have become entangled in the same NFSF network – what Latour would
call the same hybrid collective. British and European government adds successive layers
of surveillance and bureaucracy in addition.
CHAPTER THREE

Experimenting Standards:  
The Interbreeding of Sciences

Map of Chapter

This chapter considers how farms and farmers are connected with myriad other diverse networks, each offering different scopes for experimentation. Firstly, I reveal that how formal planning through the NFSF model cannot always provide a standard, normalised product, and that not all policy can be policed. Secondly, I show that as a place where scientists work, it is within the farm-laboratory that knowledge and practices are often created and where discourses of farming and non-farming science are woven together. Therefore, this understanding of farm space shows that the narrative of the NFSF construct must be read alongside the experiences of those trying to control the farm from the inside. The laboratory analogy is still as strong, but the emphasis is on the situated dynamics and contingencies of operation with the farm as the control-site rather than its prescriptive and normalizing potential. To illustrate these ideas, I focus on farm animal and conservation management sciences. In both, there is a tendency for the farmer to fabricate his/her own methodology from the many viewpoints and voices associated with these sciences, and the farm space hosts the interbreeding of these knowledges where informal and formal networks intermingle. In this way, this chapter is really a chapter of science studies, seeking to show that the practice of science is not always like the model. And the argument is not about whether farmers chose to not always act as instructed (an argument that would focus on the policing ability of the panopticon), but that the prescriptive and standardized science cannot be applied and replicated in a normative and controlled way from outside. This is how different configurations of the farm space become apparent.
3.1 Muck and Magic? Farming Sciences

3.1.1 Replicating the NFSF Model: the introduction of heterogeneity

The model for a farm – the standard farm – and the modelling agent - the normal farmer - are necessarily fabrications derived from formal planning that work towards an ideal farm-laboratory. On the standard farm, the experiments are controlled from outside the farm because they are spelled out, documented and supervised. In this way, they are more akin to procedures than to experiments. But following these procedures often entails using different apparatus at different times, depending on the specificities of the place where this science is practiced. It would be wrong to expect each farm ostensibly following the same rules to be exactly the same. The normal farmer is not a robotic engineer and neither is the standard farm a factory of automatic machines. Translating the disciplinary imperatives of the standard farm model into the specific contexts of Applesham, Broadleaves, and Chase Farms is a challenging exercise of power. This variation from farm to farm is not ‘bad science’ but often ‘good sense’. And what appears ‘normal’ to one interviewee farmer was not necessarily so for another. Science is not absolutely ‘controlled’, even in the purest closed laboratory: and a farm-laboratory is far from ‘pure’ because not all variables can possibly be controlled. The NFSF model works to accommodate this heterogeneity in three ways: by enforcing the idea that normal farmers must consult the model first on issues of farming; by directing normal farmers to meticulously record all new and established practices; and by always imposing the ‘threat’ of surveillance. Indeed, the threat of taking away the subsidy payments is also critical to the way the normal farmer is disciplined. The freedom of manoeuvre accorded to each farmer, such as it is, can be contracted or even taken away at any time.

The NFSF model aims for replicability because it would allow the supervisors to work almost flawlessly and for the products of the standard farm to be marketed uniformly. But this is not happening on the farm. This is why, for example, companies conducting tests on genetically-modified (GM) crops have to perform ‘trials’ at different farm sites because they are unsure of the replicability of their agents and its ability to work as planned outside of their testing-laboratory in the farm-laboratory. In principle it might
seem as though the standard farm could indeed be abstracted in its totality and exported to a new setting. In practice, however, the complexity and contingency of the farm-laboratory militates against the abstraction and replication of the model in this manner. Amongst interviewees, there were ‘non-standards’ in farming practice and ‘non-normality’ in farmer behaviour; attributes which have repercussions for the replicability of any farming science. And as will become apparent, the farm-laboratory is itself much more a breeding ground for new knowledges, new scientific methods, and new networks that take on a whole new transformative stance and break with the normative. There is more to the farming unit than just a normal farmer and his standard farm. There are norms and behaviours, procedures and decisions.

The activities observed in the laboratory not only involve tools and materials which are highly preconstructed, they also involve decisions and selections. The choice of a particular measurement device, a particular formulation of chemical composition, a specific temperature or of the timing of an experiment is a choice among alternative means and courses of action. These selections, in turn, can only be made with respect to other selections: they are based on translations into further selections, the so-called decision criteria. (Knorr-Cetina, 1983: 121)

The protocol of ‘discipline’ could also be used against itself. Much of the tracing of farmers’ activities through documentation is done on trust – a risk-taking farmer can invent the fieldnotes at a later date to falsely suggest that s/he is aiming to replicate the farm as prescribed:

I have to monitor and write down everything that goes into the shop and everything that goes out.... Well I’m sorry but I could make that up. All these records would not stand up in a court of law because I could sit and invent them of an evening. [Louise, Longsbottom Farm]

The farm-laboratory may therefore undertake trials and compile data that remain unknown outside of the farm premises.

Replication occurs more smoothly if someone familiar with a laboratory set-up moves away to try to configure the same unit elsewhere, as compared to if someone of no experience attempts to copy a set-up by translating from its guidebooks. Richard stressed the salience of the ‘seeing is believing’ philosophy in farming, which is why he encouraged open days on Raddington Farm: We can sow the seeds in their mind and give them a picture ‘cos we remember in pictures really’. Education in a farm-laboratory is best conducted by enabling others to witness experiments first-hand. The same experiment conducted in a
different farm-laboratory provides a different experience which may have to be witnessed if it is to be understood. Norman explained that in addition to reading agriculture books, he had learned: ‘Just from observing really. And an enormous interest in it too. That willingness to learn. An attention to detail.’ (Norman, Narrowlane Farm). Many farmers wanted to show others what they had learnt:

If I had the time, I would show people round every day but it is just not practical. It is something I would like to look into – getting school visits and that. [Fred, Fairbanks Farm]

At Fairbanks Farm I witnessed another processes of learning and this is re-captured in Photograph 6. Fred’s son was organising a personalized farm space using farm toys he had collected: ‘The chap farming on the outskirts of the village – his son and mine are best of friends and they are always playing tractors’ (Fred).

Photograph 6: Learning to farm

The predictability of animal characteristics is central to the possibility of replication of a livestock farm. The NFSF code refers to livestock by encoding them as different ‘livestock units’. The machinery on these farms is configured to suit a regular size,
weight, and shape of animal. And so are the manuals: *We've got some books that are pretty old, but mastitis was mastitis whether it was eighty years ago or eight hours ago* (Oliver, Oaker's Farm). Farm books document the physiology of animals and their ailments. Farmers rely on stocks of knowledge derived from books, regulations and also from their own experience and together this comprises 'management expertise'.

The basic way to looking after cows and calving cows and that is probably the same now as it was years ago. There's probably better management expertise now and also as time goes on people get to know a great deal more about how the actual cows work, what are the best feeds going - proteins, degradable proteins and one thing or another - and you could probably grow animals better now with a lot of the feeds and that what they know out about - or supplement feeds what they got to actually help the animals to utilise sort of grass, silage and things like that. [Harry, Hillside Farm]

Because livestock farmers interact with animals on a daily basis, and in turn work with specific livestock management machines, their knowledge and understanding of both becomes taken-for-granted - or as Latour would say, they are 'black-boxed'. In reality, the complexity of animal physiology means that farmers only possess partial knowledge. Sam, an animal behaviour specialist, recognised the limitations of his knowledge and so suggested it was inappropriate to treat them as machines:

*The more you know about the anatomy, physiology, basic functioning, and especially the more sophisticated functioning of the body and of the brain and of the control of behaviour, of the extent of cognitive ability, of individuals of other species, the less easy it is to consider them as something like a machine. They very clearly are a long way from being a machine - they are very close to humans in terms of their functioning.* [Sam]

Also, animals have often been modified by breeding selections, by the changing range of diseases and parasites that threaten them, and by the quality of care they have received when growing. They cannot be treated as standard machines which can be mass-produced. The dangers of doing so is illustrated by Geoffrey:

*The Herefords [cattle] came from a SA authorised organic herd. But even having an organic label on them, they were coming from a farm that had different problems. They were used to different things - probably better quality feed than they are getting here. ... The BVD must have come in on those Hereford cows. Ours had never been exposed to it and they just got it.* [Geoffrey, Grandview Farm]

The presence of circulating BVD (Bovine Virus Diarrhoea) viruses destroys the credibility of animal labels, licenses, and tags. Farm animals cannot be treated as machines - as 'black boxes' - since each herd or flock has had certain experiences and hence possesses certain attributes (such as viral immunities). And even if their
physiology is apparently unchanged, the way they are put to work on farms and the
expectations of their performance have changed: 'I count myself lucky that I qualified [as a vet]
30 years ago whereby animals weren't formula one racing cars – they were just individuals' (Stanley).

Farmers change just like their animals. It was clear that each farmer in this study was
pulled and pushed in different directions by forces outside of the normal-farmer-standard-
farm nexus. As one vet described it:

The farmer is very influential because their attitudes to animals and how they manage
their farm obviously have a big effect on what happens. And attitudes are affected by
legislation and what the retailers say. But they are also affected by their own education
and by what their own family says and by what their neighbours say and by what other
people in the same business say. So the way that people act on farms is affected by a
wide variety of different factors going in somewhat different directions. [Sam]

Sam’s statement emphasises the importance of the age, family background, farm history,
business interests, personal associations and contact networks, and generational
characteristics of each farmer. The ages of farmers in this study varied between 24 and
69 and the average age was 47 compared to the British average of 58. Therefore, their
experiences of agriculture varied and variability was accentuated by the different
timescales for which they had been managing their organic enterprise. Tim suggested
how much of an influence the farm’s characteristics and its location can have on a farmer,
so much so that: 'In a way, you could look at the farm as being somebody’s employer and dictate their
career and how it goes. So in a way you could reverse the roles, couldn’t you?’ These are non-normal
characteristics derived from networks outside of the NFSF construct that contribute
towards the heterogeneity of farming practice. Farmers are often rule-benders and even
rule-breakers. Not everything is as transparent, regimented and controlled as the NFSF
model implies.

Plumb (2001) emphasises that the attitudes of farmers and styles of farming practice
differ between regions of England, but this study also revealed differences amongst
interviewee farmers. Tim from the Soil Association suggested that there are three ‘types
of organic farmer’, each sustaining and sustained by different networks:

You get those who are only in it for the money and they’re quite often fraudulent and
there are certainly a few of those and I suppose those are the people whose job it is for
us to get rid of and to catch out.... And then you get people who aren’t that interested
in the ethics but they are interested in producing the crop, calling it organic and selling it as organic for the money and doing it right — and they are in a way less hassle because whether or not they have the right ethics, they know what we need, they can fulfil all the requirement and they will do it right for you.... And then you get what we would call the ‘best of organic farmers’ — the people who are in it for all the ‘right’ reasons.... [Tim]

People in agriculture have in the past branded organic farming as a group of agricultural techniques based on ‘muck and magic’ and its practitioners a peculiar crew: ‘they used to laugh at us. Muck and magic they used to call it. ... But it’s strange now most of the farmers in the area are thinking of converting to an organic system.’ (Eric, 1999). The increasingly competitive nature of the organic food market weakens this notion of a community of organic farmers, of a solidified consensus of scientists. But despite this and regardless of its reputation with those outside the movement, Richard and others described all organic farms as spaces for controlled experimentation, conducted over long time periods and recorded by the observations of the farmer: ‘I am a great believer in experimentation. It’s an ongoing thing the whole time whether it’s a bit of drilling or weeding or leaving something untouched and observing what will happen if you don’t do something’ (Richard, Raddington Farm). My experiences of the farms in this study exposed significant heterogeneity of farming practices at different farm premises because of these processes of trial and error. It calls into question the very nature of organic farming is exactly. There was always an ongoing interplay between a fundamental emphasis on nurturing biomes in a manner most rewarding\(^1\) at each location and, as important, an emphasis on constructing and implementing a rigorous system of documentation, certification and inspection. Although farmers like Charles would contend that the definition of their organic farming system is pre-determined by virtue of their organic certification agreement — the second of these modalities -, the individual’s site-specific scope for variation is still considerable — the first modality cannot be minimised, still less discounted.

Farmers had to be reflexive in how they worked. This ability was jeopardised if they had to spend too much of their time negotiating the NFSF programme. Theirs was a

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\(^1\) I use the term ‘rewarding’ to acknowledge the importance of both monetary and non-monetary returns for the farmer.
proactive and reactive philosophy, not simply instituting the protocols of the standard farm but modifying as time went on.

There are occasions when you can see the theoretical support behind something but then you use your practical experience to really decide what you will do. And also those cases when the theory is all there but in practice it just doesn’t work out. So, so often you just seem to stick with what you know works. [Charles]

You’re always looking for the problem. You’re always trying to predict what is going to happen, how it's going to happen, and why it's going to happen. ... You're always trying to evaluate everything, always thinking ahead. [Andrew, Applesham Farm, 1999]

This attitude was also espoused by Tim at the SA. Even though organic standards are supposedly ‘fixed’ in rules and regulations, he acknowledged the need for a less ‘controlled’ NFSF model:

I think a lot of farming is about trial and error. And what works on one farm and on one soil type may not work at all for another. And I think that people shouldn't have fixed ideas about what organic farming is, and what a rotation should be, and what stock mixture there should be, what breed is best... [Tim]

Natalie advocated that her reflexive farming activity through experimentation developed her skills as a scientist:

But you’re a better scientist than you give yourself credit for because you’re a very good observer of what’s going on. And assessing the situation which is what science is. And you're doing bits and you're not calling it science but are calling it common sense. What I am relating it to is what is around me – I relate it back to what I see. Whereas science to me doesn’t do that. [Natalie, Narrowlane Farm]

And yet the room for such ‘trial and error’ was constrained by the economic risks of a new venture. The economic security of the NFSF model gives it its coherence – and in farmers’ eyes its legitimacy – and is what often encourages farmers to subscribe to it. In fact, Fred explained that the financial reward appended to the NFSF model secured the profitability of his enterprise as a whole, and could in fact enable him to experiment more flexibly in areas outside of the model.

The NFSF model does not emphasise the importance of scientists who influence the farmer’s management capability. But farmers suggested that different sorts of scientists and visitors supported the configuration of the working farm laboratory, although not all of this was on the basis of invitation and according to the farmer’s wishes. Commercial and ministry vets, inspectors, wildlife surveyors, footpath users, and anyone else invited or authorized to enter the premises were mentioned in interviews. These different
humans experienced the farm and negotiated its space over different daily, seasonal and spatial patterns. For example, a footpath user would only take designated routes through the farm, often only occasionally. Vets also gained an impression of a farm by their visits and by talking to the farmer. As one vet told me:

The first impressions when you walk onto a farm are vital. And if you walk onto a farm and you've got a tractor tyre with a puncture that's leant up against the wall and it's been there for a year... I think if the farmer when he's walking round his premises can't see those aspects - you know, which way is his brain working - if he can't see the untidiness of it. I mean that really slips into the whole of his enterprise. [Stanley]

Thus the scope of experiment for the farmer depends crucially on what that farmer 'sees' - the fact that he tours the space of the farm daily does not mean that he necessarily observes everything. Different visitors to the farm conceptualise farming science differently, since they have a different portfolio of experiences. But the farmer was always the key scientist in each farm space because of his/her extensive experience and because it was through their actions that the space was constituted.

3.1.2 The Farm-Laboratory as Control-Site: the scope of experiments

What the discussions have been pointing towards so far is the existence of a knowledge gap characteristic of the NFSF model. As Norman suggested: 'It is the experience gained from that experimenting that's important. You can farm by the book, but really you must believe in it' (Norman, Narrowlane Farm). The NFSF does not spell everything out, consider every locational specificity, nor completely control what happens on site - nor can they. The idea of the scope of experiments describes the flexibility with which science is practiced and is predicated in the extent of control. Important processes characteristic of experimentation may be to “observe, isolate, purify, intervene, control, vary, record, interpret” (Gieryn, 1999: 237). But the familiarity with and experience of these tasks is often specific to a particular study site. Through this empiricist intuitionism, location-specific knowledge is acquired. And that knowledge is important because, as Gieryn (ibid) remarks, ‘making it work’ depends on more than ‘skilled production’; even the most skilled technicians accept a number of ‘experimental failures’.

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*Both 'experience' and 'experiment' originate from the Latin word 'experiri', meaning 'to try'.*
The idiosyncrasies of farm-laboratories can be brought into view by charting the various farming and non-farming networks that are at work in a farm space. The conjunction of these networks, sometimes in collaboration and other times in competition, gives rise to experiments that are not controlled by the NFSF model. Rather, on most farms, 'experimenting' or experienced science is improvisational, often relying on tacit rather than discursive knowledge, and involving embodied memory rather than textbook formularies. This experienced science in practice is overlaid on top of the procedures of prescriptive and regulated science. In this way, farmers try to make their farm into a site that controls its own science in order to negotiate the disciplining accompanying the NFSF programme. These other modes of practicing farm sciences are being bred all the time and so intermingle with the 'controlled' grid-lines of the NFSF construct.

In effect, individual farmers experiment with the envelope of formal standards by learning from other knowledges and other histories which may reside in non-conventional farming networks. When refurbishing the farm laboratory into an agri-environmental system, for example, it is difficult to erase the legacy of the pre-existing agro-chemical regime and of other non-agricultural land uses. Louise remarked that it had cost her 'thousands' to remove all the 'little bits of plastic' from the silage-wraps left around the farm by the previous farmer. Put simply, all farms look different on the ground, but the way that knowledge and science, power and agency, are distributed within and between them is what distinguishes the farm laboratory as a practiced site. For many farmers therefore, this is a practice literally of 'farming sciences', because the farmer is weaving networks of associations from the heart of the farm laboratory rather than merely having directives imposed from the outside.

[JS]: As a human, as a technician, how much do you have control over the farm?

[Brian] Well my control weather conditions notwithstanding is pretty absolute. Why I feel most vulnerable if you like is because I have to buy in certain feeds of an organic nature whereas in an ideal situation an organic farm would be growing literally all of its own feeds for its own livestock. Using that same manure to grow more feeds for the livestock and so on – but it simply isn't practical on this holding. Otherwise I have virtually complete power unless the Ministry come in and say Foot and Mouth has arrived at the farm next door and irrespective of how they've treated their animals and how you treat yours, we're going to kill yours too.
The establishment of a rotation on site was key to management. Figure 10 provides an illustration of how the space of the farm is subdivided and annually planned.

Figure 10: An example of a rotation in practice at Oathill Farm

(Source: Henderson, 1944: i)
Farms like Raddington displayed a rotational management system that combined the use of various fields in different combinations:

Conventional agro-chemical farming’s becoming more and more specialised and more and more monoculture in its nature. Instead, we have a seven-year rotation that’s key – three years clover and grass, followed by winter wheat, spring oats, spring beans and winter rye and back to grass again. [Richard]

But since a farm rotation takes years to complete, its specific merits can only be evaluated after a longer period:

You set up a rotation. Four years. You have to have twelve years before you can tell you’ve got a stable rotation because you look at your wheat yields every fourth year and you have to see if they’re increasing or declining. And then if we see a fall or increase in the yield, was it because we had a difficult winter? ... It is very difficult to do what is proper science, what is properly controlled science, so it’s very valuable to be able to call on other people’s experience and other people’s formal science. But then you have to be able to understand the different factors involved in theirs and then modify it based on your local knowledge and your experience. [Queenie, Quaker’s Farm]

Other management rotations are overlooked and not necessarily considered science, such as clean grazing policies. Rotations were therefore designed to disrupt other cycles, to strengthen the productivity of the farming system against rivals and pests through arranging space-time (as Figure 11 suggests):

Rotations are a key part of organic management. And there is a very good reason. They work positively with breaking up pest and disease cycles ... and also for building fertility into the soils. [Trisha]

Experiments were therefore at such a complex scale that they could not be easily followed from outside of the farm site and reported on. But to the farmer these practices were critical to management.

I have already suggested that the farm is an expression of the farmer, a balance of landscape and landscaper. But this can be pressed further: farmers arranged their farms specifically to ‘suit’ their own requirements. In this way the farm is becoming more of a control-site in its own right:

So many farms – people seem to set them up what suits them. And through their own buildings, layouts, and one thing or another, you set up a system that suits you. You can’t say that – oh that’s a bad farm ‘cos he isn’t doing something. But the thing is if it suits that person and the animals are being looked after, being fed, you run a system
that you are happy with. There are no two farms that are ever the same. It is also so dependent on the farmer himself. [Harry, Hillside Farm]

Livestock farmers similarly arranged their breeding stock towards a particular product:

With regards breeding, we concluded that although we had been quite careful in our selection of the Holstein bull, our cows were getting too big and too rangy and too much the kind of American design of high input and output. So we've decided and started this summer to use semen from Ayrshires and Swedish Red, as not being dual purpose but being dairy breeds that haven't been swept down this line in the hopes that they will have greater disease resistance to mastitis and that sort of thing, and be more efficient forage converters rather than big eaters. The Holsteins are designed to stand in the yard and have huge amounts of food shoved in basically. That's not what we are doing here. [Charles, Chase Farm]

Figure 11: A pasture rotation designed to prevent problems of over-grazing

(Source: Cooper, 1961: 86)

In each case study, farms had one ‘farm manager’ and one approach to management. Their enterprises were often also distinct from one another and if farmers did visit another farmer’s premises – which happened rarely – they were very rarely there in an
advisory role. Specific agricultural advisors linked to the government were available for this role. William, a consultant working for ADAS (Agricultural Development and Advisory Service), explained that his capacity was only to advise and steer towards standard farm protocols, and not to recommend or interject.

Farmers’ ideas about ‘science’ confirmed the importance of methodological diversity and individual creativity:

So many people frame science as multinational big business, but really it is about knowledge and understanding and applying it to a method. My knowledge of the animals and the soils I can apply as a scientist. Of course it's all done on a feel. [Louise, Longsbottom Farm]

Indeed, the way ‘science’ is typically framed alongside ‘big business’ led some farmers to feel resentment towards its methods and practitioners:

I think of it fairly negatively — I think of technicians in laboratories in comfortable enclosed environments seeing only a small part of the whole picture. Looking only for problems and addressing more the eradication of a prob than looking for the root cause. So I tend to see it fairly negatively when I think it should be — in a sense I am a bit of a scientist around the farm because I’m constantly observing, changing my working practices or my methods of care to suit what I am observing. And that takes into account the whole farm — or more than the farm — the whole thing ‘cos my eyes are open and I am outside of that microscopic world. [Brian, Broadleaves Farm]

Under the standard farm regime, the normal farmer is taught to accept — to have faith in — the abstraction of pre-ordained and pre-tested science. But in practice farmers saw science as (literally) a much more ‘down-to-earth’ affair:

Well I would say it's the anecdotal science if there is such a thing. Pretty well everything you do on the farm could be argued as scientific but a scientist would say that it's not at all scientific. It is a difficult one. There is a lot of knowledge about but not enough wisdom. It would be nice to see more wise science or applicable science.... We have a few sort of rules that we follow that have science at the heart of them but we don't regard them as science. You've got everything in farms really — you've got chemistry, botany, soil science, biology, zoology, physics — something for everyone. [Richard, Raddington Farm]

Indeed, many farmers were sceptical about ‘agro-chemical conventional’ farmers who had simply ‘followed the book’. As Brian put it: ‘Agro-chemical conventional farmers have a much better knowledge of the outside world than they have of farming.’ In his view, a normal farmer following the standard farm protocols takes more direction and inspiration from what is occurring and brought in from outside, whereas he saw himself as following his own
instincts, putting into practice his own science whenever possible. Brian could financially afford not to subscribe to the subsidised agri-environmental schemes by diversifying his beef and sheep enterprise to include specialist pork and marketing this directly to restaurants in London. In short, among many organic farmers there is a conversation of sciences – a process of negotiation in practice – more than an abstract application of scientific protocols standardized towards a replicable product.

With mechanical things - things are invented and they are put together and when certain things happen you know that things will rotate and that sparks will ignite this and things will work mechanically. But with things to do with life – plants or animals – the way cells multiply and things grow – it is coming from almost nothing. I think farming is a science – you are dealing with natural cycles and they are all part of science. [Pat, Partridge Farm]

In changing from an agro-chemical to an agri-environmental approach, farmers have had to look more specifically at resources at their own location and see their own farm space as a control-site for profitable cultivation through science, rather than always relying on ‘the [fertiliser] bag and the [medicine] bottle’ from outside.

Nowadays you've got to look for more sort of soil fertility in order to try and produce something off the ground. Soil pH and that is probably going to be a bit more important whereas before you went out with an extra bag of fertiliser to sort it out. If it didn't look green, put on a bit more, and it would usually have come right! [Harry, Hillside Farm, 1999]

The ‘conversion’ of the farm and farmer to the organic system, as we have seen, requires a particular set of exclusions and inclusions to be made. The fact that it is indeed called ‘conversion’ and not ‘application’ suggests that an existing arrangement has to modified rather than a blank space built on. In our conversations, farmers often referred to an ‘organic mindset’ which, so they implied, was established once the farmer’s thought-processes are allied not so much to the NFSF model but to a culture of farming as practiced from the farm control-site. It takes at least one full rotation for the practices of organic farming to stabilise in the farm-laboratory space. The conversion process is therefore in effect two different processes: conversion of land then of farmer. Geoffrey was weary of farmers who had recently started the process of conversion and had not yet established this moulding together of the cognitive and the practical. They could therefore be following the NFSF model, but doing so by farming by the book and not by – what Louise referred to as – farming organically ‘for the love of it’. Louise suggested that
some of the farmers who were converting were liable to split from the culture and philosophy of organic farming if the NFSF programme reduced the funding allocation. And yet at the same time, Louise explained that farmers could at first follow the organic rules of the NFSF model and then later internalise this discipline and develop this into a new philosophy of management – ‘the organic mindset’.

No farmers in this study suggested that they could accurately plan how they were going to execute the requirements of standard policy legislation over the coming year:

The SA always ask for a forward cropping plan even though we just basically graze the grass, they want to know which animals are going to be where when. And I always say well how can you tell. If it's very cold and the grass won't grow, we'll have to move them on quicker and if it's very wet they'll have to move up to higher ground and that sort of thing. They don't seem to understand. They think you can just do it all by sitting at your desk and planning what's going to happen in the future but you can't do it like that. [Norman, Narrowlane Farm]

Farm science could not be controlled and predicted quite as the NFSF model assumes. Just as the farm standard cannot be accurately set in the offices of Whitehall, so the farm cannot be planned in the office of the farmer. Also, the NFSF construct is not scripted directly into bare earth, but its regulatory regime is differentially inscribed over pre-existing irregularities and specificities. The outcome is thus variable; it is not a normative socio-spatial form.

Knowledge transfer is not always unidirectional from the outside to the inside of the farm. Farm-laboratories are not sites where one form of science is mechanically ‘applied’ or implemented’; they are also sites in which science is constantly debated and shaped. As the farm-laboratory space becomes established as its own control-site, it develops knowledge that is transferable outside. In this particular case, some farms were much more open to others’ assessment, especially Chase Farm which has various open days and media events. Fred sought to replicate his experience of Chase Farm when he established Fairbanks Farm. Also, institutions organised by farmers are on hand to contest and offer revisions of policy. When individuals come together in these ways, they themselves can inspect the inspectors. Returning the gaze, the farmers may look out for one another. Contrary to the isolation seemingly built into the NFSF model, farmers learned from each other and routinely exchanged ideas, and occasionally even machines
and livestock. The National Farmer’s Union (NFU) plays a prominent part in this process of knowledge production and dissemination, and is increasingly activist through the lobbying efforts of its President, Ben Gill. In concert, farmers could pressure the central surveillance and regulatory institutions into changing their prescriptions. The NFU works at both national and regional scales, but other organisations such as the West Dorset Food and Land Trust operate locally, and in fact many of the interviewee farmers had further diverged from the population of ‘normal farmers’ and the ‘standard farm’ through more localised initiatives. Five farmers – Irene, Charles, Mike, Queenie, and Richard – sold produce at a farmer’s market at least once a month. Four farmers – Jack, Pat, Harry, and Ken – had joined the Organic Livestock Marketing Co-operative (OLMC), an organisation formed by organic farmers in 1996, and had been able to increase their returns and their economic security this way.

In summary, the process of moving from experimentation to the stabilization of knowledge is a process of increasing abstraction. The knowledge informing the NFSF model is increasingly removed from the farm-site and so it is an abstract model of procedures more than experiments based on uniform knowledge. But on the farm as the control-site, there is experimentation and this tends to lead to multiplicity of science. This is why the NFSF model breaks down; the standardized, uniform knowledge it provides for national policy is far removed from the multiple, heterogeneous experiences on individual farms. This was evident in the way the SA decided on new organic standards, as shown in Figure 8. The practice of farming has much more in common with experimenting than with applying rigid procedures. Farming successfully requires knowledge at the farm-site and that is why farming knowledge is more sedentary than transient. The way knowledge is translated is not always a logical, rational or economical progression from doctrine to indoctrination. In short, one might say that the standard farm protocols attempt to impose a system of knowledge on farm/ers and in the process they become more abstract, and so they risk becoming inapplicable.

Farmers directed their own science (to different extents) despite the pressures to conform to the standard farm protocols. They all viewed their knowledge of their farm space as
superior to anyone else's; they are site expert, but for the occasions when ancillary personnel are required. For example, the physical space – topography – of Dinglewell Farm undoubtedly moulds Dennis's knowledge. The creation and exchange of local, personal knowledge operates in this way on site. This diagram from Shucksmith (1993: 468) helps to summarise the many influences on farmer behaviour (Figure 12):

Figure 12: Controls on farmer behaviour: actions, structures and dispositions-to-act

![Diagram of controls on farmer behaviour]

The sovereign science – the science of artifice, control and precision – attempted by the NFSF model cannot be enacted. Science is made on the farm and not just imported there. There are difficulties and weaknesses of relaying 'normal' science from a control-site beyond the farm perimeter and so the 'standard farm' is not always the product. The idea of replicating the NFSF 'by the book' – by what Latour would refer to as an 'immutable mobile' – is stretched, because the standard farm textbooks and documents have to be made referable to the real world. They are mutable because they are open to different interpretations. In fact, for science to 'work' elsewhere, it needs to be adaptable. Mutability makes science possible. The next two sections both aim to sharpen the focus of these debates: firstly, since the farm is increasingly its own control-site, practices are planned and experienced locally; secondly, that these experiences bring into play a host
of other agents and networks; and thirdly, how knowledge is extended between farms and outside of the NFSF model.

3.2 ‘Sciences’ of Farm Animal Health

3.2.1 The Veterinary Practice

The health and welfare of farm animals illustrates conversations between sciences that take place on the farm. Veterinary practices are organised centres for veterinary science. Each practice differs in its animal focus and each has a group of veterinary surgeons with different experiences and interests. But there are common characteristics to their organisation. I want to discuss the formalisation of this science ancillary to farming; one that does not fall within the NFSF model but is instead implicit in it. This is largely because the NFSF model cannot prescribe veterinary science from outside the premises. I hope to show that vet science shows a tendency of all laboratories: that is, to rely on the knowledge and experience of other laboratory systems and not to remain in isolation.

Veterinary Science

Ken, one of the farmers I interviewed, reminded me that healthy livestock are profitable livestock. Such vitality has traditionally been provided by the combination of using careful management techniques and veterinary services. As one vet put it: 'If I keep my farmers in business, I'm in business' (Stanley). Stanley also explained that the farm veterinary service is an established network, although its role has 'moved from the fire brigade of going to see an animal that is ill to part of the whole preventive medicine and production cycle of the farm itself', entailing routine consultation and inspection. Veterinary surgeons may be required for pregnancy diagnosis, artificial insemination, bovine nutritional advice, and for drafting a farm health plan. And yet like many farm services, these agents usually only enter the premises on invitation. In fact, many farmers are increasingly reluctant to use conventional veterinary medicines and incur their high costs, and in consequence farm animal practice is now a declining proportion of veterinary activity. I interviewed vets at
two different practices, and at both, farm work was still an integral part of their enterprise. Each vet treated each farm premises as a different scenario:

Mentally it takes me on there 100 per cent. Physically it takes me on there 90 per cent of the time. Because when I say mentally 100 per cent, when I have a farmer ring me up that wants to use a particular vaccine and I advise him to do that, I am mentally visiting the farm. [Stanley]

Veterinary practices are regulated and supervised by the Royal College of Veterinary Surgeons to protect – as Stanley suggested – ‘the interests of the public’ but also animal welfare.

The principles guiding veterinary practices are explicitly framed as a formal science and they entail making and comparing fieldnotes in a similar way to how farmers record the activities of their farms, but vets have a different perspective. One vet told me:

I think it's a very scientific business, especially on my side because I'm dealing with the disease situation, conformation - it's very scientific.... I am relating my findings, my papers, or somebody else's scientific papers into practice.... I record everything I do on a farm. It's in a bit of a code there because I report to various journals with it. But you do record the important things - or what you perceive as important - in your diary, there and then. I carry it around and it all goes down. [Stanley]

Vets also treated the farm as a laboratory. Simon, a research vet who teaches and conducts investigations into veterinary science, explained:

I think 'laboratory' conjures up ideas of chemical analysis. But I think other people must think of it as a workplace. But I have never really viewed it as such.... For me very often the farm is the laboratory but it is not me that is on there, it's some poor research student.... [laughs] Having said that I would probably far rather be probably on the farm than sat here writing papers! [Simon]

Like other scientific practitioners, vets relied on a selection of tools and apparatuses, the most indispensable of which for Stanley were: 'a thermometer, stethoscope, hands and eyes. That's about it.' Sarah acknowledged other tools that could be used in special circumstances:

The basics would be thermometer and stethoscope. You would usually have sort of special tools like a foot knife and most things beyond that you actually do with patience and listen to the animal. Ultrasound machine is something which is carried quite frequently now, especially for fertility work. You might have something like a stomach tube either to administer drugs or if an animal is bloated to actually release gas. And you would have a small surgery kit with you as well so you could do a caesarean section.... You might ask them for water and you would probably expect them to have a crush to restrain the animal. The majority in the back of your car would be drugs and needles and syringes and son on, but you would have foot clippers and you may have your own rope and so on and you might have some surgical instruments and sutures. [Sarah]
These tools are operate as machines in some form: for example, the stethoscope is simply made up from rubber tubing, earpieces, and a bell, but it functions as a complex piece of machinery by transmitting profound and invisible events along a semi-tactile, semi-auditory axis.

Stanley contended that: 'My vehicle is my surgery'. Indeed, his Landrover was a mobile laboratory, stacked high with different drugs, clothing items, and animal handling aids. This Landrover-laboratory connects the farm-laboratory to the veterinary practice’s surgery through the agency of the vet. The vet and his assistant require this portable equipment as they navigate between farms so that they do not routinely have to bring animals back to the surgery. This mobility enables vets to travel for ten minutes down the road and onto another premises, into another farm-laboratory where their expertise is required. Between farms, Stanley is 'basically using intuition and clinical impression' in his comparison of farms, whereas farmers often only have experience of one farm and one group of farm animals. Stanley further strengthens his position by adopting the laboratory and surgical space of the 'specialist farm animal laboratory', linked to the farm laboratory by the Landrover: 'You must appreciate that taking lab tests or samples for the lab tests from farm animals needs a specialist farm animal lab to – one to do the tests and one to interpret the results' (Stanley). Simon, a veterinary researcher, conducted himself and his experiments on farms such that the same methodology could be followed by others from scratch.

The aim is to describe the work you've done in such a way that it could be done in entirely the same way by a novice reader.... I would describe things like the soil type, the latitude and longitude of the farm where it was conducted. I would describe how the cows were milked and things like that. So reasonable.... [Simon]

Mutable Animal Science

When the farmer contacts a veterinary practice and 'calls the vet out', s/he is seeking the vet's expertise in curing animal disease. Because animals are not machines, as I have suggested, they need individual examination and not a uniform prescription for care. In a case that I witnessed, the vet arrived to find a cow with suspected mastitis already prepared for consultation in a cattle crush (Photograph 7 shows unoccupied cattle
handling facilities, including a crush, and Photograph 8 reveals how a herd might be brought into this space, and each animal into the crush, for routine treatment).

The crush as a restraining device enabled the vet to inspect the immobile animal at a distance and to carry out a diagnosis based as much on observation as any exploratory or invasive technique. This became evident as I asked Stanley questions:

[JS]: Does your knowledge of the anatomy and physiology of the cow affect the way you understand them?

[Stanley]: It shouldn't do but I do. I do because one of things that I try and teach students is the fact that when you look at an animal, you can often tell more from five yards than five inches, because you're looking at the general demeanour of the animal. You're really translating in technical terms our feelings onto that animal. You're looking at the cleanliness of the animal, the general demeanour...

[JS]: So you don't often have to actually be invasive?

[Stanley]: No. What you do is stand from afar, look at the animal before you do the individual examination.

[JS]: Is a lot of your knowledge of the internal functioning of the animal black boxed?

[Stanley]: Well, what you do from your stand off and your close examination is trying to categorise that animal as to what's wrong with it, and then interpret it into a herd situation. The two phases... And then there are the two stages – the molecular level and realistic level – at which you work.

The way Stanley practices veterinary science has been routinised to involve 'two phases' (assessment of individual and of member of a herd collective) and 'two stages' (scopes of visual interrogation). With overalls removed and disinfectant applied, Stanley the vet left the premises.

This episode illustrates how the vet only visited a small part of the farm space and only one of its subjects. And yet Stanley did not feel that certain parts of farms were closed off:

I never feel that anything is 'closed off' for me. But in the true sense of the word, with some of these dairy farms, when I go weekly I can get so involved with the backside of a cow that at times I am not walking fifty yards up the yard and seeing what's actually happening in the farm. But nothing's closed off for me – from me walking up the yard and seeing what's happening. [Stanley]
Photograph 7: The vacant cattle handling facilities at Talltrees Farm

Photograph 8: A cow restrained in a cattle crush during treatment at Talltrees Farm
Examining the animal as it is prepared in the crush – in effect a clamp to restrain the superiorly powerful animal – was common practice for the vets. Using this same prepared consultation area reduced the time and hence costs of the veterinary visit, but as another vet explained it also:

...can be a problem. I mean if I thought that that one animal that they present is an indicator of the problem then I would ask them if I could walk around the other animals or whatever I want to see. But you can miss those things. You can be so busy that you don't follow things up and also I think a lot of times farmers – I don't know whether it's pride or - they may not necessarily come straight to you and say ‘I've got a problem’. So a lot of times you have to keep your ears open because they may drop a hint in a roundabout way. Whereas if you actually made it a habit to walk around just around the entire farm every time, you would pick up problems and you could then say – 'did you realise...'. Proactive rather than reactive. [Sarah]

The vet’s respect for the animals themselves was never in question, and they became subjects when under individual examination: 'I treat them as subjects, but they are objects in the herd. So I treat that individual as a subject and then translate the findings of that subject into an object of the whole herd' (Stanley). This holist philosophy reflects the necessity of not considering a case in isolation.

A vet’s ability to collate information from many animals on many farms augments his knowledge obtained from books and academic papers and must be compiled together in an appropriate format:

You come down to pure scientific knowledge. You know that a cow with a particular disease stands very little chance of becoming pregnant say. So I've got to transfer that knowledge when I am examining that particular animal as to me advising the farmers to the prognosis for that particular animal. So I can have the book knowledge but I've got to examine the individual and recognise the signs in the individual before we can do anything.... The knowledge you get from papers is scientific and it's up to the individual to break it down into terms that.... It's also no good me putting standard deviations or whatever into a client report. I've got to break it down. It's a different language – the language of science is in a different context and we've got to bring it down to a context which can be understood. [Stanley]

James Herriot reminds us that the knowledge gleamed from books has to be put into context:

They didn’t say anything about this in the books, I thought, as the snow blew in through the gaping doorway and settled on my naked back. I lay face down on the cobbled floor in a pool of nameless muck, my arm deep inside the straining cow, my feet scrabbling for a toe-hold between the stones. ... My mind went back to that picture in the obstetrics book. A cow standing in the middle of a gleaming floor while a sleek veterinary surgeon in a spotless parturition overall inserted his arm to a polite
distance. He was relaxed and smiling, the farmer and his helpers were smiling, even the cow was smiling. There was no dirt or blood or sweat anywhere. (James Herriot, 1970: 7)

The farm is not like a book and can only be read like a book if its script is legible and its language is understandable. But Stanley explained how with each animal patient, his knowledge draws on his and other documented experiences in a circulating reference. All farm animal knowledge has been learnt on a farm or laboratory somewhere. Knowledges cumulating and circulating across multiple times and space are organised together as if they come from one central farm. When an animal is administered a particular drug or operated on in a certain way today as a means of prevention or cure, a host of apparently absent agents – what Latour would call actants – are called upon across time and space to constitute this knowledge. It is these experiences of many other vets and animals which the vet then applies at one specific farm site. An event that happened 15 years ago on one farm in Dorset may inform a vet of a recommendable course of action 15 years later on a farm in Warwickshire. Therefore, veterinary science is a formal and widely disseminated science which operates as if it were one large laboratory system using many farms as testing grounds.

It is not just knowledge that extends between farms. The implications of the veterinary visit often extend beyond the area the vet treads. The drugs that the vet prescribes trace a different pathway through the farm space. A farmer or vet wearing protective latex clothing may administer Ivermectin, for example, a powerful wormer fluid, orally or as a spinal pour-on to a restrained animal. As Pat suggested, Ivermectin is typical of the ‘agro-chemical armoury’ in the war against those elements that restrict productivity. It was criticised by Eric as being characteristically used by those pertaining to ‘a pill for every ill’ and ‘quick fix’ philosophy, as opposed to preventative management. This chemical hybridises with the animal as it takes a route through the body, but surplus Ivermectin and additional by-products may be discharged onto the soil where another group of vectors and bodies negotiate this virulent and resistant chemical. The agency of these chemical residues is unmistakeable. Soil invertebrates are killed when this

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3 We are reminded of how Latour maintains such military metaphors in his account of Pasteur’s ‘war against microbes’.  

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chemical is delivered at a certain concentration, which manifests itself visibly as less fertile patches of ground and less visibly as damaged soil structure and fertility. Wesley described an instance when a deficit of knowledge on trace chemicals cost the lives of many of his pedigree Ayrshire cows. His herd were being fed a recommended supplementary feed sourced from South America and were concurrently losing condition and even dying. After almost three years of expensive testing and trial and error, a young vet realised that the fluorine content of the feedstuff exceeded the recommended maximum by 500 per cent. No previous analyst in veterinary laboratories had detected this or even thought to test for it. It illustrates the risks of importing black-boxed feedstuffs from uncertified and untraced sources, and the importance of key scientists in breaking new ground in testing.

**Vets working with Farmers**

Vets and farmers have different perspectives and understandings of farm animals out of the context of the farm since, as Figures 13 and 14 suggest. The farmer’s interest is more on the animal as food product rather than as biological organism. But the farmer’s situated knowledge is critical for the vet who is not at that site with those animals daily. The interrogation of the farmer by the vet was therefore of central importance. In effect, the farmer was speaking on behalf of the cow. As Sarah explained, generalising from this, there were regular consultation procedures that vets followed:

First of all you would ask why they are concerned. Obviously you don’t expect them to make the diagnosis but they just say ‘oh she hasn’t eaten for three days so’.... You would depending on what the case is, you would probably ask about the others and any sort of recent history so what have you been feeding them, has the bull been in, or whatever. Then usually you would actually look at the animal herself – listen to it and feel. And then depending on what you think the problem is you then go back and ask questions to come to a better diagnosis. [Sarah]

Learning from the farmer’s experiences and intuition is critical. As Dennis explained, each field on Dinglewell farm has a different latent risk susceptibility, to threadworm eggs, Redwater, flukes, or Blackleg, and his own local knowledge can aid the vet’s diagnosis.
Figure 13: A veterinary surgeon’s knowledge of a bovine skeleton

(Source: Robinson, 1943: 460)

Figure 14: A farmer’s knowledge of the cuts of meat on a bovine

(Source: Robinson, 1943: 587)
In a similar way, authority on a question of farming seemed shared between farmer and vet, depending on the issue. Geoffrey praised the perceptiveness of his vet who 'stands and looks at the animal rather than making hasty verdicts', and Stanley suggested that rather than being a presence in a white coat, the farmers 'treat you with a mutual professional respect'. Harry suggested that when he pays for a veterinary service, he is paying for professionalism and so would not question the drugs to be administered. 'I don't think I've ever questioned because I don't think the vet is going to start giving you drugs that aren't any good anyway. So I trust their judgement. It's like when you go into a hospital, are you going to question the judgement of the doctor?' Stanley confirmed how labelled drugs are black boxed as trustworthy: 'They don't even know and they don't even ask.' But Sam highlighted that it is the farmer who has to be relied upon to administer the drugs in the manner and frequency as prescribed. Occasionally a farmer would take animals or samples to the veterinary surgery:

If I have a problem with the lambs and it seems like something's up, I take a sample immediately into the vet – a dead animal, faeces, a chunk of wool with a scab on it. I get the vet to check what it is and see what conditions is producing it. I very much use my vet as a key to my management. [Ken, Kestrel Farm]

But except for during routine testing, it is the individual farmer has to decide at what stage in disease prevention, diagnosis, and remedying that the veterinary surgeon should be called. In view of the financial predicament of most farmers, Sarah explained that the vet is usually the last resort and, in effect, often has to prescribe the 'bullet' – the slaughtering gun – and not the 'bottle' – the drug.

3.2.2 Reconciling Remedies

The plethora of rules about animal housing, feeding, transport, and so on, laid down by both the government and bodies like the Soil Association, help to ensure a minimum standard of farm animal welfare. The veterinary service comprises the main formalised supplementary science that supports these standards. As a reputable scientist with an array of experience and an army of co-agents, the vet seems in a strong position. But, the farmer does have some autonomy in what science animal health science is practiced on the farm. To illustrate this, I turn to the relationship between formal veterinary science – a science that relies on drugs – and the more informal science of homoeopathy – essentially a preventative medicine that builds immunity amongst animals. Homoeopathy
was used continually by 47 per cent of the farmers in this study. A further 40 per cent used it occasionally, yet 13 per cent remained deeply sceptical of its ability to support welfare. The farm becomes its own control-site where both sciences interact: through conflict, competition, and cooperation.

**Conflict**

Animal welfare was a breeding ground for controversy in discussions with farmers and vets. According to one vet: *'the farmer is very suspicious of the views of the scientist about things like animal welfare. What the farmer thinks is animal welfare is quite different to a scientists’ view'* (Simon). Indeed, part of the reason why the proportion of veterinary activities concerned with farming has declined is because of the growing appeal of the main alternative to this science, ‘homoeopathy’:

Yes, homoeopathy is scientific. But we obviously haven’t had five years training on physiology and anatomy which is where the vet still comes in in terms of diagnosis and that sort of thing. But that doesn’t necessarily mean that homoeopathic science doesn’t give you as much of an ability to treat a sick animal. And it can take a fair bit of concentration and detailed study to get the right remedy. [Charles, Chase Farm]

Homoeopathy involves identifying the health problem early in an individual animal, specifying exactly what nosode is most appropriate for the individual and the herd, and following the course of ‘preventative treatment’ until all animals are fully fit.

We look at it as a very positive way of treating a sick animal. It takes quite a lot more understanding because it’s very very subtle and it’s very precise in terms of the fact that you do need the right remedy to make an animal better. We’ve had some spectacular results with it. The thing with an antibiotic that is so easy is that it’s a pretty broad spectrum and if the animal’s not very well and you give it an antibiotic it’ll often reduce its temp or make it come right that much quicker.... Someone once gave me an analogy for it. If you think of it as a very fine wire. The finer the wire, the easier it is to get through.... There is actually scientific data now – it’s energising the water and there’s something to do with the memory of the water and there is a change that goes on and they’re just beginning to sort of understand how it works. But I’ve no question in my mind that it works. And very often when it works it is very spectacular – that means you’ve really got the right remedy. [Richard, Raddington Farm]

Like any science, it requires discipline and planning and is supported by a host of other knowledges and machines:

I’ve had great success with it. It’s the whole system. You also have to be kind of disciplined about it. It’s preventative instead of curative so I have my plan of the year.... But you’ve got to be disciplined about it so that the right thing goes in the trough at the right time. And you have to hold your nerve – it’s very frightening –
because you go – it gets worse and worse and your dosing and thinking my god. But when it does resolve itself, it resolves without scarring, without any visible sign that that animal's had anything wrong at all. And you don’t get that if you inject an antibiotic into the eye. [Louise, Longsbottom Farm]

In his description of homoeopathy, Brian – who manages a bio-dynamic farm – adopts the rhetoric of conventional science in an attempt to justify his practice, but ultimately decides that the proof of the science is in the eye of the beholder – seeing is believing:

What I see before me is the application of certain remedies to certain symptoms that leads almost always to cure. What better evidence could there be? The fact that neither I nor people who know much more about homoeopathic remedies can actually explain how they work is immaterial. I don’t need necessarily to know how something works – the fact that it works is good enough for me.... I don’t need to know how the sun rises to realise that it has risen. ... I don’t know how to explain the way it works – it’s not a science in as much as it’s known that in some of the remedies for example – the main constituents of that remedy are no longer there. They are not detectable – they are so dilute. And that the more dilute that constituent, the more powerful the remedy. That goes against everything we’re taught. But I think for me the logic of imagining how small a molecule is and an atom and how cell structures are made and so on – it’s fairly logical to me that things of a very dilute nature could have an action at primary levels. But I’m just waffling really, aren’t I? As I said, they just work. And they work staggeringly well. The biggest mystery to me is that they are not used never mind more widely but almost exclusively. I don’t see a physician for modern medicine other than the great improvements that have been made first and foremost in anaesthetics, which has allowed surgical practice and which has hugely benefited mankind. Surgery, anaesthesia, pain killing. Those three avenues apart, I see no need. [Brian]

Both veterinary and homoeopathic approaches relied on systems of knowledge and skills, and Pat presented these approaches as substantially different, even though both could be used on the same animal:

A lot of very efficient agro-chemical farmers are very knowledgeable, but a lot of their knowledge contains the armoury of what dosing to do just right when and what date to put on their nitrogen and what date to cut it to get the right ‘D’ value and all those things. There’s a lot of knowledge necessary to be an efficient agro-chemical farmer. Whereas an organic farmer using homoeopathic methods as much as possible – there’s a lot more knowledge needed there and we’ve only got a moderate amount of homoeopathic knowledge but the amount you need is very great I think. And when we’re stumped we ring this company in London – Ainsworth – that supply it. [Pat, Partridge Farm]
Some interviewees had adopted these techniques because they had become so disillusioned with the environmental impacts and dangers of drug therapies prescribed by conventional vets.⁴

All these drug administrations have withdrawal periods so that the residue is at "an acceptable level". Well, it's that "acceptable level" that I question. People are constantly consuming food that has got this acceptable level - I believe there is a cumulative effect. [Pat, 1999]

Many interviewees seemed to agree that, as a result of agro-chemical farmers routinely using prophylactic measures, in some cases even illegally, new animal health and environmental problems had arisen. Homeopathy claims to treat animals as individuals, working through preventative management with the whole herd, and not through the collective administration of drugs.

By relying less on the vet and more on his own knowledge, the farmer becomes increasingly the animal health scientist rather than merely the technician. The homoeopathic farmer often prepares the nosodes that he gives to the animals himself. Consider Ken’s ability to perform detective work on nematodes: "I think a lot more people have got to think about having their own microscope and looking at it and thinking this is a worm, this isn't a worm - what else is it?" (Ken, 1999). Homoeopathy allows the farmer to source the remedy and consult the distributor directly – and even creative his/her own remedies –, rather than relying on the labelling of drugs by agro-chemical companies. The farmer not only decides what enters the premises, therefore, but also controls how this remedy is to be administered in the space of the farm.

At the organic dairy farms in this study, homoeopathy was the preventative treatment used in over 90 per cent of cases. This popularity is not surprising since it is imperative to minimise the withdrawal periods associated with administered drugs to safeguard milk production and sales. Organic rules specify that, as a precaution against the risk of drug residue contamination, animals are withheld from slaughter for a period after treatment of not less than 14 days, or three times the recommended period (Redman and Holden, 1994). But with homoeopathy, the convalescing animal does not have to be partitioned

⁴ Their disillusionment, it must be stated, is not with the vets themselves but with their dependency on conventional drugs for treatment.
off from the productive herd. The science of homoeopathy is largely preventative as it works by enhancing immunity and its success depends on maintaining a healthy livestock population through careful management. This is why it is a form of health science that must be delivered by those regularly on site.

Although the consensus amongst interviewee farmers was one of support for homoeopathy, two individuals saw it as inadequate, non-progressive and potentially dangerous.

And I know people who use these homoeopathic treatments. The thing is though, they’ve spent years producing injections and bloody penicillin and one thing or another and why not use it! It’s proven to work and ‘cos someone wants so-called, you know.... I mean, you’re not going to go back to driving a Model T Ford are you? People like the latest in technology and why not if you can sort of like worm cows and keep them healthy, why not do it through medicine. It seems silly.... They want us to farm in the Dark Ages. [Harry, Hillside Farm]

Simon, a vet, was discontent about what he saw as an over-confidence in homoeopathic remedies by some farmers, which occasionally led to catastrophic welfare problems. In summary, both drug-based and homoeopathic-based treatments have different benefits which can be considered against each other. But organic farming practices have embraced homoeopathy because it can be more easily controlled and its potential side effects are far less harmful.

**Competition**

Although all interviewee farmers agreed that homoeopathy is scientific, the extent to which they trusted and adopted its methods varied. Such practitioners were sitting on the fence to see which techniques came out on top in different competitions. Harry performed his own experiment to determine which technique best cured BVD (Bovine Virus Diarrhoea) in his herd:

I actually did a bit of a trial because we, I suppose, bought in calves to rear up for the sort of suckler herd. We had this BVD. A couple of years ago, out of the sixty cows we calved, we lost half the calves with it. I was talking to a chap and there’s a homoeopathic treatment and an injection from the vets, so I done half the cows with the homoeopathy treatment and half the cows were injected with treatment from the vets and that. And more of the animals on the homoeopathic treatment were not pregnant, ... I think it was like six or eight barren animals on the homoeopathic
treatment, whereas there was only two on the injected ones, so I've injected them all since. [Harry, Hillside Farm]

Since homoeopathy is not as established a science as veterinary medicine, its strongest supporters often point to the successes recorded on their own premises and through their own experiences, rather than referring to formal documents and national records. In this competitive arena, farmers tended either to dispel mythical stories about homoeopathic science or to weave new narratives to weaken the status of its alternative. These processes all entailed fabrications of networks:

I have to say I don't fully understand homoeopathy. I use it though. But then again I suppose you don't know exactly how all the drugs work. But then you've got a tested system – it has been demonstrated. ... Antibiotics are very effective against mastitis but it now recently turns up that a lot of mastitis is not an infection but just inflammation. And therefore treating with antibiotics is really nonsense. So you treat with an anti-inflammatory not an antibiotic. But it happens that antibiotics have an anti-inflammatory effect as well as an antibiotics effect. So the fact is that they work on mastitis – whether or not it is an infective mastitis – is because of the anti-inflammatory effect as well as the antibiotic one. And people didn't realise that and they did the work and they concluded that antibiotics worked for mastitis. And they were right. But they were right for the wrong reasons. And that actually annoys me sometimes because that statement has meant that they have been overused. But I would love to see homoeopathy get tested. I would love to see nice simple controlled trials with a standard for comparison. I actually have quite a feeling that if the animals are basically well and I keep a jolly good eye on them, I would probably be as well as if I just gave them an antibiotic and left them.... I strive for positive health instead of thinking how to cope with disease. [Queenie, Quaker's Farm]

The decision-making process is impacted by 'welfare perception [which] comes from the individual herdsman and the individual farmer' (Stanley). This is particularly important with preventative medicines where timing is crucial. Similarly, the condition of the animal and its immunity prior to intervention with a drug affects the success level, especially since homoeopathic remedies are based on immuno-enhancing ability. Together, it is clear that a farmer's attitude, his/her ability to diagnose and to time when to request advice, and the general well-being of his/her livestock all influence the competitive relations of the two sciences. It is not a single trial of strength between the two sciences but a multitude of trials at each site between different networks which depend on various contingencies. Interestingly, the size of the farm unit does not necessarily affect which science is preferred, although homoeopathy can be very time-consuming in its early stages of learning. And homoeopathy is – like veterinary medicine – still in a process of learning:
I would like to see the day when drugs are banned in all organic farming systems, but we have to have acquired enough skill with our homoeopathy to replace them and we're maybe two or three years away from that. [Andrew, 1999]

If the farmer did decide to call the vet, the vet's statement about the diagnosis and prognosis would not necessarily be taken as 'truth' in the view of one vet:

Thirty years ago, if I went to your father, and said – 'you've got to smack that cow twice on its rump, twice a day, and it'll get better', he wouldn't have questioned it. But today.... I think it's just people are questioning professional decisions these days. [Stanley]

The ability to make a correct diagnosis relates to the question of whether a farmer and a vet possess different knowledges rather than simply different trainings. Stanley associated knowledge production with the farmer's ability to detect a problem at the outset and to then effect a change:

A vet's knowledge is not necessarily different from farmers'. It's the fact that I'm an impartial observer of that farm enterprise, so hopefully if the farmer respects my opinion that I can go in, advise something – something the farmer's often thought about but not put into practice – and I can be just the catalyst for him to put whatever practice he's been thinking about into practice. [Stanley]

Under writing these decision-making processes is the fact that: 'you've got to prove that there's a cost-benefit to the exercise that you are doing'. And in circumstances when farmers are confident that their knowledge is sufficient, the onus falls increasingly on vets to prove their economic value.

There was a case at Partridge Farm where the final arbitrator in the competition between sciences was the coroner. A calf displayed strange behaviour, including fitting, and upon examination, Pat could not determine the cause of the problem. Eventually he sought veterinary advice but this also was indeterminate and a course of antibiotics 'just in case' was prescribed. But the calf's condition worsened, fatally so, despite agonisingly sifting through textbooks, asking friends for advice, and carefully attending to the animal. The calf was opened up to answer this question of science and there, in the oesophagus and stomach, was a large hair ball obstructing food and drink and causing considerable swelling. Neither science could offer a correct diagnosis or prescription in this case.
Cooperation

Since both sciences aim to maintain the health and welfare of farm animals, there are strong similarities both and they can collaborate in this goal. The appeal of experimenting with this homoeopathic science is especially because the farmer can switch back in part to the ‘conventional armoury’ – as it was described by Pat – in the battle against microbes. Even then, this is only possible according to the Soil Association rules which categorise medicines as permitted, restricted, and prohibited. Sarah acknowledged the possible weaknesses of each science and suggested that it is through collaboration that they can equip the farm-laboratory most effectively:

The big problem we have at the moment is that there have been very few studies done. I think there's a danger there because the organic standards require that wherever possible you don't use chemically synthesised products – which is fine but we just don't have any other knowledge. Nobody knows whether giving a certain remedy is going to help or not. So I think if you've got a stockman who is not very astute in observing slight changes that the animal is getting worse, then it could be a disaster because they think – oh well, I'm giving this something – and it isn't until three or four days down the road when the animal is half dead that they think – 'oh, I think that didn't work'. I think it would be complementary – I don't think it could replace conventional medicine altogether and equally I don't think that conventional medicine is going to cure everything we are faced with. So I do believe it works, but it would be great to have better knowledge in animals. [Sarah]

Also, the farmer often requests the vet to perform surgery (invasive work) and certain diagnoses because there is a boundary to the farmer’s animal-science expertise. Even on a farm that has banished all veterinary drugs from its premises, therefore, the vet is hardly irrelevant. The farmer is still reliant on the vet’s anatomical and physiological knowledge rather than the vet’s curative, prophylactic and medicinal advice. For the majority of the farmers, however, vets were too expensive and so were only called out as 'a last resort service now really. ... When he started there ten years ago, one vet, he said it was about sixty per cent big animal stuff. It's now something like twenty per cent' (Geoffrey). Still, for the most part, livestock farmers are concerned to reduce animal welfare problems through preventative

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5 Even farmers opposed to conventional veterinary science are obliged to allow Ministry vets onto their premises for disease testings. For example, testing cattle for Brucelosis and Tuberculosis every 3 years.

6 Using vets for diagnosis purposes is cheaper too since, as Stanley claims, drugs are often 60 per cent of the bill from a visit.
management rather than through prophylactic measures, and so any form of curative assistance is really a last resort:

You can use homoeopathy for the livestock, but the most important thing for livestock is that you must reduce the stress and the actual feed must be the best you can give that animal – not a cheap ration. Stress free and a healthy diet – then homoeopathy has a chance to work, enhancing the animal's natural immune system. [Ken, Kestrel Farm]

We have been moving the lambs around frequently to try and beat the worm cycle... [Pat, Partridge Farm]

Farmers could also selectively cull and breed to shape the immunity in their herds.

As we have seen, vets are part of a formal community of animal welfare scientists and so have a network of knowledge, contacts and experiences to draw from. The homoeopathic farmer can be isolated in his more individualist science. This science does not possess formal laboratories designated for undertaking controlled experiments and to prove it works – the farm-laboratory serves this purposes. There is not always a formalised language for its communication, there is rarely a forum for contrasting experiences, and expert practitioners have often only been able to arrange successful clinics through years of their own hard work. But processes of knowledge dissemination are underway. For example, Fred, who was establishing his organic dairy herd, regularly sought the advise of Charles, who had been using homoeopathy at his organic dairy for over 15 years and was willingly to share his knowledge. In this way, science is multiplied and spread.

3.3 Sciences of Conservation Management

3.3.1 Reading Agri-Environmentalism: churning out countryside?

Farming is quite literally a science of the field. It is also a science incorporating many public interests, aspirations, and demands. The connection between countryside management and animal health and welfare is stronger than is often recognised: People think of meat as something dressed up in a bit of polythene which they get in a supermarket. They don't think of it as running about on four legs and managing the land which we all want managed' (Geoffrey, 1999). Farmed space may be opened up by the farmer for profitable enterprises that entail public access, or riddled with public footpaths and bridle ways, or merely adjoining
the backyards of suburban and rural dwellings. In consequence, many people besides farmers have a stake in the outcome of farming science. Lowenthal explains that the English landscape is an important component of English nationality:

One icon in heritage has a distinctively English cast. This is the landscape. ... Nowhere else does that very term suggest not simply scenery and genres de vie, but quintessential national virtues. (Lowenthal, 1991: 213)

The public demand for ‘English landscape’ becomes inculcated in the practice of farming through the rhetoric of ‘managing for conservation’. The same vision has been taken up with increasing zeal by the key funder of British farming science, the government. Subsidised agri-environment schemes organise farmers to manage for conservation and so to produce this farmed landscape. Here is an economic rationale driving a process of making the farm-laboratory open and visible. This visibility impacts on the practice of farming science because the whole farm-laboratory is on view. Landscape is about the visual register and this is how it is acknowledged in public culture (Macnaghten and Urry, 1998). More specifically, landscape is the visual register of farming in the public mind and there are multiple observers of that register.

As we saw in chapter 2, the model of the normal farmer assumes s/he will implement the stages set out in the formal, documented programme. In this section I examine how this model fails to take account of all the variables and so a distinct farmed landscape is evident at each farm. The main reason the NFSF model fails is that it is a programme designed and controlled from outside the farm, whereas practices aimed at ‘managing for conversation’ are organised inside the premises. The farm is increasingly its own control-site. Countryside as defined in the agri-environmental literature cannot be simply churned out. Each farmer reading the formal programme of policy rules understands and enacts those rules in a certain way relative to his/her experiences and his/her location. Therefore, a particular format is translated onto each farm space and made visible in different ways.

Most emblematic of the government’s stance on farmed-landscape management is the Countryside Stewardship (CS) scheme, a ten-year grant partnership to improve and maintain the space for wildlife. The scheme “makes payments to farmers and land
managers to improve the natural beauty and diversity of the countryside" (MAFF, 1999: 1). Therefore, farmers “are no longer food producers only, but also caretakers of the environment, countryside and landscape” (van Mansvelt and van der Lubbe, 1999: 13). The Environmentally Sensitive Areas (ESA) scheme is a similar bilateral countryside custodianship available on farmland in particularly regions of Britain. The CS scheme was very popular amongst the farmers I interviewed: 67 per cent of the farmers were members of the Countryside Stewardship (CS) scheme and 27 per cent (predominantly on the chalk downland in south-west Dorset) were involved with the Environmentally Sensitive Area (ESA) scheme. The scheme was in fact over-subscribed in the West Dorset district: “The Countryside Stewardship agri-environment scheme has to reject about 20% of applications each year due to budget limitations” (Curry, 2002: 76). The CS scheme has particular aims for different regions and the stipulated target for each region reflects the influence of Objective 5B funding from the EU, described as the Rural Regeneration Grant. All members of the CS scheme must be inspected every three years, during which the progress towards environmental attainments is assessed in situ. The CS scheme allies closely to the organic standards:

We believe that any farming system, whether it be conventional integrated or organic, can achieve the environmental benefits that organic farming aims to achieve, but it does appear that because organic farmers are bound by UKROFS regulations to aim for environmental benefits, then more generally organic farming is likely to achieve those benefits.\(^7\)

There is an exchange taking place on the land between spaces of production and of non-production. Whereas the MacSharry Reforms of 1992 introduced the ‘set aside scheme’ to take land directly out of production,\(^8\) so that it was unused, these newer initiatives both reduce land for food production and at the same time actively make space for wildlife. Farmers were often conscious of their need to retrain themselves away from the productivist ethic:

I think you've got to move to a situation where you can't sort of think: 'Well if I get a weed problem then I'll get the sprayer out' or 'if I've got a fertility problem I'll go and get the spinner out'. It's working with nature. ... I get quite annoyed with people who

\(\text{\(7\)}\) Dr. Keith Goulding. Minutes of presentation to the House of Lords Select Committee (Sub-Committee D), 19th May, 1999 (unrevised proof copy).

\(\text{\(8\)}\) There was a popular argument at that time that you can't stop one of every cow's four teats to reduce Europe's butter mountain and milk lake.
come and say 'oh it's lovely - all your hedges are still here, you haven't taken them out, you haven't ploughed and reseeded and made it all productive'. But all farmers have been encouraged to do that since the end of the last war basically and they've done it extremely well. And now everybody's saying 'oh aren't the farmers awful - look what they've done to the countryside'. But they've been paid to do it and they've produced really efficient well-run businesses. [Geoffrey, Grandview Farm, 1999]

A Geoffrey indicates, farmers are as capable of environmental degradation as they are of countryside production. The agri-environmentalism project did not start from a clean canvas and it has had to overcome resistant attitudes inside and outside the farming community. But now, where landscape used to be a byproduct of farming practices, it is increasingly becoming a product in its own right (Potter, 1992).

The agri-environmental schemes accept that the farmers are the best positioned agents on the ground to carry out conversation management:

**Farmers manage over 75% of the land area of the UK, maintaining a landscape that has been cherished for generations.**

Around 25,000 farmers have entered nearly a million hectares of farmland into "agri-environment" schemes to care for the countryside. They have planted and renovated 23,000 kms of hedgerows in the last three years and manage 230,900 farmland ponds, an increase of 12,200 on 1990.9

However, the agri-environmental management packages are typically framed more in terms of their benefit to non-humans - wildlife and the environment - than to humans. As Dennis explained, this is a mechanism deliberatively adopted to avoid farmers being framed as subsidised 'national park-keepers' performing 'environmental services' on behalf of the government. Instead, they are framed as farming with an 'environmentally-conscious' approach. Similarly, the shift of payments towards Rural Development Regulation (RDR) payments and away from commodity payments is a strategy aimed at reducing the corporatist relationship between British agriculture and government. It is also steering rhetoric towards the idea of agricultural rewards rather than subsidies. The RDR payments support the farm as part of a wider drive towards rural regeneration that includes non-farming businesses and is therefore not such a political issue in Whitehall. It is also driven by the European Commission's 'Agenda 2000' reforms of the Common Agricultural Policy (CAP).

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These debates have important consequences for the operation of the farm-laboratory. Agri-environmental projects give more room for experimentation than the agro-chemical regime because they depend on less outside sourcing of inputs. The agri-environmental system is much more concerned with the networks inside the farm space since these are also the product of the farm. Therefore these networks are fostered. The farm is part of the countryside space and so *the act of 'producing countryside' means making certain parts of the farm laboratory network visible and accessible.* It also shows that what is devised inside the farm can also be translated outside and so it is not just a case of imposing the NFSF construct from outside.

As stewards, farmers are acknowledged as the agents responsible for crafting the landscape so that it appears in the intended 'farmed landscape' form: in effect they are producing – what Harry referred to as 'churning out' – countryside. In this way, each farmer is responsible for making his/her own farm-laboratory openly *visible* and environmentally productive. Photograph 9 shows a newly planted hedgerow funded by the CS scheme that runs down a slope between two fields. The spacing between the parallel fences has to be exactly 12 feet.

William reminded me that under the CS scheme, farmers and farms have to meet a certain eligibility profile and this is often determined by a site inspection by an equipped scientist:

> There's not much more than myself and my knowledge. I sometimes take a soil augur, particularly if I know that somebody's hoping to plant some trees and there's a question mark about the suitability of the soil – is it deep enough or over rock. I would give it a test. I have been known to do pH tests. And I do take a camera on commercial things to remind myself of what's there and to put photos in reports and that sort of thing. I do take things to show off – I carry a clinometer so if someone says that's a big tree I will say it is so many feet high. And I carry my girthing tape. But I haven't got time to get too involved – I might get carried away! [William]

Once the site-assessment has been completed and the farm deemed suitable, the policy package becomes established and legislated. Certain expectations are made of the farmer, as noted in a recent report:
We think farmers should embrace the idea of access to their farms. They should see this as part of their new contract with taxpayers, who will be funding environmental management payments. Farmers need to give their full and active co-operation in delivering the requirements of the Countryside and Rights of Way Act 2000. (Curry, 2002: 98)

Photograph 9: A newly-planted hedgerow as specified and funded by the CS scheme

Wilfred, a wildlife trust consultant, literally finds himself speaking ‘on behalf of wildlife’ when he presents his case for the importance of wildlife on farms:
The real aim [of the trust] is to try and influence the way money goes into the countryside, so more money can go into making space for wildlife on farms through CS money or whatever grant system - a relatively small fraction of the money that currently goes to support agriculture in Europe – if a little of that can be diverted into looking after the countryside from a wildlife point of view, the difference it could make could be immense and happen quite quickly really. But it's getting the political will and the farming will to do it. [Wilfred]

But this process of ‘making space’ was complicated immediately depending on what science is given precedence. There is no single naturalist viewpoint, but instead viewpoints of botanists, entomologists, coleoptarists, and further subdivisions of scientific interest.

The biologists want everything grazed to like that length because it's good for the plants. Entomologists want it all a mosaic of long and short grass because you've got all these microhabitat and microclimates and these little warm bits. The bird people want more scrub and more thick hedges and more trees. So it's a balancing act. [Geoffrey, Grandview Farm]

Each farm is differentially suited to these claims for space because of its location. By embracing biodiversity, the farm can increasingly become like a wildlife ‘reserve’, a space more dedicated to wildlife than to food production.

If a farmer wishes to set aside a piece of land and run it primarily for wildlife then that's his reserve. Our reserves provide lots of different uses. They are examples of how to manage land and they also places where people can go and see conservation in action. [Wilfred]

Wilfred suggested that farmers are different from ‘wardens’ because their legislated space is not a countryside ‘refuge’ providing ‘sanctuary’, even though an organism can derive as much benefit from both farm and reserve. But not all ‘spaces for wildlife’ are necessarily pristine and organised; wildlife can appear in unintended spaces such as at the feet of electricity pylons marching through a field. And so it is not necessarily the most legislated, regulated and monitored ‘wildlife spaces’ that support the most species.

Queenie remarked that the willingness of the farmer to comply with the countryside legislation was also salient. She explained that the countryside schemes had to be embraced as a way to improve the farmed landscape on a farm and not merely as an opportunity for grant payments. The individual farmer’s philosophy of management was therefore critical and the countryside schemes should be regarded as merely ‘tools’ to help achieve the desired landscape goal.
These [agri-environmental schemes] are only tools. They are only actually a very small part of the picture. ‘Cos if people aren’t willing when they take them up, they won’t work anyway.... When Countryside Stewardship first came along there was enormous resistance. But getting there you get a few individuals working, their neighbours see what happens, and gradually using all these different techniques you gradually change a mindset. There are still a lot of people who will never go in agri-environmental schemes. But that’s not the point. The point is that you’ve managed to influence a whole change in attitude towards the concept at least even if some of the detail is not perhaps what we want. [Geoffrey, Grandview Farm]

Grazing ovines and bovines are just such tools if put to work on pasture in the right manner, and this is how they are justified from an ecologist’s perspective:

There are two ways to look at it. They produce food whether that’s milk or meat – that’s their primary reason for being there. However, the way in which grazing happens and so forth, they are a tool for maintaining certain types of habitat. You can’t maintain grassland without grazing so in that sense they are a tool. Mowing and cutting regimes are no substitute. [Wilfred]

Conservation management decision-making is largely a human endeavour, but a collective of humans and nonhumans undertakes its operations and the characteristics of this collective varied between farms. Grazing animals were often sited as most important: ‘We are employing the animals as tools, as workers, for our conservation’ (Norman). Carefully managed livestock grazing is the true agent of grassland conservation (Oates, 1998).

The farmers differed on the question of how the government could produce a better plan for the English countryside. Wilfred wanted policy to be better informed of wildlife in the countryside:

Survey and monitoring work in the countryside can highlight the changes that are taking place for good or for bad in an independent way. From a science point of view, if you want to know what the influence of farming is on the landscape, on the countryside, you’ve got to undertake survey work to show what actually is happening. Personally I believe very much on getting the facts and not just on saying err and complaining. You’ve got to have the information both for good and for bad. [Wilfred]

Charles wanted a more integrated and tailored approach, based on rewards rather than compensation:

The Countryside Stewardship, ESA and organic farming payments – they should all be in one scheme and payments should be made on a sliding scale. And with the level of payments, the idea that you are compensated for the loss of income from reduced output I think is wrong. You should be rewarded for the environmental and social benefits that you bring to get the farmer in the right mindset and away from this idea of dependency on subsidies and on the latest scheme in the post. [Charles, Chase Farm]
But Fred viewed some form of renumeration, like all subsidies, as an unfortunate necessity at a time when farmers were not being paid sufficiently by the market. William, an agricultural adviser who notified farmers of new opportunities in policy, seemed to agree:

> Obviously number one they've got to make the farm pay.... The whole concept of agri-environmentalism is subsidy led. That's why people do it really – almost everyone. You do get a few who are very conservation-minded and they want to do it purely for the wildlife. But I think for most farmers it is more of a pragmatic approach. They obviously like the countryside – that's why people live there and farm – but I think without finances behind it the actual money from growing crops would have to come first. [William]

We are again reminded that the NFSF model is more readily sustained if an individual farmer neither has the resources, nor the vision, to look beyond this model, and where the market will not reward any attempt to invest, to break away from the funded but bureaucratised loop:

> I think farmers are being pulled rather than pushed into this agri-environmentalism. I don't think they are particularly willing partners always. I find that farmers' number one goal is to make a profit. If they have to do it by signing up to a number of environmental schemes, then that's what they'll do. But I don't think they're particularly enthusiastic of that. But you've got a generation interval really that you've got to get through probably before you get to farmers that are intrinsically interested in improving the environment. [Simon]

Norman was suspicious of what he saw as an increasingly drive to nationalise the English countryside attached onto these ‘glossy subsidy packages’:

> The sting in the tale of these schemes is the fact that the public access is always pinned on the bottom of any scheme or payment and so on which farmers apply for. And it's the public access that's a two-edged sword. It is good that people should understand the countryside, but they are looking for a day out in a leisure park....

[Norman, Narrowlane Farm]

> You are putting yourself in the control of people sitting about at a desk in an office somewhere else and having to get permission to do this and permission to do that ...

[Norman, Narrowlane Farm, 1999]

### 3.3.2 Writing Agri-Environmentalism: personalizing landscapes

Each farm in this study had a different landscape character, and this was more than just the product of its location. In accepting this added variability, it seems that farmers are asserting their own agency and decision-making aside from what the government is
proposing and regulating. Indeed, farmers may not even read the programme in the first place. They may choose not to enlist in the programme at all, or they may accept the funding but then attempt to actively exploit the discrepancy of legislation and weaknesses of its policing. In these ways, farmers personalise the landscape of their farms. Here they compose and write countryside in their own script. And unlike animal welfare issues, there is not (yet) the same level of legal management requirements.

Each farmer had different ideas about how best to manage hedgerows for wildlife, each farmer had a particular naturalist focus – what Irene referred to as a ‘wildlife audience’ – that s/he aimed to provide for, and each farmer was at a different life-cycle stage with respect to managerial priorities. This latter point must be clarified; whereas many land management schemes pay annually and plan at most every decade, farm wildlife habitats – planting a hedgerow or a coppice, digging a lake – typically take years to mature and become established. Therefore, a sustained commitment to conservation management requires a sustained investment of time, money, and thought. Pat was proud of the amount of wildlife at Partridge Farm and described his farm as ‘an island of organics in a sea of agro-chemical farming’. However, “the notion of achieving sustainability on one farm is an absurdity” (Lowe and Ward, 1994: 88), and is illustrated, for example, by the spatial demands of farmland bird populations (Dodds et al., 1995). This is because only the very largest of farms are able to fully support a wildlife community, and those organisms comprising that community do not recognise farm borders, and therefore a consensus of neighbouring farmers and land-users on wildlife management issues is often a prerequisite for sustained viability.

All farmers stated that managing for biodiversity was at the heart of their experimental approach, and Irene described it as part of her ‘organic farming philosophy’. Biodiversity comprised an accepted but constantly improvable laboratory protocol to work with from the farm control-site, and was being increasingly formalised and recognised as such:

We are always managing for biodiversity. It’s very much part of what we’ve been doing. A lot of the scrub management has been carefully planned for clearing to enhance the wildlife rather than increasing the area for stock grazing. We leave curvy edges and little wildlife patches in he middle of it and glades and things – it’s a lot more fun than doing straight lines up and down the field. Conservation management
has become, within the right set of people, more ordinary. It's actually been recognised that it's perhaps a reasonable thing to do – which was never thought before. It was always thought of as bizarre. [Queenie, Quaker's Farm]

It was also a division of farming science that was recorded in different ways, both formally by naturalist institutions and informally by the experiences of the farmer:

Conservation is very important to us – very. We also believe in leaving areas of rough grassland. But we've had research on the farm to show that there are higher numbers of birds on the farm, certain small mammals, non-predatory insects. The scientists ran out of money so they couldn't complete the study. But the BTO study has been interesting because they showed that there are more birds on organic farms compared to similar conventional farms and also greater diversity of species. So they are a very good indicator species birds. [Richard]

People in the village out walking have said to me how good the hedgerows are looking and how they are seeing lots of birds and that. It makes me feel proud. [Fred, Fairbanks Farm]

What the BTO (British Trust for Ornithology) surveying adds is a consensus on farmland bird management techniques and requirements bridging and conjoining individual farm spaces. Birds are indicator species. Their abundance and distribution can be read as indicative of biodiversity decline, making the more latent species visible and traceable by virtue of their association.

Richard explained how his limited understanding of interlinked food chains and wildlife habitats informs his double tasks of conservation management scientist and conservation science manager. Here he points to the scientific basis of his methodology:

Not putting fertiliser on is beneficial because we know that a number of the fertilisers we use upset the activity of the soil and micro-organisms, and that in turn will perhaps reduce trace element availability, mineral availability, which will impact on the animal's health. Not always in obvious ways but one's intuition says it's got to be better. But of course the scientists will say that there's no proven data to show that – blah blah. And that's how the whole world functions at the moment.... Biodiversity starts in the soil. The chain of events that goes on between all the living parts of the soil is incredible – forty-thousand different species or more. That is very significantly affected by what goes on on the soil above. And we know that a lot of fertilisers and chemicals do have a bad effect. Because they are so dependent on each other. Likening it to a chain – if you break that chain at one point it really causes quite a lot of havoc.... I would say with all these things that you never fully understand everything and it's a permanent quest to get the right thing. You can't say with a particular conservation tool that this is the machine that we will use and nothing else because a lot of conservation tillage is almost an art form. Because you're dealing in a natural system, conditions and soils and everything can vary – there are a huge number of variables. What's right for one year is not necessarily so for the next. So a lot of it is just based on your experience. [Richard, Raddington Farm]
Back at the SA supervisor's headquarters in Bristol, Tim conceded that it is implausible to prescribe precise menus for conservation management projects, which implies that the normal-farmer-standard-farm construct cannot specify a correct management agenda for farms as a generic group:

I don't think that agri-environment schemes that allow spraying through the middle of a field and not around the edge quite get the point of things like island bio-geography theory and the fact that that really is a very limited.... The benefits of the whole field not being sprayed are exponentially larger than the benefits of not spraying particularly round a metre round the edge of a field to me. And that's basic conservation science and any government policy person who doesn't pick up on that has kind of missed the point. To my mind. [Tim]

Farmers did not always look at the countryside through the same lens - some interviewees took for granted the space in which they worked daily, whereas others had begun to scrutinise it more closely:

I suppose in effect when I go to the top of the hill and look across and think the farm looks nice. But I suppose what looks nice to me may not be for someone else. ... I am aware of the countryside but when you're there everyday you get complacent. [Fred, Fairbanks Farm]

As an organic farmer, you actually take more notice of what's going on and what wild flowers and all the hay meadows and that – you take more interest that you may have done a few years ago. Been more involved in it. [Dennis, Dinglewell Farm]

What Dennis is registering with here are the linkages characteristic of a complexly networked ecosystem. His 'involvement' is more direct than he perhaps realises; in his years of farming actions, he has variably promoted and expelled a host of different agents from his farm-laboratory space.

West Dorset is a particularly rural area and so conservation organisations were active in this region. The Dorset Wildlife Trust is certainly respected as a voice on managing for biodiversity, but it is not necessarily seen as the authority on the topic. William reminds us that conservation science is often a private and very individualist enterprise:

Farming – you can be fairly bloody-minded if you want and say this is me and this is how I shall run this farm. Obviously there are all the regulations to obey, but how big your fields are, how you manage your hedges, what crops you grow – all this is down to the individual. [William]

Wilfred and Andrew had different ideas on whether managing for wildlife would bolster the economic productivity of the farm system:
But I'm afraid money talks when you get down to it - that's the real problem. If somebody's trying to earn their living and there is a grant or support system available then naturally they'll want to get the best of it out that they can. If that means planning every square inch and cultivating every square inch then you can't blame people for doing it. And you find that if there is space left for wildlife on farms that is outside that, it's up to the individuals. [Wilfred]

The biggest spreader of mastitis is flies.... If you can get the songbirds here in numbers, they'll control most of those flies for you. ... A lot of songbirds are seed eaters - we collect up the discarded wheat in bags and feed back to the birds in winter in a fertiliser spinner to encourage them around the stubble. They're here ready for the spring to breed and start the cycle again. Feeding them over the winter is over the top but it is necessary because we are a large organic farm in the middle of a conventional area. It's no good saying I've got an island of organics and I'm looking after my wildlife because it's still not sustainable unless it's a horrendously big area. [Andrew, Applesham Farm, 1999]

As a result of this individualism, it can be difficult for the CS scheme to fit everyone's requirements. Hedgerow management on Grandview Farm is emblematic of that:

When we went into the original CS agreement, the Wildlife Trust saw all these payments and thought - yes, that will be extra income. We'll have some of this. And we committed ourselves to more than we can readily cope with sensibly. We're just going into renewing the agreement now for another ten years, but we've cut down the hedge-laying to about half. ... Once we've layed them it's a controversial subject. I personally think we ought to be trimming them for a couple for years to get them to thicken up more at the bottom. But the Trust says no - they just want the lay left for fifteen, ten years, whatever. The only thing the SA says in hedges is that you mustn't trim them annually unless they are alongside the road. You can trim them biannually but we didn't want to do that. I'm not even sure that's good management really because if you leave that hedge for two years and then flail it it looks awful. The argument is I think that you've always got some hedges that are producing fruit and that for the birds. But I am not sure that they are going to do that in two years. Some species might. [Geoffrey]

At Applesham Farm, the science of hedgerow management was formalised:

We always top as the SA recommends in January/February, but also you've got to change the shape of your hedges. We go for A-frame hedges which is eight foot at the bottom, six foot high but eight foot to the top of the A. It's a good thick hedge which serves two purposes. One it's very good shelter in the winter. But most importantly in the spring when you've got song birds breeding, the hedge is so big and thick that birds of prey cannot get into them very easily. Whereas with square-box hedges, it's very easy for cats, birds of prey, all sorts, to get to the nests very quickly. [Andrew, Applesham Farm]

Wilfred suggested that when he tours farm spaces, the condition of the hedgerows can reveal much about a farmer's interest in conservation:

You're looking to see how hedgerows are managed - they are quite a good indicator.... If all the hedges are heavily flailed or gaping, and if they're ploughed right up to the hedges, then you can see they are not interested. Does he cut some hedges every three
years, leave a better margin, does he have margins on his hedges, does he still spray
the bottom of his hedges? – it is silly and creates weed beds. [Wilfred]

Some farmers, especially Eric, were adamant that hedge-laying should be common
practice on farms because it both reinforces field boundaries and farm borders and also
provides wildlife habitat.

Summary of Chapter

This chapter has illustrated the idiosyncrasies of farm-laboratories and the inability of the
NFSF model to organise the science and the space of the farm-laboratory from a controlsite remote to the farm premises. Science “must adapt its means to conditions of the local
environment – the result: a different sort of knowledge is made” (Gieryn, 1999: 267).

The science of farm animal health that is practiced in any particular farm-laboratory can
vary significantly between sites and is determined by the contingencies of different
knowledges.

The local lab site turns out to be the place where the empirical character of science is
constructed through the experimenter’s local, practical know-how. The resulting
knowledge is extended outside the lab not by generalization to universal laws
instantiable elsewhere, but by the adaptation of locally situated practices to new local
contexts. (Rouse, 1987: 125)

We go from one local knowledge to another rather than from universal theories to
their particular instantiations. (Rouse, 1987: 72)

The science of conservation management is predicated on the visuality of the farmed
landscape and on the visibility of management practices in the farm-laboratory, and this
explains why it is also subjected to a multiplication of viewpoints and negotiated at the
farm control-site.
CHAPTER FOUR

The Laboratory Infected:
The Trials of Microbes and Scientists

Map of Chapter

This chapter considers the context of disease on farms as it has been witnessed in recent outbreaks, most notably those of Bovine Spongiform Encephalopathy (BSE) and Foot-and-Mouth Disease (FMD). So far the processes of setting standards and experiencing experiments have contributed to our understanding of the farm space. However, making the distribution of these formal and informal science networks visible has been a project of disingenuous simplicity – agents have been identified and their associations and structures of power mapped within an apparently isolated and *human-controlled* farm-laboratory – controlled either by central surveillance and disciplining institutions or by farmers who practice their sciences on farms. Nonhuman agents have been in the background – they have *been* enrolled or excluded, but have not themselves been recruiting or expelling. But now, through disease, these players – specifically microbes – come to the foreground in the realm of ‘nonhuman experiments’, where the control of the farm-laboratory is not centred only on humans. As Latour would argue, the way these microbes hybridise as they form relationships – ‘disease’ – in the farm space can be stunning and soon a proliferation of *hybrids* is brought into view in the farm collective. The microbes are capable of translations unknown both to the NFSF project and to farmers, and so disrupt established scientific protocols and practices. This chapter begins by examining the series of microbes that have plagued British agriculture and caused public food scares over the last fifteen years. I shall then address BSE and FMD in turn in order to trace how the farm collective is infected, to investigate through which mediums the contagions are mobilised, and also to assess the new technologies produced in response to each apparent crisis.
4.1 Great British Farming? strong microbes, weak scientists

‘Food’, the product of the farm-laboratory, is possibly one of the most taken-for-granted constituents of contemporary society. In its myriad forms, it is manifested in a dispersed network of relations, extending daily from irrigated plains to alimentary canals, lowland pastures to patio barbecues. “Food is a liminal substance … bridging … nature and culture, the human and the natural, the outside and the inside” (Atkinson, 1983: 11). British farming has been disrupted by a series of crises in food and animal health that were triggered by the invasion and then exposure of nonhuman pathogens in the farm space.”

“In industrial societies, food scares are the order of the day” (Adam, 1999: 219). Latour (1988: 37) suggests that microbes link discourses of food and disease: “Microbes connect us through diseases, but they also connect us, through our intestinal flora, to the very things we eat.” Disease and food scares are episodic events in which the hybrid co-productions of natures-cultures that make up human food practices are revealed and re-negotiated. The nonhumans in them are suddenly revealed as more than just the machinery in the background to aid farm production. They can take control of the way the farm space is organised. Since the pathogens themselves are microscopic, the visibility of disease often depends on the visibility of the diseased body – a body-pathogen hybrid – in which the pathogen is embodied in a living organism. Farm-laboratories host many diseases involving bacteria, viruses, and parasites – what Latour refers to as actants2 – that are potentially fatal in combination. These pathogens further highlight the way the farm is a place for experimentation and emphasise that this can rarely be standardized.

In one of my interviews, Wesley declared that British farmers saw themselves as the best and most efficient farmers, whereas those on the continent ‘see us as the dirty man of Europe’.

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1 Since the Lanarkshire E. coli outbreak, the food scare events have been particularly English and Welsh phenomenon.

2 The term ‘actant’ is used in preference to ‘actor’ to indicate the de-humanized and de-centred conceptualisation of agency. ANT refuses the logocentric bias of social theory which links agency (the capacity to act or to have effects) to language-based intentionality. This is reinforced by its methodological commitment to treating any distributions of authority amongst ‘actants’ as practical achievements to be elucidated (Callon and Law, 1995: 490). The ethical repercussions of this view may make the transposition into social science problematic, unless viewed solely methodologically.
As Table 4 shows, over the last 15 years 'Great British Farming' has involved, in particular, GMOs, BSE and FMD.\(^3\) These events have affected the livestock industry especially seriously and the repercussions on consumer confidence have extended far beyond Britain. These issues have not yet been resolved – the networks of infectious spread associated with these microbes have been stubbornly persistent despite legislative changes designed to weaken them. BSE has arguably set a precedent for the future in terms of the design of a code of institutional response. FMD illustrates the capacity for a microbe that has been in Britain since 1869 (Plumb, 2001) to rear its ugly head in present times. Both of these storylines will be discussed below, but here I want to draw on some of the consistencies between these examples in the context of the farm-laboratory and to suggest the importance of public perception.

### Table 4: Britain, the sick man of Europe?

<table>
<thead>
<tr>
<th>Nonhuman, microscopic agent</th>
<th>Visible manifestation in farm-laboratory</th>
<th>Dates of Outbreak in last 15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virus</td>
<td>Foot-and-Mouth Disease (FMD)</td>
<td>February – October 2001</td>
</tr>
<tr>
<td>Prion</td>
<td>Bovine Spongiform Encephalopathy (BSE)</td>
<td>November 1986 – present</td>
</tr>
<tr>
<td>Gene</td>
<td>Genetically-Modified Organisms (GMOs)</td>
<td>Controversies over trials since 1990</td>
</tr>
<tr>
<td>Bacterium</td>
<td>E. coli 0157</td>
<td>Largest outbreak: 21 died in North Lanarkshire, Scotland, 1996</td>
</tr>
</tbody>
</table>

It would appear from Table 4 that the history of late twentieth-century English agriculture is one of applying chemicals and performing practices which disturb the status quo in the farm-laboratory. Scientists affiliated with farming have not been in complete control of the experiments they have been conducting and more then just harmless food has been produced. Under the banner of productivism, new practices and agro-chemicals have been introduced onto farms before a full understanding of their effects has been available. Particularly important is the possibility that they follow a non-standard trajectory. The normal farmer is only mandated to cope with ‘black-boxed’ knowledges. Accordingly, when a disease strikes, s/he is routinely expected to administer a ‘black-boxed’ medicinal treatment according to the guidance of expert opinion. But the events in Table 4 illustrate

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\(^3\) I also use the discourse of 'disease' when referring to Genetically-Modified Organisms (GMOs) because although this is not a livestock illness, the British public and media have framed this food as 'diseased'.

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that the boxes are not self-contained. Instead, carried along with them in association, are visible and invisible agents, some of which are far from benign. These infringements on the NFSF code provide further testimony to the inadequacy of its depiction of the farm in practice by itself.

Microbes have led those disturbances but they have needed a whole network of other agents in association. Indeed, the mobility of nonhuman agents within and between farm-laboratories depends on contexts and associations and so cannot be studied in isolation. And such nonhuman microbes are most disruptive and destabilizing to farm-laboratories when in a collective form and when the disease that they bring about escalates from an outbreak to an epidemic. It is not only the ‘invisibility’ but also their capacity to hybridise that constitutes the greatest threat posed by these microscopic agents. As their associated events unfold, more and more agents are enrolled in the narrative and the events shift from the meso-scale of the farm onto the macro-scale of the country and beyond.

Issues of consumer-purchaser health and food perception have become key to these food controversies. Consumer-purchasers have interests in the farm-laboratory because they experience its products (and as footpath users in the countryside they may also experience farm-laboratories directly). As Wesley put it, farming really is ‘everybody’s business’ and those stakeholders become more vocal as soon as that ‘business’ is threatened. Images of the food scare events are powerful media that make visible all sorts of connections to the food consumer-purchasers eat. The events have become crystallized in the public imagination as infringements of the regular code of farming. The everyday visibility of these events has opened many farming practices for scrutiny, which in turn impacts consumer confidence and trust because they realize how much can be invisible. Consumer-purchaser knowledge is one of the key determinants of the unfolding of these

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4 Although this is true, farmers are often exposed to added risks, as exemplified by the body wasting resulting from organophosphate sheep dips.

5 ‘Public’ refers to a European audience as much as it does British. But each European country has different reactions to different events, from ‘British’ BSE controversy to ‘Belgian’ bovine hormone scares. If we extended the audience to North America, we can see how the American public makes widely different associations with GM trials, framing them more around developmentalism and progress than around issues of health and welfare as is the case in much of Europe.
storylines outside of the farm space. 'But the biggest difficulty is that most people are so divorced from the production of food that they don’t always see the connection between what is in the field and what they buy. And that’s something we lost because it’s been so long since most people were involved in agriculture’ (William). Tim explained the importance of bridging the gap between producer and consumer networks:

I used to sort of cover a front line phone for the whole of the Certification Department and you get questions from consumers like:... ‘I’ve bought three carrots and they haven’t gone off - why haven’t they gone off? Have they been sprayed?’ Or ‘I bought three carrots and they have gone off – why have they gone off’. And you have to have two different answers for the same question.... But I shouldn’t be complacent because the bottom line is that the market is important and the good thing is that they are consumers who are thinking about where their food comes from which I think ninety per cent of the British public don’t. [Tim]

Indeed, Charles suggested that it was a prerogative for farmers and Government alike to engender a sense of pride and confidence for British consumer-purchasers in their domestic produce rather than to remain dismayed and sceptical about the security and sustainability of the agricultural industry. Walter suggested that the ‘more discerning’ British public were increasing their support for domestic produce: ‘A couple of years ago terrible – absolute crap – no support from the public whatsoever. They are now starting to open their eyes....’ But Brian recognised the hegemony of supermarkets in linking producer and consumer-purchaser:

I think the supermarkets have destroyed English agriculture, English culture, English towns, everything. ... The public who are shopping in the supermarkets – no connection is made between one thing on their plate and what they look at in the countryside and whether or not it's conservation. ...The link between the consumer and the farmer has been totally severed. [Brian, Broadleaves Farm]

Farmers maintained that the lack of a public understanding of animal science is a problem. Pat, a farmer in my study, also questioned the credibility of animal scientists who researched into improving farm animal output. He blamed such scientists for causing animal and food health scares.

Scientists in connection with animals – I don’t feel much favour towards them because they seem to be constantly trying to manipulate anything living – animals and plants. I hate the way they are developing all this genetically modified stuff. I hate the idea of them cloning animals. I think because they are scientists, it is as if they feel compelled to keep trying different things and trying to manipulate. ... I am all for science finding out how things work but not this boundary pushing. [Pat, Partridge Farm]
Pat's disdain towards 'manipulation' and 'boundary pushing' revealed his weariness towards what he saw as the irresponsible financial goals of corporate science. But his own work at Partridge Farm was also a project of 'manipulation' because of the way his farm was organised. And yet he phrased his work differently and referred to it as just farming rather than science business' and saw his project as self-contained within the administrative boundaries of Partridge Farm. He trusted his own science because he could witness its unfolding daily. He coped with his distrust of corporate business by being very vigilant about what food he purchased and consumed on his premises; he bought only organically certified foodstuffs and informed himself through his subscription to scientific food journals about less-publicised dietary health issues. In a similar way, Walter queried the testimonies of corporate scientists because these testimonies often seemed to change:

These scientists doing these bloody million pound projects... Oh, they say oranges are good for you and the next month they are saying they are bad for you. I heard on the radio a couple of years ago – they think we are far too hygienic now and they're talking about injecting mud into children to get the antibodies moving again! [Walter]

Oliver suggested that much of this had to do with funding: I've lost confidence in the scientists. ... They've got to find someone to sponsor them - they ain't got the funding from the government that they used to' (Oliver, Oaker's Farm, 1999).

The controversies surrounding the introduction of genetically-modified organisms (GMOs) into agriculture offers an illustration both of the work of corporate scientists and of the way in which food scares open black-boxed agro-food networks to reveal the hybrid collectives in which daily food habits and practices are enrolled. The introduction of GMOs can be understood as attempts to enroll new hybrid co-productions of nature-culture into stable, strong co-ordinated networks – what Latour would refer to as establishing new translation regimes. These hybrid entities mediate the dual metabolisms connecting agricultural nature and human reproduction. Multi-national corporations such as Monsanto, Novartis and Zeneca distribute their places of scientific investigation across the globe. Monsanto would defend its science and argue that GMOs are devices that offer a higher degree of standardization and replication of farming process and food
product, because GMOs have added resistant strengths against parasitic networks, which in turn reduces pesticide dependency in farming and increases productivity.

However, there are many environmental and health concerns surrounding the promiscuity of these variant genes when outside of Monsanto’s corporate laboratory. In the wake of the BSE-outbreak, there are fears that a similarly fatal co-production may be unleashed. Questions then arise concerning whether such intensive industrialization of agriculture does actually constitute ‘progress’ or not. Some farmers suggested that the possible promiscuity of GMOs’ constituent genes, their tendency to hybridise further, constitutes a serious risk.

I think that putting the genes of a fish into a lettuce to give longer shelf-life is a no no. I think that should never have been researched. To put poisons from another plant into wheat is dangerous because there’s now a poisonous gene in that plant which many people can react to. If it then produced a hybrid, it perhaps could be even more vicious in its poison. [Ken, Kestrel Farm]

Jack was concerned about potential risks of GMOs to his own farm and was aware of proposed trial sites ‘somewhere in Dorset’. The BBC Radio 4 Farming Today programme reported that 15 new trial sites for GM crops in Dorset were announced on the 14 March 2002, 4 of which were in the same Dorset village.6

Modifying genes in a farm laboratory is commonplace; particular pedigree and crossbred gene pools are used by farmers to engineer the desired animal characteristics. A bull is ‘selected’ for that specific purpose. But some far more sinister connotations have arisen with the idea of GMOs.

There has been a lot of talk about the GM stuff because they have been growing it round here quite a lot. It seems totally unnecessary and very dangerous to me. I mean you’re releasing a new gene into the wild plant population without really knowing what’s going to happen. Releasing whole genes is absolutely crazy. It makes it clear that the farm is not safe from it because it can be carried in the wild. [Jack, Jersey Farm]

It is the notion of releasing ‘Frankensteins’ from the high-tech laboratories of multinational giants like Monsanto into what are for the genes uncontrolled and uncontrollable playground spaces beyond, which has instilled fear in public imagination. Corporate laboratories are closed spaces and most of the farmers I spoke to thought of them as

places of non-transparent science conducted by non-trustworthy scientists. Again it is a case of ‘boundary pushing’ – moving parts of the high-tech laboratory further outside its engineered space and consequentially broadening the realms of scientific experimentation. When Monsanto refers to ‘GM trials’, transformations – similar to those translations Latour showed us in the work of Pasteur – are being performed and elements of that corporate laboratory science are being moved outside of their place of design. It is the rhetoric of ‘trials’ that worried Brian because he suggested the potential for these ‘modified genes’ to combine with ‘unmodified genes’ in uncontrollable ways. Brian also identified the driving engine:

The supermarkets are behind it really because they just want standard product, delivered in standard time, by a standard person, for a standard price. It's all about commerce. It's nothing to do with need or reality and my instincts tell me GMs are wrong and that's good enough for me. I still have some instincts left. [Brian, Broadleaves Farm, 1999]

Geoffrey dubbed the lack of responsibility and control over food science experiments as ‘science fiction’:

I'm desperately worried about GMOs. Having just gone through this stupid BSE thing where we didn't really address the problem or know the effects or even how it was caused... We seem to be going headlong into something else that we don't know the effects of – it's almost gone into the realms of science fiction. [Geoffrey, Grandview Farm]

The effects can be long-term since the GMO can remain ‘dormant’ in the landscape and appear to have no potential agency – the capacity to act or to have effect –, when in fact it might at any moment enrol itself, or be enrolled, into a network. In this regard, the GMO saga is similar to issues of drug residues in the soil, except that the GMO genes are considered potentially much more active and capable of disguise.

This year we had a problem with worms ... and I spent an awful long time researching what I thought would be the best nasty chemical treatment and I have chosen one which is not on the permitted list so I had to get permission to use it. I usually sell wool to individuals because it's organic. Well, this year all my wool went off to the Marketing Board without a question – every single bit got packed away. Shearing was months and months after the date when it was supposed to be perfectly safe but there's no way I was going to sell that to anybody who'd think it was organic even though technically I could have done perfectly well. ... You just never with chemicals and GMs what they'll do. [Queenie, Quaker's Farm, 1999]
The Soil Association takes a very precautionary approach to such risks; it decided as far back as the late 1980s to prohibit GMOs from its approved livestock feedstuffs. This approach has been successful:

The controversy over genetically modified food has led to an unprecedented surge in the sale of organic food. (The Independent, 8 March 1999: 6)\(^7\)

Food scares were once a cranky obsession of the green-minded fringes. Now they worry many ordinary families. A measure of that change is the growth in sales of organic food. (The Economist, 21 August 1999: 28)

The organic agro-food network invites scrutiny of its constituent metabolic relations, an interrogation that follows from its organizational and ethical premises of connectivity, in contrast to the punctualization or black boxing characteristic of industrial agro-food networks. (Goodman, 1999: 32)

However, some of "the organisms that cause food scares do not respect Soil Association or animal welfare credentials. Organic animals and foods are just as susceptible to disease and contamination as conventionally reared stock" (Robert Uhlig, The Telegraph Weekend, 4 May 2002: 11).

4.2 Mad Cows and Englishmen

4.2.1 Cloven Opinions

Engaging with science is a project of conversation. Different ensembles of scientists and machines espouse controversial and sometimes contradictory accounts. If a scientist's claim is one of seeking truth, s/he must also accept that s/he necessarily publicises truths. And once a viewpoint is made public, so the network of interested agents conjoins to make a stronger ensemble. The BSE saga in Britain is emblematic of this multiplication of truths within the practice of science. The first case was detected in 1986 but it was not until June 1988 that UK government scientists formally notified BSE as a new cattle disease (Table 5). The incidence of BSE in cattle then rose dramatically, peaking at approximately 700 new cases per week in 1992, falling to approximately 70 new cases a week in mid-1996.

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\(^7\) All newspaper articles will be referred to in this way, with the newspaper's name in italics and the author's name appearing only when specified by the newspaper.
Table 5: Summary of the key events in the BSE saga

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Event (in the UK unless stated otherwise)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td></td>
<td>‘Proteinaceous infectious particles’ or ‘prions’ were identified as the agents that cause transmissible spongiform encephalopathies (TSE)</td>
</tr>
<tr>
<td>1986</td>
<td>Nov</td>
<td>A newly recognized form of neurological disease appeared in cattle in the United Kingdom; the disease is identified as bovine spongiform encephalopathy (BSE) by the Central Veterinary Laboratory</td>
</tr>
<tr>
<td>1987</td>
<td>June 5</td>
<td>Chief Veterinary Officer informed ministers about BSE</td>
</tr>
<tr>
<td></td>
<td>Dec 5</td>
<td>Studies concluded ruminant derived meat and bone meal was only viable cause of BSE</td>
</tr>
<tr>
<td>1988</td>
<td>June 21</td>
<td>BSE Order 1988 made BSE notable and provided for isolation of BSE suspects when calving</td>
</tr>
<tr>
<td></td>
<td>July 7</td>
<td>Decision to introduce slaughter policy announced</td>
</tr>
<tr>
<td></td>
<td>July 18</td>
<td>Ruminant feed ban enforced</td>
</tr>
<tr>
<td>1989</td>
<td>June 13</td>
<td>Offals ban announced</td>
</tr>
<tr>
<td></td>
<td>Nov 13</td>
<td>Ban on use of certain specified bovine offals (SBO)</td>
</tr>
<tr>
<td>1990</td>
<td>June 8</td>
<td>Council of Ministers agreed rules for trade in beef and calves from UK</td>
</tr>
<tr>
<td>1991</td>
<td>Mar 27</td>
<td>First case announced of BSE offspring born after ruminant feed ban</td>
</tr>
<tr>
<td>1993</td>
<td>June 14</td>
<td>100,000th confirmed case of BSE in United Kingdom</td>
</tr>
<tr>
<td>1996</td>
<td>Mar 20</td>
<td>Chief Medical Officer, health and Agriculture ministers announced possible link between BSE and a new variant of CJD</td>
</tr>
<tr>
<td></td>
<td>Mar 25</td>
<td>EU banned imports of British beef</td>
</tr>
<tr>
<td></td>
<td>April 22</td>
<td>UK Government offers a beef cull programme</td>
</tr>
<tr>
<td></td>
<td>June 6</td>
<td>Five new cases of CJD are announced in Britain</td>
</tr>
<tr>
<td></td>
<td>July 22</td>
<td>Fears expressed over BSE and sheep meat</td>
</tr>
<tr>
<td>1997</td>
<td>Jan 30</td>
<td>UK Government appointed a new Food Safety Adviser</td>
</tr>
<tr>
<td></td>
<td>Mar 30</td>
<td>A 62-year old man in Indiana dies of CJD</td>
</tr>
<tr>
<td>2000</td>
<td>Dec 2</td>
<td>Latest numbers of cases of BSE in 2000: 1,149 in Britain; 57 in Ireland; 90 in France; and 86 Portugal. Total number of BSE cases in Britain: 180,000. Current death toll from CJD: 111. (The Economist, 2 December 2000: 58)</td>
</tr>
</tbody>
</table>


The BSE saga is now a well-rehearsed debate. But the BSE outbreak pushed the boundary of science to a new horizon.

[The disease was expected to have a particular (micro-)spatiality. Discrete entities were expected, to which primary properties and agencies could be attributed. To this end, there was a tendency to equate the transmission of disease with the conveyance of nucleic acid in stable form from one individual host to another. (Hinchliffe, 2001: 189)]

Eventually, the ‘prion’ – an acronym for small proteinaceous infectious particles – was identified as the trigger agent that instigated this ‘mad cow disease’. Initially scientists suspected that it was a viral infection. This prion was a novel agent and its analysis required a new approach and in turn justified an expanded budget. Bovine brains and spinal tissues were harbingers of prions and so were classified as ‘infectious’. When the ‘mad cows’ – the bovine-prion hybrids – were identified, they were incinerated. But the

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processes of identifying the prion and the mad cow have not been straightforward and the strategies to cope with both processes have been contested by scientists, as Table 5 shows. As one vet told me, the epidemiology of BSE demanded a new scientific approach:

I think the difference is that with BSE – yes there were a lot of clinical cases but it was never thought that it was infectious from animal to animal or being carried by a vehicle or whatever. Whereas with FMD that is very much what you would concentrate on. So the whole epidemiology is completely different. [Sarah]

In accepting the need for a new ‘truth’, myriad networks have been woven, hypotheses have been proven, but opinions still remain divided. But the greatest criticism of all this ‘new science’ is its failure to ground itself in the inherent contingency of the working farm laboratory and to appreciate the mobility of its nonhuman constituents: it is predicated on the NFSF model hence incorporates its highly partial and restricted conceptualisation of the farm-laboratory. The BSE events have acted as a precedent for subsequent institutional responses to food scares – and for many theoretical projects: “The BSE controversy … illustrates beautifully Latour’s notion of the translation of actants into different collectives, which variously struggle to deny, recognize, contain or extend the scope of the mobilization” (Goodman and Fitzsimmons, 1998: 211).

Diseases are made all the more real but at the same time frightening by what is often perceived of as their zooenotic potential – their ability to change hosts and infect humans: 'I think when they [scientists] start talking about major livestock diseases, there's an automatic perception that it's going to affect the human’ (Stanley). The perceived risk of hybridisation with a human body resulting in disease has become a powerful narrative ever since a connection was made between new variant Creutzfeld-Jakob Disease (CJD) and BSE: the admission by two government ministers on 20 March 1996 that BSE may in fact be transmitted to humans was a complete reversal of the scientific position held on that subject for over a decade (Table 5). This admission followed a report by SEAC (Spongiform Encephalopathy Advisory Committee) that ‘the most likely’ explanation for a new strain of CJD involving 10 young people was exposure to BSE before the offal ban in 1989, and caused the price of British beef to plummet. In this way, the act of ingesting prion-infected bovine food products was identified as a plausible route for this re-hybridisation.
The prion could change host from bovine to human and hence switch from a bovine-prion hybrid to a human-prion hybrid. Narratives are complexly woven around the prion: in the instance of the clustering of CJD victims in the small village of Queniborough in Leicestershire, England, investigators believe that it was the contamination of meat by knives harbouring prion-infected neurological tissue at one small abattoir that propagated the disease to its five victims (*The Economist*, 24 March 2001: 93). What the consumer was garnering from the BSE saga and its occupying portfolio of devastating farm images was the notion of a frail human body with tendency to inadvertently take up such hybrid expressions.

To understand how the prion appeared, it is necessary to follow the way bovine feedstuffs were processed and how a distended network that turned bovines into carnivores – and even cannibals – increased the strength of the prion relative to the bovine. The temperature at which offal was cooked in order to be 'neutralised', to be effectively de-hybridised of any infectious matter, was lowered to save time and energy. These 'shortcuts' have been identified by some as enabling the passage of prions back into the bovine food chain in an active and hybridisable state. But the prions needed a host of allies to enable this change; not only reduced cooking temperatures, but also processes such as increased demands for protein supplements in bovine feeds and the increasing presence of bovine material in that protein mass. The prions themselves may have come from ovine matter, specifically the nervous tissue of scrapie-infected sheep. Scrapie is a similar disease to BSE but has been present for over a hundred years in Britain. Wesley remained convinced by the scrapie link, and recalled an Oxford scientist warning him as long ago as 1946 of the potential for neurological diseases to 'jump' from ovine to bovine and then into humans. They were just waiting for the right springboard configuration to assist their jump. But even this is a disputable claim. Stanley referred to a report by a New Zealand scientist who traced BSE in Britain back to a rare breed of deer at a zoo whose infected carcase made its precarious route into the bovine food chain.

A post-mortem offers the only sure diagnosis of prion infection: the bovine-prion hybrid relationship is suspended when the animal is dead and this allows the prion to be
uncovered. A diseased animal is in this way treated like a lab rat. Ken emphasised the
need to develop an accurate testing procedure in the living animal, such as a swab test of
bovine saliva, to reduce the inefficiencies of BSE diagnosis:

The health of your livestock is very much tied into science.... We ought to be
researching a swab technique to be able to swab every tonsil of the two-point-five
million sheep in the country and cull out those that are carrying scrapie or BSE or
whatever. The test is there. We need science. There isn’t enough being put into the
diseases of livestock. It’s all gone mad looking at cow brains to try to find scrapie in
sheep – well heck what we need to do is identify it in the living animal and cull that
animal. There’s a lot of wasted money. Nutrition – it has really advanced
considerably in the last thirty years and that knowledge needs to be disseminated to
farmers more so that they know more and have a better feed ration for their corn mills
for livestock. It has been ridiculous – those rations have been driven by the greatest
profit margin rather than quality. They should be able to put that on their label. [Ken]

If the farm animals were handled like lab rats, then the livestock farmers believed that
they had also been subjected to the whims of another’s experiments. As Harry
contended:

The thing is with BSE is that it’s all put down as the farmer’s fault and yet that was
produced by companies not cooking meat or bone to the right temperature. We only
happened to buy the cake, you know. Buy the cake off the feed firms and sort of you
trust them – you’ve been using cake for years off a certain person and you’d think it’ll
be alright. [Harry]

This statement clearly shows that Harry was conducting his farming on the authority of
someone else’s science. He presumed that the network from which his ‘cake’ feed was
derived was as rigorously analysed and supervised as his own productive network on
Hillside Farm. The individual farm-laboratory may appear to have a BSE-free herd, but
it is not necessarily a BSE-free farm since the farm-laboratory cannot be assured of its
constituents.

I simply don’t trust these feedstuffs. You know, after the BSE thing – maybe that was
the iceberg. Cheap rations mean there’s a price to pay - simple as that. ... For me, it’s
basically good forage, healthy animals, great meat. ... Healthy ground, healthy stock,
healthy humans. [Brian, Broadleaves Farm]

While I was conducting my interviews, it emerged that ‘the government’ – the phrase
farmers used to refer to any government organised science – had been conducting tests
over the previous 5 years (1996-2001) into the possibility of ‘BSE’ in sheep using cow
rather than sheep brains by mistake (The Daily Telegraph, 19 October 2001: 1). Using
bovine brains had yielded positive results and so these particular tests had suggested that
BSE could be passed into the national sheep flock. This result could have led to the slaughtering of part of the national flock if the mistake had not been recognised in time. BSE and the subsequent beef crisis “is a symptom of a fundamentally flawed agri-political system” (Elworthy and McCulloch, 1996: 743). The farmers’ disaffection with government science was all the more deeply felt since it was mostly the same collective of scientists who had been responsible for setting many of the farm standards in the first place. Therefore farmers suggested that BSE science is ongoing and that there seem to be no experts:

Unfortunately when that sort of thing comes up, it doesn’t give you any confidence at all in the system. I don’t give a monkeys what DEFRA is saying – what would they know. If they can’t even tell the difference between a cow’s and a sheep’s brain. I think you just sit back some days and think do they care really anyway.... Is there anyone in government who really cares about farming any more? [Fred, Fairbanks Farm]

If there is no clear agreement amongst scientists about BSE, then this adds additional sub-narratives at the level of the individual farm. One vet suggested that the weakness of investigation lies in the ‘Ministry’s’ – the government veterinary scientists’ – conception of science:

[JS]: Why do you think there is still no answer to the question of what caused BSE?

[Stanley]: Because they are dealing with pure scientific terms. Pure science. ‘Cos they’re giving the prion to mice and the mice are getting BSE. Or they’re injecting pure prion into pig’s brains and they’re getting BSE.

[JS]: So they need to root their science in practice then – on the farm?

[Stanley]: No, not necessarily. You need pure science to prove what it is if you follow me – you need pure science to prove what it is.

[JS]: So your definition of proof isn’t to do with tracing to the root cause, but rather it is re-enacting?

[Stanley]: Yes, it's not tracing, it's re-enacting.

Stanley questioned the validity of a ‘pure science’ approach, but at the same time he felt that this offered the only pathway to proof provided the correct apparatus and conditions were applied in the investigation. But, contrary to Stanley’s suggestion, we have already seen the problems with ‘re-enacting’, with replicating the laboratory elsewhere. The specificities of the farms where BSE had emerged should be better evaluated because it is in these farm-laboratories where the prion first appeared and not in a carefully
constructed government laboratory. Perhaps there are important variables hidden amongst the complexity of farm-laboratory that contribute to the way the prion is mobilised. This contingency might be critical to the way the prion propagates and the BSE disease is spread and so Stanley’s idea of ‘pure science’ might be a myth.

4.2.2 Tracing the Madness

We have seen how Stanley referred to the difference between tracing and re-enacting experiments. Whereas re-enacting an experiment in controlled conditions can lead to the sort of ‘pure science’ outcome that Stanley desires, tracing and learning from experiences – not always formalised as ‘experiments’ – can be every bit as revealing. The task of tracing the prion is of interest to the farm-laboratory since it exposes myriad associations that were only acknowledged in the wake of the BSE outbreak. Farms, farmers and farming have been turned upside down in the search for understanding how to protect themselves and as a result of that search. As Hinchliffe (2001: 199) argues: “Species and state boundaries, and the space-times of industrial-agricultural practices, were no match for the mobility and motility of the disease.” In effect, farming practices are trying to reorganize the farm space – to engineer a (re-)translation of the collective – in order to safeguard the welfare of humans and bovines: “The hybrid mediations inscribed on ‘food’ have been exposed and we may now ‘follow the actors’ in the translation process as hybrid collectives are reconstituted” (Goodman, 1999). The ‘Thirty-Month Rule’ “came into force on 29 March 1996, and banned the sale of meat from cattle aged over 30 months for human consumption” (Curry, 2002: 51). It was an attempt to curtail the prion’s spread by limiting its hybridisation to the stages of gestation. The potential prion is unable to switch hosts and infect humans. As a result of this rule, any bovine aged over 30 months that has ended its productive working life on a farm premises is incinerated and this rule is still in force with few exceptions.

I now turn to the principal strategy of ordering the BSE epidemic, that of ‘traceability’. This was launched at the same time as the Thirty Month Rule and was a way of recording

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8 Brian explained that the 30-month rule is potentially restrictive on extensive cattle management regimes. Low grade grazing is unable to fatten animals before this deadline and so their diets must be supplemented.
the movements of bovines across Britain. It is a classic response to making sense of experiences when the standards have been disrupted that rests on objective of maintaining the visibility of bovine networks. As part of this, the British Government introduced a scheme of cattle passports so that every bovine in the county could be monitored. Figure 15 is an example of one of these carefully numbered passports.

Figure 15: The cover of a cattle passport as issued by DEFRA
This scheme augmented existing on-site requirements of a large yellow EU ear tag for the left ear and a metal tag numbered similarly for the right ear of every bovine. Photograph 10 shows these tags and the applicators used to embed them in ears. The rules have also been developing over time:

Under EU legislation, enforced from Jan 1, 2000, the UK has to fall in line with new rules giving cattle and dairy producers a maximum of 27 days to tag calves and register births rather than the previous 45-day limit. From tomorrow, beef cattle must have both ear-tags inserted within 20 days of birth, instead of the previous 30-day limit. (Farmers Weekly, 31 December 1999: 2)

Together these traceability schemes enabled every bovine in Britain to be traced to a farm and to a breeding history. Some farmers dissented from adhering to these standards either because they were impractical, inflicted pain on the animal, or because they were simply seen as a waste of farming time:

Our cattle do not have standard ministry ear tags – they have labels and they have the silver tags. They lose their tags and they have their names on. If they leave the premises then I make sure they are properly tagged. I don’t see why they have to on the farm. [Norman, Narrowlane Farm]

Photograph 10: Ear tags and ear tag applicators for sheep and cattle
A stage further in tracing would be to place microchips just under the hide of cattle so that there details could be made available to anyone with the right scanning device. This is common practice in Ireland and may soon be adopted in Britain.

[F]ull electronic traceability of livestock should be achieved as soon as possible. DEFRA and the industry need to put in place better systems to trace sheep and pigs if their movements entail anything more than one movement to slaughter, as well as enhancing the current system for cattle. This will reduce the remaining paper burden on livestock farmers, by allowing more electronic data transfer. (Curry, 2002: 50)

But the need for tracing the movements and exports of animals was accepted by all interviewees, as was the need to ‘know what’s going into our animal – that’s the most important thing’ (Stanley).

The farmers described the incredible detail of recording that tracing entailed:

BSE has been followed with incredible detail. It is infuriating and time consuming and difficult to deal with. It happened to be very lucky that we had introduced all the tagging and traceability. Without that we would not have known about where all the sheep were moved in the foot-and-mouth. It showed the ridiculous distances animals were being moved. [Queenie, Quaker’s Farm]

It has now been indelibly inscribed as part of the protocol of the standard farm, as Tim confirmed:

Traceability comes in at the inspection. If they have bought store stock, they have to show us who they bought it from, that they were licensed for that product, how the animals were and what they had been fed before they got to the farm, and that’s all done by a form provided with an invoice for the animals. [Tim]

These processes of recording that have been developed as a response to BSE reveal the persuasiveness of the nonhuman prion in effecting change in the standard farm. The realisation that the pathway from field to fork is not a linear progression, but instead a network of polyvalent currents, has methodological implications for tracing. For example, once farmers have been informed that it was most likely ‘infected’ feedstuffs that represented the host for the prion, they may respond by cultivating bovine feedstuffs on the premises or buying in unprocessed feedstuffs from a reputable and accountable source. The way centralised traceability procedures codify one farm-laboratory space to another on a national scale enables a better understanding of where bovine products move during the processes of production and consumption. A plethora of actants and bodies are connected. And it is important to consider the potential for many more cases of CJD
developing in humans – more than the current statistic of one in every million people in Britain – that are all linked to BSE.

But secure traceability almost always relies upon the integrity of operations at other laboratories and this allows the possibility of dangerous ‘weak links’:

I think traceability is vital but it’s an impossibility – absolute impossibility.... Well how can you have a traceability in... You’ve got ten lines of pork in a container – it’s all done on trust, all the way along. If you’ve got one weak link, traceability means nothing. The weakness lies beyond the farm. Unless you can take your beast to the slaughterhouse. Get them killed. Get them hung. Take it back to the farm and sell it from your back door. That’s the only way true traceability can work. [Stanley]

Few farmers suggested that the project of traceability and the concept of tracing products from field to fork were having an influence on consumer decision-making. Maintaining integrity in the bovine food chain is an expensive enterprise and consumers are more likely to assist with costs if they are able to ‘ask the right questions’:

When you go to the butcher’s do you ask which farm it came from? I do. When you go to a restaurant do you ask where the food came from? It’s that sort of approach that one needs to encourage. If we could just get people to ask the questions then I think sixty or seventy per cent of the battle would be won. [Wallace]

Pat has responded to the more discerning consumers and follows recommendations like Stanley’s by marketing his produce from Partridge Farm. In so doing, consumer-purchasers can effectively trace a localised food production-consumption system in operation:

When they are in the room out there and are packing up, they can look out at the fields and either see the sheep or lambs out there or cattle. The people – the hard core – have always appreciated the way the animals are treated and reared and the conditions they grow in. Those people actually come here to pick up it. I don’t think they’re doing it for reasons of community spirit. It’s just because they want meat that they know has not been chemicalised and can see the production system. They know the lamb in my freezer has only left the premises briefly for slaughter. [Pat, Partridge Farm]

Sarah identified problems with too long and complex a food production-consumption chain, and so ‘tracing’ these disparate networks might only be part of the solution. She suggested that perhaps the ‘distances’ food travels between production and consumption should be shortened rather than just traced to make the system more local integrated and accountable. Stanley also recognised the need for such a change in emphasis:
I think first it means people are more likely to find loopholes and not actually follow any regulations that they have because it's overburdening them. It also removes the consumer from actually how his meat ends up on his plate – I think that is a problem in this country– it was noticeable compared to New Zealand where most people still have a very strong connection with agriculture. [Sarah]

This ‘shortening’ must not be a ‘shortcut’ however and it must not come too late:

Unfortunately traceability schemes are necessary. It wasn't twenty or ten years ago, but it's happening as farmers are taking shortcuts.... But what can they trace? When they find out it's too late! [Walter]

Farmers have learnt much from the BSE saga and have realised the implications of their actions:

It certainly brought home to me the benefits of record-keeping. I know it seems we've all got much more paper work to do now on farms but I think this has just proved the case that we need to really have a good system in place of tracing animal movements and identification. [Fred, Fairbanks Farm, 1999]

The currency of ‘traceability’ among the farmers is an example of how Whitehall rhetoric makes its way from the policy-table to the farmyard. Its application to farming is in fact wider if it is seen as simply one more way of making a farmer’s operations transparent. The testing of milk from Fairbanks Farm by outside agents involves a similar process of tracing a sequence of actions:

They've got collars on with a transponder for when they go in and out the parlour feeders. So they get the right amount pre-programmed. We do use the national milk recording service but we take our own samples to make it a bit cheaper – but they supply the test pots and they do all the testing. But the local supervisor drops off a tray of the pots every few months and we take the samples and do the readings and my wife fills it in on the forms. That gets taken away by the tanker driver like it would normally but they get a print out of the results each month. So that's quite useful. [Fred]

Dennis similarly recognised that ‘traceability’ should be an integral constituent of organic farming practice anyway because organic farming puts onus on the reliability of its food label. But there can be a critical difference between traceability and certification because certification is designed to monitor the movements of humans, whereas traceability is designed to monitor the movements of nonhumans.

It is very important with the organic because that is the major issue really. I think that's why there's all these farmers markets starting up and that because people can trace where it comes from. I think that's what's happened with farming in the recent past – the problems of not being able to trace where it is coming and where it is going have presented themselves.... Years ago my granddad used to sell the milk in the village. We used to have a butchers shop over the road as well because he was a
butcher. We used to slaughter the animals in the house up the track over there and sell them in the shop there – you couldn’t get more able to trace it locally than that. But it’s got more centralised now…. They are now ear-tagged and they have their records and passports. But one step further would be to get the microchip and then they’d be traceable to anywhere – the ultimate thing when they go to market or slaughter and get recorded on a database. But whether it happens or not. These slaughterhouses could have a centralised database and scanners and know where the animals come from really. Some of what’s been going on up to recently like these sheep like in one market one day and selling them somewhere else the other was what spread foot-and-mouth around wasn’t it? [Dennis, Dinglewell Farm]

But some aspects of farming are still untraceable, even in the beef and dairy sector. They may not constitute risks in the current language of science but we have seen how that language can change:

We have insemination straws – don’t know where they come from. We order them and they send them – ‘Genus’ the catalogue. You chose your bull and they send the straws and you keep them in the flask for when you want to use them. [Oliver, Oaker’s Farm]

The traceability schemes are still expanding networks however. The Animal Health Bill, under the auspices of Lord Whitty, attempted on 27 March 2002 to give more power to Ministry agents in order to assist with a ‘higher level of surveillance’ on farm. ‘Surveillance’, the testing of suspects off premises comprising sick animals, fallen stock, or those at abattoirs, was to be extended. The present government is seeking to implement a new protocol enabling Ministry agents to enter premises and slaughter suspects outright in order to suppress TSE (Transmissible Spongiform Encephalopathies) related epidemics more swiftly. TSE epidemics are identified as a different pathogen genre from ‘exotic diseases’ like FMD. This new legislation is publicised as part of EU rules but there is a concern about its implications for further surveillance and on the classification of suspected and susceptible animals.

4.3 Viral Strains: The Dis-Ease of Foot-and-Mouth

4.3.1 Big Chinks and Weak Links: diagnosis dilemmas, conflicting controls

The BSE saga acted as a precursor to Britain’s FMD epidemic of 19 February 2001 to 30 September 2001, both in how the disease was framed and perceived. This is because the populations of farmers and members of British public who experienced it were often the same, and these populations were still recovering from BSE. This situation in Britain
helps to account for the absence of equivalent large-scale public anxiety when FMD flared up in southeastern Europe, notably Greece, in the summer of 2000. FMD had first come to Britain in 1839 and FMD epidemics were not new – for example, in 1923-1924 there were 1,929 individual cases, as a result of which 128,000 animals were slaughtered (Plumb, 2001: 47). Oliver noted why FMD was a different agent from BSE.

When I was a boy there was a foot-and-mouth nearly every bloody winter somewhere. Since 1967 there hadn't been for years. Foot-and-mouth is a contagious disease – like what we know about – BSE is not contagious and is a new disease – different – and it's frightening because it's a fear. And they don't really understand it. It's all bloody theories – it's not fact. Nothing's been proven about any of it – how it came about or what it is. It's probably this and probably that but there's nothing set in stone as a scientific fact so far. But foot-and-mouth we do know about. [Oliver, Oaker's Farm]

Although, as Oliver suggests, FMD was an established infectant, the public scare that accompanied the 2001 outbreak was diagnosed in a similar way to how BSE had been and misguided fears arose about its zooenotic potential. Sam provided an excellent synopsis of the 2001 FMD epidemic:

What actually happened was the disease was brought in - they don't know exactly how – and because animals which were being transported to various places in the country were infected, it arrived within a period of probably a couple of weeks, probably around for a couple of weeks before anybody spotted it. It was identified in an abattoir in Essex but it had clearly been around for a while before that because the Ministry thought 'well OK we're going to find out where that came from and we're going to deal with it'. But what they didn't realise was that there were already probably forty sources of infection, forty different farms by then. So that was why it was so difficult for them to deal with. They did have a strategy but the strategy didn't work for that scale, and unfortunately the state veterinary service had been very substantially cut in nineteen-ninety-two to only about half of its former size on the basis of 'oh, we don't need all these state vets; we'll save money'. And that was as it turned out a very expensive mistake because they just didn't have the manpower to deal with it. They just did not have enough people to slaughter the animals. The best policy is to slaughter the animals which are infected or which might be infected – in other words within two or three kilometres of the infected animals. That's our view in our scientific committee so that's the best thing to do. Vaccination is useful only in the circumstance when you can't slaughter fast enough because if you can vaccinate faster than you can slaughter – which you can normally – then that gives you a little bit of extra time, but it takes almost three days for the vaccination to take effect so if you can slaughter within the three days there is no point at all in vaccinating. [Sam]

The virus had brought a state of dis-ease to the British farming community and we can learn about how the virus and responses to it were expressed in the farm space. Veterinary inspectors and a host of other agents from all over the world were brought into the campaign to help confine the epidemic.
The key to progressing lies in learning from what is observed and not always wanting to take this interventionist approach that we've become educated to — inculcated to thinking in terms of disease is a problem, how do we cure it. As opposed to seeing the word disease as it was intended which is dis-ease. Look for the cause of the problem. Root that out rather than simply identify a problem and try to knock it on the head there and then by means of synthetic drugs. [Brian, Broadleaves Farm]

By plunging British agriculture into chaos, the Foot and Mouth virus that re-emerged in February 2001 at Burnside Farm in Northumberland dramatically showed the symmetry of human and nonhuman agency. In this 2001 outbreak, over 8000 farms were infected and 3.5 million animals destroyed. This microbe exposed the porosity of the farm border and it soon became evident that no farm-laboratory was isolated. The virus was camouflaged and black-boxed because it had hybridised with many vectors, including infected livestock, careless humans moving between farms, and even particles in the wind. Figure 16 shows the development of the disease and the mobilisation of controls in response, and suggests how the animal-virus hybrid is negotiated over time.

**Figure 16: Key stages in foot and mouth diagnosis and control**

![Diagram showing key stages in foot and mouth diagnosis and control](Source: Woolhouse and Matthews, 2001: 2)

The main problem was that not all farmers knew what they were looking for because few farmers had ever seen the disease and fewer still had ever seen the agent. Figure 17 shows what the virus looks like through a microscopic — a view no interviewee farmers had been able to offer themselves.
The benefits of operating a closed herd and flock where made clear by this viral outbreak: 'We know we are buying in disease when we buy in livestock' (Richard). The adoption of coping strategies for the disease reveals how the nonhuman agent was the impetus for legislative and practical change that disrupted standard farm practice. Queenie felt afraid because there was a vacuum in the standard farm construct; it had not adequately accommodated for this nonhuman in its policy and so could not guarantee a smooth transition away from infection.

My experiences are of acute fear that I would get infected and lose my animals and have to decide how to cope with it. I was fearful, nervous and uncomfortable over a long time. [Queenie, Quaker's Farm]

Yet the library of the House of Lords contained a report written after the previous outbreak in Britain in 1967 – what Latour would call an ‘immutable mobile’ – that specified exactly which procedures should be followed in the event of another epidemic. This report, published in March 1969, was effectively a laboratory blueprint for the same disease. However, the context into which this report was brought and the way it was interpreted, particularly by the current Blair Government and its advisers, had changed and so was largely disregarded. British farms, farmers and farming had also changed in that 35-year period. Indeed, there is a long and complex history and trajectory relating to FMD at each farm location that I studied. My own study is a transect between two points in time, 1999-2001, but that is only a fraction of the long and matured experiences of the farmers I interviewed. The experiences of farmers of FMD were in some cases limited to the 2001 outbreak. However, farmers like Oliver evidently recalled parts of the 1967 and
earlier epidemics, and such knowledge conditioned their thoughts and actions in 2001. It is difficult to quantify such knowledge and experience, but it augmented, or sometimes contrasted with, veterinary science, EU regulations, and other recent commentaries of FMD.

We went back thirty years from the moment the foot-and-mouth was broadcast. We got things from DEFRA telling us how to protect our farms which we did—we had footbaths and all this and never went anywhere. I didn’t go anywhere. We were unable to move the stock which was fine for me but must have been ghastly for other people. [Louise, Longsbottom Farm]

What farmers really had remembered was FMD’s proclivity for rapid spread.

The outbreak on my grandfather’s farm in 1924 was believed to have arrived via a letter sent from cousins in Cheshire, who wrote to say that they had foot-and-mouth disease on their farm. My grandmother took the letter to grandfather for him to read while he was milking, evidently carrying not only the news but also the virus to the milking-shed. That is how virulently infectious the disease is. [Wesley]

But even those interviewees who had clear recollections of the 1967 FMD epidemic might, as William revealed, have seen it as buried history: ‘I remember the outbreak in sixty-seven and people used to talk about it like the plague or something. People today saw it as historical—they didn’t think of it as a current problem.’ The epidemic constitutes a rapid proliferation of hybrids and their enrolment in a network with an identifiable space/time. The particular configuration of hybrids in the 2001 epidemic is unique and so, while the specific disease (body-contagion hybrid) is always more or less repeated, the epidemic is never quite repeated.

The movement of livestock during the epidemic was very restricted and complicated licensing procedures had to be followed. For example, an inspection was necessary if farmers sought to move animals outside of a farm for welfare reasons. In addition, new rhetoric was introduced to farming discourse, particularly that of ‘biosecurity’. Farms were barricaded against this latent and potentially catastrophic agent. A video cassette entitled ‘Biosecurity: stopping the spread of disease’ was mailed in June 2001 to each farm in the country by DEFRA, showing 8 steps to follow both in protecting the farm from infection and in cutting down the interactions beyond the farm in the event of suspected infection. Here is an extract from the leaflet accompanying the video:

Biosecurity is extremely important and the measures you’re carrying out now to help eradicate foot and mouth disease must be continued once the outbreak is over. High
standards of biosecurity practised all the time will help prevent outbreaks of animal diseases. Although it involves some extra work it’ll soon become part of your normal routine. Everyone gains by these measures – your neighbours, the farming industry as well as you and your family.

Some farmers did follow these measures very carefully:

We had a barrier across the road and no vehicles came in or went out without being totally washed off and disinfected. And nobody walked in or out without having their boots done. And we kept the Landrover and our car on the road all the time and we even changed – we got in the car in different clothes from what we walked here in. We were very strict. [Charles]

Brian expressed how he had stepped up their policing of the premises during the FMD campaign:

Every entrance was strawed and disinfected. Signs were put up to prevent people walking through – but they were in fact. That was underscored by the local law so we had the locals on our side. But let’s face it, there are deer and badgers and foxes and dogs and cats that go off from one farm to the next. It’s impossible, isn’t it? Ultimately you depend on the robustness and the health of your livestock because they must be assailed by potential disease all the time. [Brian, Broadleaves Farm]

Photograph 11 shows how farm gates were kept strictly bolted and activity on the farmyard restricted during the FMD epidemic.

Photograph 11: A view of the gates at Talltrees Farm during the FMD outbreak
But the scale at which biosecurity operated was contentious and revealed the limits to the authority of different agents.

*Biosecurity you can only do in a macro-form rather than in a mini-form. ‘Cos your farmer on his farm, he can close the gates but he can’t stop the birds coming across, he can’t stop the vermin, the footpath. So for me it’s a macro rather than a mini risk.* [Stanley]

As Figure 18 suggests, infected farms were strictly cordoned off as contaminated spaces and in this way at least humans could be *instructed* to keep away.

**Figure 18: A police notice of FMD infection at the entrance to a farm**

![Police notice of FMD infection at the entrance to a farm](http://www.bbc.co.uk/fmd)

New farm-laboratory protocols had to be invented to cope with the confusion brought on by the virus. When vets visited farms during the outbreak, they did so in radically new ways:

*The difference there is that I wouldn’t go onto the farm. I would park on the exterior of the farm, phone the farmer, ask him to meet me at the entrance, disinfect down and then go onto his farm. I would be dressed up from head to toe in white disinfected overalls. And there was a lot of objection to me going on the farm because they see me as a government agent going onto the farm.* [Stanley]

The government agent was viewed by some farmers as a harbinger of the virus itself and so they were hesitant to allow them onto the premises.

Queenie expressed the frustration and difficulty of fighting an unseen enemy and she revealed how this became translated into her practice at Quaker’s Farm:

*The farm is right in the middle of the village so there’s no real way you could do anything really effectively. It was more just a lot of time taken out of the day – washing things down. And actually a feeling you were doing it for the sake of doing it*
— you actually didn’t believe in it. I didn’t actually — it sounds stupid. But you had to do it — you had to everything you could. You would go up the road to fetch bales of hay to fetch from one side and back into the yard with those. And you simply couldn’t every time you brought five bales down in a load, spray the tractor right over. You washed it down at the beginning and the end, but not every time you backed into the farm. It just wasn’t a plausible proposition. If it had got any closer, I don’t know what we’d have done. I really don’t. At the beginning I kept stock in away from the edges of the farm and away from the main roads that surround the farm. But you couldn’t maintain that. [Queenie, Quaker’s Farm]

However, Brian explained that enforcing what seemed to be total ‘biosecurity’ on Broadleaves Farm did not necessarily safeguard his livestock. The government’s rule of ‘contiguous culling’ stated that all animals on infected premises should be killed within 24 hours and animals on farms immediately adjacent to this premises should be killed within 48 hours. Therefore, Brian told me that slaughterers might ‘turn up one day and tell me that my animals that I have been looking after so carefully have to be shot because someone next door has not been careful enough’. Indeed, not all farmers were as rigorous with biosecurity:

When foot-and-mouth come in you had sort of on the drive the carpet down and knapsack sprayers. We actually had them on the roads all the way round the village and that — straw, sheets down and then straw on top — and each farm would look after one so you sort of keep it neat and tidy. Then after two or three months, it got to the stage where, you now, blow it [laughs]. If you’re going to get it, you’re going to get it. So many of these farms that had it — you know people were living like hermits, you know, just shutting themselves in and not allowing anyone in and they still get it. And it just makes you think whether it’s worth all this extra hassle. If it gets into an area, it is so hard to stop it. [Harry, Hillside Farm]

Again we see that farm-laboratories are not isolated from each other and that a scientific consensus between farms may be a prerequisite for effective control of the FMD microbe.

Although all interviewees had been affected, none had been infected by the 2001 FMD virus.9 In fact, Dorset county escaped infection altogether. The fact that they were organic farms had little bearing on their predisposition to infection, except that they tended to operate closed herds and so were not involved in national livestock dealing. But they did have friends or family whose livestock had been afflicted. Farms that had been infected were forced to hand over power to the Ministry and to accept the mandates of superior scientists. A new on-farm consultation process developed, reversing the

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9 Indeed, had any been infected, my interviewing schedule would have been even further postponed!
power roles by taking away the farmer’s decision-making capacity. And yet the Ministry’s authority on the issue was certainly in question:

I moved forty sheep. I had to cleanse my lorry trailer four times. That cost me one-hundred and forty-one pounds. I had a vet there – no quibble about that. But a DEFRA man come along. He was self-employed. He was paid ten pounds an hour, thirty-six pence a mile visiting. He had milked someone’s cows in the morning, he had someone’s sheep he looked at, and he was in Durham the day before. He was the heaviest point of infection in the district because he’d been round everywhere. He hadn’t disinfected his wheels of his car, the seat. The bottom of his trousers and boots were but not his jacket. As far as I could say, he could carry it in his tonsils. He should never have been allowed in the place! [Ken, Kestrel Farm]

Several interviewees spoke of a ‘Channel 4 Dispatches’ documentary of the FMD crisis broadcast on British television in October 2001 which revealed ‘government incompetence and mismanagement’: “The Ministry’s 24-hour slaughter policy was in disarray. They were giving the virus time to move from farm to farm and so build a larger epidemic. ... The Ministry scientists had only been able to chase the virus and not get ahead of it”.10

It certainly was in this country before February, I feel the government knew that it was. If there was an outbreak, there should have immediately been a one-hundred per cent livestock clamp down. [Ken, Kestrel Farm]

Figure 19 shows a cartoon in a farming newspaper that suggests that Elliot Morley MP, the Minister for Agriculture, was always chasing the tail of the monstrous epidemic.

William, who was involved in some clear up operations, explained the difficulty of purifying the farm space of the virus and its hybridisations:

When we were cleaning buildings, we didn’t know which particular bit of muck the virus was on so you really had to clean every sort of nook and cranny. Just not knowing really. Inside hollowed blocked walls. [William]

But even those involved in the operations were unsure about the scientific basis of their practice:

We had to wear white overalls. The thing that cracked me up was that it’s an airborne disease and we go onto farms and all they do is either disinfect your wheels or dip the soles of your boots in. They put it in your hair, everything you can get on. They might as well not bother doing anything and do that, but I suppose it’s just showing willing really and your trying to sort it. But it’s airborne for god’s sake! [Walter]

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Figure 19: Cartoon from a farming newspaper depicting government disarray over FMD

(Source: Farmers Guardian, 3 August 2001: 11)
The military metaphor is particularly appropriate for describing the events surrounding FMD outbreaks, because of the enrolment of military personnel into the Ministry team. They were joining the Ministry vets, local support vets, contract digger and loader operators, DEFRA inspectors, slaughterers, disinfection squads, and so on; an eclectic army amassed to meet the assault of the virus head on. However, William suggested that the vets and not the military were the highest scientific authority during farm purging. All the other new agents who had invaded the farm space were made accountable to those vets. But when drafted in, the army added a new dimension: 'What the army added was the presence of a uniform. It was an official uniform that said we meant business - which was good' (Stanley). But the inclusion of the army reminds us how potentially interlinked even the seemingly most disparate networks are, although for the nonhuman conducting the experiment they might well be in control.

The fact that the army are eating beef from Argentina and everywhere else which has Foot-and-Mouth is just ridiculous. And to think that those army soldiers were then going onto farm premises in Britain, eating these rations that have come from here, there and everywhere with goodness knows what in them. To think that they were potentially bringing Foot-and-Mouth in whilst supposedly ridding the farm of it! It's ridiculous! [Ken, Kestrel Farm]

Borax is a homoeopathic prophylactic recognised by some as declining the spread of FMD. Some interviewee farmers enrolled it into their farming networks to strengthen animal resistances:

> We used homoeopathic prophylactic for foot-and-mouth before I discovered it wasn't allowed – Borax. It was very funny. We got a letter from the SA saying that we weren't allowed to use it as a prophylactic, but of course by that time it was well after. It's a ten-day course and by that time I was nine days into it. And so they had the last dose. And then we had a letter later from MAFF which didn't say we weren't allowed to use it – it said it isn't effective. Their researchers had looked at it. But they didn't say it wasn't allowed. [Queenie, Quaker's Farm]

Both Chase and Quaker's Farms had developed the idea of using Borax as a prophylactic nosode and they had filtered the knowledge outside of the government mainstream to other premises, including to Jack at Jersey Farm. The network of Borax's distribution was trying to keep one step ahead of the virus:

> And just about every organic dairy farmer was putting homoeopathic stuff in his cow's water anyway – Borax. We got word around very quickly. Our herdsman was on holiday that week and I was milking and he rang me up and said I'd better get some Borax and start putting it on the water because that's what McLeod says for prevention
against FMD. So I ordered it and rang round a few people and said this is the thing to do. And within days homeopathic pharmacies were inundated with requests for Borax. And then a sort of directive came out from the SA saying we shouldn’t be doing this and it wasn’t worth the paper it was printed on. MAFF didn’t say that. It said beware of people coming round selling you potions that can protect your cows against FMD. Beware of salesmen claiming they could give you a homoeopathic thing to protect your cows. MAFF never said stop putting it in your water, so we went on doing that like everyone else who had any sense. [Charles, Chase Farm]

In any epidemic, time is of the essence and the hesitancy of government action helps explain why such contingency plans were drafted.

The Borax episode is a debate of unconventional science but there were also more conventional scientific debates. Wars were not merely fought against this microbe itself but also between two factions of science advancing two different control mechanisms – those who supported vaccination and those who supported culling. Vaccination involves injecting an attenuated virus into the healthy animal so that it develops its own immunity to FMD without bearing the symptoms. What culling does is to strengthen the livestock networks and help to maintain its purity by removing potentially lethal hybrids from the collective. Farmers opinions were really divided on the merits of each approach, although the Soil Association itself campaigned for vaccination on organic farms:

It became this polarised division. It seemed to me very bizarre that the SA whose standards ban vaccination for any other disease unless you have a known farm problem and recommend the use of alternative medicines and homoeopathy – that this didn’t get a mention. It was just ‘we must vaccinate’.... The SA totally let us down in that respect. It just said ‘don’t use homoeopathy, we want vaccines’. So the homoeopathic theory of Borax wasn’t really tested. [Charles, Chase Farm]

4.3.2 Viewing the FMD Crisis: Spectres and more inspectors

During the FMD campaign, the farm collective was also exposed to the full onslaught of the British media. The virus is not capable of making the networks of interactions in the farm space visible by itself: it requires an array of allies and British news reporters often acted in this way. British newspaper, television and internet coverage of the FMD epidemic was critical to how the knowledge of the disease – and of responses to it – were framed and spread (Table 6).
Table 6: A year of British media statements on FMD in Britain

<table>
<thead>
<tr>
<th>Date and Source</th>
<th>Statement (Note: epidemic lasted 19 February 2001 to 30 September 2001)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The Daily Telegraph</strong></td>
<td></td>
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<tr>
<td>(22 February 2001: 22)</td>
<td>&quot;The nature of the disease is such that any outbreak could be catastrophic. The organism of infection can be borne through the air ... 40 miles overland and 200 by sea. The range of animals affected is wide – all those with cloven hooves, except for horses – and foot and mouth hits some that are not bound by barn walls or field boundaries: deer are susceptible and even birds can be carriers.&quot;</td>
</tr>
<tr>
<td><strong>The Economist</strong></td>
<td></td>
</tr>
<tr>
<td>(3 March 2001: 27)</td>
<td>&quot;[T]his particular strain of FMD virus has been doing the rounds. It started in northern India in 1990, and then spread to Saudi Arabia, reached Greece in 1996 ... and over the past two years has caused nasty outbreaks in South Korea, Japan, Russia and Mongolia – countries which, like Britain, had been free of the disease for decades.&quot;</td>
</tr>
<tr>
<td><strong>The Economist</strong></td>
<td></td>
</tr>
<tr>
<td>(17 March 2001: 31)</td>
<td>By mid-March, the epidemic really had swept across England and Wales and into parts of Scotland – it was a national outbreak.</td>
</tr>
<tr>
<td><strong>The Sunday Times</strong></td>
<td></td>
</tr>
<tr>
<td>(12 August 2001: 3)</td>
<td>&quot;In Whitehall, full disinfection procedures have been ordered. The spread of embarrassing government papers and the risk of infectious public testimony have been completely contained within the Whitehall information cordon.&quot;</td>
</tr>
<tr>
<td><strong>The Daily Telegraph</strong></td>
<td></td>
</tr>
<tr>
<td>(13 October 2001: 17)</td>
<td>&quot;The foot and mouth slaughter policy was like ‘carnage by computer’ because it was run from Whitehall by civil servants who took no account of local geography or knowledge.&quot;</td>
</tr>
<tr>
<td><strong>The Daily Telegraph</strong></td>
<td></td>
</tr>
<tr>
<td>(3 November 2001: 22)</td>
<td>&quot;Centralised control of the foot and mouth epidemic by Government caused a lot of trouble and vets needed more local authority.&quot;</td>
</tr>
<tr>
<td><strong>The Daily Telegraph</strong></td>
<td></td>
</tr>
<tr>
<td>(8 November 2001: 4)</td>
<td>&quot;The three-day delay in banning animal movements after identification of the first case of foot and mouth caused the epidemic to be between one third and one half greater than it need have been.&quot;</td>
</tr>
<tr>
<td><strong>The Daily Telegraph</strong></td>
<td></td>
</tr>
<tr>
<td>(30 January 2002: 24)</td>
<td>&quot;[T]he Government admitted that, between October 2000 and September 2001, no less than 108,339 tons of meat from bovine animals was imported from countries where foot and mouth is endemic.&quot;</td>
</tr>
</tbody>
</table>

The government was often trying to control the spread of this media in addition to controlling the FMD virus, especially because of the general election planned originally for 3 May 2001: “Diverse actors promote particular media framings in order to justify and legitimate their own chosen actions (or inactions) as environmentally sound and benign” (Magnaghten and Urry, 1998: 99). Details of the epidemic were broadcast daily not only into non-farming households but also into the very heart of the farm-laboratory and would sometimes serve as the only available knowledge.

The NFU were sending daily reports and I could read the update for the southwest each night. It got a bit depressing after a few months when each evening before you’d go to bed you’d sit in front of the computer screen. Oh dear. [Fred, Fairbanks Farm]

I have an e-mail come everyday right throughout the crisis from the NFU. I set that up. It's gone back to twice a week now. During the peak of the crisis, it was daily which was really good. [Geoffrey, Grandview Farm]
Farmers described to me how it was impossible to escape the images of livestock being burned on pyres or buried in huge lime pits. Figure 20 illustrates the power of these images.

Figure 20: A cover of The Economist news magazine at the start of the outbreak

(Source: The Economist, 3 March 2001)
These graphic images were an important constituent of political debate and public alarm, especially because the government were 'burning again' so soon after BSE. And it was not just farmers who wanted to disassociate themselves from these images of infected and infested farm-laboratories.

I've come across people who now don't eat meat after this because they don't like it all.
If you put images like that in front of people, they are not going to want to be part of it.
I don't want to be part of it. [Queenie, Quaker's Farm]

The visibility of the virus for farmers seemed to depend on the media spotlight; once the lights were removed, the virus crept back into darkness from where it could stage fresh onslaughts:

It was quite frightening because it got nearer and nearer to us. And then suddenly it all stopped – the reporting. You could get some info from the internet. And the NFU too... But then you do get the impression that it didn't exist – if you don't hear it on the news and you haven't got the internet and don't have NFU bulletin, you do relax your guard. We have already because we know that there hasn’t been a case for four weeks. We are still keeping some measures up but we were so paranoid – the cars were parked up the track, we changed our shoes our clothes, we washed our hair when we went everywhere. But if you don't hear about it on the news, to even hear very briefly what's happening, you think it doesn't exist and is not a problem anymore. And we're farmers so imagine what the public must think. [Norman, Narrowlane Farm]

Farmers often followed the outbreak in the newspapers (Table 7) and these provided valuable maps and diagrams of how FMD was being spread across the country (Figures 21 and 22).

Table 7: Statistics of FMD spread as released from DEFRA 29 May 2001

<table>
<thead>
<tr>
<th></th>
<th>Infected premises</th>
<th>Direct contact contiguous premises</th>
<th>Direct contact non-contiguous premises</th>
<th>Slaughter on suspicion</th>
<th>Grand total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>272,068</td>
<td>115,611</td>
<td>82,259</td>
<td>10,841</td>
<td>480,779</td>
</tr>
<tr>
<td>Sheep</td>
<td>754,447</td>
<td>581,504</td>
<td>1,069,508</td>
<td>86,923</td>
<td>2,492,382</td>
</tr>
<tr>
<td>Pigs</td>
<td>22,944</td>
<td>36,186</td>
<td>58,460</td>
<td>2,374</td>
<td>119,964</td>
</tr>
<tr>
<td>Goats</td>
<td>780</td>
<td>798</td>
<td>216</td>
<td>54</td>
<td>1,848</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,050,239</td>
<td>734,099</td>
<td>1,210,443</td>
<td>100,192</td>
<td>3,094,973</td>
</tr>
</tbody>
</table>

Total number of farms affected by FMD = 7,763
Total number of farms infected by FMD = 1,661

(The Daily Telegraph, 30 May 2001: 12)
Figure 21: A map of the spread of FMD on 18 March 2001

Yesterday's new cases

- Existing cases 298
- Cases confirmed yesterday 25

Total to March 18: 323

(Source: The Daily Telegraph, 19 March 2001: 5)
Together with the government, the British media was fabricating new science all the time and so the consumer did not know where to turn for secure knowledge. Public access to the countryside was also restricted and so they rarely witnessed the disease themselves: "2001’s Foot and Mouth Disease outbreak showed that the English countryside — overwhelmingly a farmed landscape — is vital for more businesses than farming" (Curry,
2002: 14). This all suggests how the farm space can become tied into the public domain. Unlike Pasteur's anthrax experiments where he willingly exposed the farm as a spectacle, infected farm-laboratories were conquered and taken over. And the farmers I studied told me how they rarely had the time or the resources to illicit a firm response to press coverage and the public anxiety. The way the infected farm-laboratory was framed in the national press was how it stuck.

The debates of FMD science also transferred the battle scenes beyond the farm space and into Parliament where FMD was framed as an economic and electoral disease: "This is an economic, not a medical, governmental issue" (The Economist, 31 March, 2001: 63-5).

Well your average farmer doesn't know what the best thing to do is at all. You need an epidemiologist and a quick decision. And that all seemed to be based on things that aren't necessarily to do with the control of the disease. Whether or not to vaccinate is far more an economic decision. [Norman, Narrowlane Farm]

It's an economic disease because beef animals waste away and they've got to be re-fattened. It doesn't make a lot of sense economically. Dairy animals lose their milk yield which doesn't make economic sense. So you've had a solution applied to this particular disease which in fact is purely to obviate the economic consequences. [Brian, Broadleaves Farm]

The costs of FMD have been extreme, for farmers but also for tourism and British taxpayers.

The mortality amongst adult animals, especially in countries where the disease is enzootic, is usually comparatively low, although the losses may attain serious proportions in the case of young stock. Apart from the actual death of affected animals, however, the disease is of serious import on account of its proclivity for rapid spread, and also on account of the great economic losses which it causes through diminished milk secretion and severe loss in condition of fat stock. (Robinson, 1949: 682)

Whereas agriculture earns revenues of about £9 billion ... a year, tourism brings in £63 billion. According to the English Tourist Council (ETC), around £12 billion of that is spent in the countryside. Because of the restrictions placed on movement in the countryside and the closure of the national parks, many hoteliers, restaurants and outdoor-activity centres have already started laying off staff. (The Economist, 17 March 2001: 31)

Norman was disillusioned by the usurpation of scientific authority and manipulation by the media and the government, and stated: 'I do have confidence in science, but it's how it's used politically I haven't got confidence in'. Footpaths had been closed down as part of the movement
restrictions for all FMD vectors. Newspapers were brandished with images of these closures just as the landscape was festooned with notices of closure. The lifting of these restrictions was controversial:

And then of course they decided before the election that they had to open up all the footpaths – they just you know – from having saying stick yourself behind a wall of disinfectant, we had green notices that this footpath is open! It goes through my farm, through my stock. Oh no no no – we’ve had an edit from on high that actually it’s got to all be open by election day – a feel good factor. [Louise, Longsbottom Farm]

Such episodes meant that that farmers like Harry believed that: ‘it was the government for the lack of a coordinated response, a lot of it. I blame the govt for everything.’ Oliver claimed that the FMD controls were devised by the wrong scientists:

I don’t blame the ‘scientists’. It’s the ones they employed. They were scientists but they employed the wrong scientists. There’s nothing wrong with scientists themselves; it’s the admin that’s at fault there. [Oliver, Oaker’s Farm]

The subsequent demands, especially from farmers, for a full inquest into the outbreak have been suppressed by government because tracing the movements of agents in FMD would be tantamount to apportioning blame.

Louise remarked that ‘the government maintained throughout the outbreak that they had the epidemic under control’, but she thoroughly disagreed. The workings of the farm-laboratory were tested to the utmost and many will have to be rewritten. Huge amounts of public money were spent in dealing with this crisis, for example in compensation settlements to farmers:

Foot and mouth has claimed its most expensive victim. The government has paid out £50,000 in compensation – for a single sheep, … [a] pedigree Swaledale breeding ram. This revelation follows last week’s disclosure that 37 British farmers have become ‘compensation millionaires’, with a record £4.2 [million] going to one farmer in Scotland. (The Sunday Times, 12 August 2001: 1)

Walter was contracted to drive a front-loader and lorry to transport carcases from the farm to the pit, and for him the money put him ‘onto a winner’. Inspections could not always be undertaken as normal and so self-assessment procedures were sometimes necessary instead. But government and farmers alike seemed almost powerless since FMD had exposed the way the farm perimeter cannot be effectively policed. Traceability schemes that had been introduced after BSE in an effort to monitor British herds by means of a cattle passport system did in fact assist with tracing the national movement of
foot-and-mouth infected livestock. However, the virus made the distribution of agency in the network visible far more readily than any labelling or traceability scheme. What this means is that tracing the routes through which the virus spread takes us through the spaces through which livestock farming operates. The government had tried in vain assert its scientific authority throughout the FMD outbreak. Stanley, who was contracted to visit farms to search for infection, confirmed this:

The rules were changing day to day.... These changes in foot-and-mouth legislation have not been the veterinary profession's change in statue. All that the chief vet officer does is advise government. It's government that changes the legislation. [Stanley]

On farms directly infected by the FMD virus, years of farming science – the complexity of which was evident in Chapter 3 – has been unravelled. The way that individual farm 'worked', before the virus arrived with its squad of vets, slaughterers and disinfectors in tow, cannot be realised again. The farm unit cannot be replicated even if its previous methodology had been meticulously recorded. Norman kept a living record of his cattle breeding as a safeguard: 'I actually arranged with a bull calf that I had sold previously that it should be kept and then brought back here if we got infected so that we could restock with our blood lines.' In this way he is taking actions to stop the hybridising of his bovines and so to maintain the 'purity' of a breeding animal even if he cannot maintain a quarantined space for his entire herd.

The standard response to the threat of infection was to enforce 'biosecurity', but for some a more radical change in scientific operations had to be adopted. One of the most powerful ways to restrain nonhuman experiments is to reduce the volume and unknown content of imports and exports moving between the farm border. Farmers did strive for such a system, although they agreed that complete self-containment was neither practicable nor possible (especially with footpaths criss-crossing the land).

There's only so much you can do as a farmer to police – if people don't obey these rules. You can't enforce biosecurity. [Pat, Partridge Farm]

We are very much aware of the risks. They're a pedigree flock and herd, we keep them closed and the access to the land except for the public footpaths which are fortunately up in one end of the farm only, are such that access to the farm is by invitation. We avoid incursions by other animals as far as we can. [Norman, Narrowlane Farm]
Louise adopted a similar decision to minimise the exposure to disease and this was evident in the way she minimised the distances animals travelled and marketed her produce at the farm-gate. In this way, her animals returned to the farm as meat in a closed process:

I mean I shush them ten at a time into my trailer and take them to the abattoir. Wait for them to be killed. And bring them home again. So it's so unlike normal farming where they're trekked around in trucks as the foot and mouth showed.... And also selling the meat from the farm is nice because it's given the farm a focus – you have no focus when you run them into a livestock trailer. [Louise, Longsbottom Farm]

Measures like these also reflected the fact that many farmers had suddenly been made aware of the extent of ‘unnecessary’ livestock movements that had been made transparent by the outbreak:

Perhaps I, and a lot of others directly involved in farming, weren’t really aware of what was actually going on. What happened to their animals after they were sold at the local market. I was naïve enough to think that they’d probably be bought by the local farmer or a local dealers possibly – but even a local dealer would keep the animals in the next couple of counties at least. But certainly not from one end of the country to another, which obviously was clearly happening with sheep and poss cattle and obviously happening for some years. Yes, I think that that’s definitely got to be stopped. And also I don’t think there was any preparation. There was no plan. Nobody was ready for this sort of outbreak. ... It was quite obvious they were just making the plans and rules from day to day as they were going into it. Which was totally unacceptable. [Fred, Fairbanks Farm]

Interestingly, Dennis suggested that Dorset as a county did not have any of the major livestock dealing highways passing through. It seemed to be a fairly closed unit of animal breeding and exchange:

I suspect there’s a lot more closed herds in Dorset I think and perhaps we’re not so much like the ‘M1’ for the sheep to come through if you know what I mean. I suppose there was no reason for them not to have landed in Dorset – a lot of it was sheer luck.... I think Dorset farmers tend to export their animals rather than bring them in I think. Like beef animals – we tend to rear them as stores and then sell them at market and they tend to get exported to other people to finish them off. That might be some of the reason why we weren’t so vulnerable as other places. [Dennis, Dinglewell Farm]

Therefore, security should be questioned at micro/farm, meso/county, and macro/national levels. The regional scale may also be significant with biosecurity: if the farms surrounding one farm are very vigilant then the farm in the middle is relatively safe if not importing livestock and so can free-ride on the others’ goodwill and effort. Regional security measures are inferior to those operating at the farm and national levels.
First of all disease was brought into this country – it wasn’t here before but was brought in. So the authorities have allowed it to come in and they still are. It's the government that has been slack at policing what's been coming in through the national border. We do import meat from other countries – from twenty-six countries where foot-and-mouth is endemic. I mean the troops are fed on this stuff. And also the recommendations that were made in the sixty-seven/eight outbreak were never carried out. Now the recommendations more or less was speed was the essence. Diagnose it, dig a hole, shoot ‘em, bury them in quick lime, on the farm, on that day. End of story. But they weren’t. They were burned, they were left for ages before they were burned, some stuff was clubbed to death – evil.... If they carried out the recommendations of 1967, it would have been over much quicker. And they should never be buying meat from countries where FMD is endemic. because what's the point of being biosecure in this country if someone can bring it in – it don't make bloody sense. [Ken, Kestrel Farm]

The FMD virus showed how the farm-laboratories are, potentially at any rate, united, and helped to make the network of actors embroiled in the practices of farming visible. In this study, I can only identify the most well-connected nodes in farming as recounted to me, whereas the virus can potentially expose other spaces in which farming is practiced. And it might well have another opportunity to do so as Wesley suggested:

For the last two years, 37,000 tonnes of pig meat has been imported to Britain from 37 countries where Foot-and-Mouth exists or is endemic. And in spite of everything, that importing continues ... If some of the red tape surrounding the premises of farms, butcher’s shops and slaughter-houses were transferred to our borders, we might be able to survive for even longer than 35 years before the next outbreak of foot-and-mouth. [Wesley]

Wesley added that because of this lack of control on food imports, many of the risks of animal disease are beyond the control of farmers. The infectious virus had to pass both national and farm borders and it is testimony to the way the farm is becoming its own control-site the farm border was relied upon as the defence. Issues of national biosecurity were raised on the BBC Radio 4 Farming Today programme, it was reported that “as much as half a tonne of illegal meat is coming in on every flight to Heathrow from some high FMD risk countries” and that “boxes full of illegal meat were being found in Felixstowe Port.”11 Therefore, the “Government must strengthen checks and controls of illegal imports of meat products, to reduce national levels of exposure” (Curry, 2002: 38).

The acceleration of science into new territory was demanded by both the FMD and BSE events and this has subsequently become incorporated into the farm laboratory. This is no neat and tidy process but instead an unplanned and hasty formalisation of standards. These standards are then fixed into place and the normal farmer becomes the puppet on a string of bureaucracy.

I suppose the paperwork might be easier if the licensing thing is over with this FMD. Because the FMD brought a whole extra level in. At the time that it broke out I actually had fifty lambs and four barren cows booked to go, and the lambs went six weeks later which wasn’t too bad. But the cows were stuck about for six months. The paperwork to get rid of barren cows was extreme. One was a three year old heifer who was about to go onto another scheme – she had two diff kinds of passports, then the old style movement records, the ‘OT17’ and the ‘OT22’. We ended up giving the lorry driver a folder and we spent hours doing it. He said we’d better get it right. If it is wrong you have to go down to help sort it out and often forfeit money. The replacement tags and the post and packing all adds up. I remember the first time – I was absolutely terrified that we’d got something wrong and I would be sent back to the bottom of the ladder again. [Charles, Chase Farm]

Again the government sends out a new set of livestock management and movement procedures to be institutionalised by the letter in the laboratory.

Standard proposals have come out through foot-and-mouth, such as trying to reduce dealing as much as possible because that is probably one of the reasons why foot-and-mouth spread. So introducing quarantine adequate periods and actually specifying that in our standards. We are also looking into distance to abattoirs and trying to minimise that as much as possible. It is going to be difficult. We need to do quite a lot of work on that but what we need to do is limit it. A suggestion has been made of one-hundred miles because that’s another huge area where there has been problems. That is why these diseases can spread cos animals go to one big abattoir. What we are trying to do is campaign for smaller abattoirs really. Trying to keep these small local abattoirs. Supermarkets are one of the made sources of problems because they just use specific abattoirs and generally one central one for the whole country. Generally we want to limit food miles. [Theresa, SA]

These adjusted standards do reveal a trend towards the simplification of networks in spaces outside of a farm’s jurisdiction, beyond the fences and gates of its premises.

But the events of FMD – the nonhuman experiments – are still able to continue, even if they have been temporarily sidelined. Indeed, despite the introduction of more rules and inspectors, the spectres of FMD – and BSE – are still present even if they are less visible. The new set of livestock management and movement procedures that the government had sent out to be institutionalised by the letter in the farm-laboratory remained:

I wouldn’t be at all surprised if some sort of foot-and-mouth control system will stay in place now forever. I don’t know when we can refer to post-foot-and-mouth. Yet
another bit of paperwork. More surveillance. It all needs staff to police it too. [Geoffrey, Grandview Farm]

These pieces of legislation are for some further (expensive) hoops that must be passed through in order to farm by the legal requirements of DEFRA. Rules such as the 21-day no movement rule were carried over after the epidemic had subsided and responded to was slowly being learnt about the epidemic: “In tracing the spread of Foot and Mouth Disease we found that sheep undertook multiple movements, involving up to eight journeys through dealers and markets, between farm of origin and finishing farm” (Jim Scudamore, Chief Veterinary Officer, in Curry, 2002: 93). The 21-day no movement rule is aimed at preventing such regular national movements of stock, but it can pose real problems for farms that are not one contiguous unit.

A lot of the restrictions they have imposed because of foot-and-mouth quite rightly. But they’re hanging onto even when they are no longer necessary for foot-and-mouth because it’s making it more difficult. For instance, this twenty-one day rule of no movement after a move. They brought in this only one movement before a movement to a slaughterhouse. I am not fully aware of whether that is one movement per year or in a lifetime or what. But for people like us with scattered land, I don’t know how we can cope if they can only move once before slaughter. I don’t know the time. But it’s something else to make things more difficult. [Pat, Partridge Farm]

Summary of Chapter

This chapter has illustrated that science on the farm is not completely controlled by humans. A series of disease events have confirmed that both humans and nonhumans influence what takes place on the farm. The controversies over genetic modification exemplify the risks – both real and imaginary – of extending the boundaries of agricultural science in a corporate laboratory and then introducing the outcome of this science – a new gene – to the farm. The BSE and FMD sagas both reveal the extended actor-networks that are mobilised by the prion and the virus respectively, show the difficulties of responding to the subsequent events both on and off the farm premises, and also suggest that the farmer is under threat both of microbe infection and of media and government surveillance. The farm-laboratory is the place where the hybrid networks are most embedded but the spaces of embodiment are extensive:

The transformation of human food-production and food-consumption processes has involved the proliferation of hybrids, through the genetic engineering of plants and animals, and the pollution of biotic networks, through the release of synthetic
chemical waste and the absorption of hormonal and chemical additives into the bodies and organs of producers and consumers of agrofood goods. The material and discursive economies of these hybrid networks connect the life practices of human food-consumers and food-producers with those of other animals, plants, and environments over considerable distances. (Whatmore, 1997: 49)
Map of Chapter

This concluding chapter brings together the different ways science has been viewed in the previous three chapters. Firstly, I show how each of the ‘standard’, ‘practiced’, and ‘infected’ farm-laboratory arrangements has different implications for how farm spaces are organised. Secondly, I reveal the implications of the preceding debates; with respect to the way agri-environmental schemes – particularly organic schemes – are implemented and also by reviewing the potential for using Bruno Latour’s and Michel Foucault’s ideas for analysing the complex empirical context of the farm.

5.1 Configuring Farm Spaces through Points of Passage

The ‘laboratory’ is indeed “the place where scientists work” (Latour, 1987: 64), but also the constructed space where human and nonhuman actors interact and in relation have meaning. Latour (1988) suggested that the ‘farm’ is at one point removed from the ‘laboratory’ and then brought inside. His context was agricultural revolution in eighteenth-century France and the experiments of Pasteur. But ever since this time, the distance – and difference – between ‘farm’ and ‘laboratory’ has been diminishing until it is possible to refer to the ‘farm-laboratory’. There have been so many translations – so many instances where different sciences are brought into conversation on the farm – that the farm space becomes the ‘farm-laboratory’. Accompanying each of the myriad agricultural sciences, policies, instruments, machines and chemicals is a set of gestures, elements and procedures that give these components of farming understanding and link together different spaces. It is that overriding feature of the laboratory – its ability to reverse scale, to switch between the micro and the macro, through translation – that makes this analogy of the farm as laboratory so informative: “We have to see inside-and-outside as an active category, created by the actors themselves, and it has to be studied as
such” (Latour, 1993b: 255). Therefore, each translation depends on the mobilisation of a collective of hybrids which lie inside and outside of the farming space and may be material or discursive, textual or organic.

How farming is practiced is not about independent farming knowledge or science, but about the ways in which all these heterogeneous components are tied to collectives; the way chains of translation weave sound, vision, gesture and scent through all manner of bodies, elements, instruments and artefacts: “Actor-networks mobilise, and are constituted by, a multiplicity of different agents, or ‘actants’, human and non-human; technological and textual; organic and mechanic” (Whatmore and Thorne, 1997: 292). Humans and nonhumans together are essential for food production, which is obvious enough, but this means that agency is shared, which is rather less obvious: no farm could survive without a combination of organic beings (from people and livestock to arable crops), technological devices (from farm-buildings to ploughs), and discursive codes (including industrial and organic agriculture). Indeed, food chains connect practically everyone/everything on earth to everyone/everything else, and consumption often occurs at a place independent of where food is produced. In this way, “[a]ll of nature and all of culture get churned up again every day” (Latour (1993a: 2), and if I were to take a Sunday rib-roast joint and excavate the networks that brought it there, “I would pass with continuity from the local to the global, from the human to the nonhuman” (Latour, 1993a: 121). But these networks are not self-sustaining and do not all extend without interruption. As Braun and Castree (1998) agree, the scientific laboratory as a relational network is constituted by fragile achievements of actants-in-relation fraught with daily conflicts, illnesses, misunderstandings, technical glitches and all manner of breakdowns.

The farmer is a vital constituent of the farm collective and actively attempts to construct an ordered farm-laboratory space. Whether the farmer is following the NFSF programme, conducting artisan freelance science, or merely clearing up after infection, s/he is inseparable from the farm space by configuring the laboratory apparatus, fostering translations, and engaging in new debates in science. And, likewise, the farmer exists only if his/her science is being practiced: “Being a scientist is a property that exists only
insofar as the network of relations between the individuals is sustained. When the network of relations stops functioning, the property stops existing: ‘Science exists only to the extent that the network is maintained’” (Galison, 1996: 17). By following the experiences of farmers I have presented the living rather than abstract spaces of farm life in much the same way as Whatmore advocates:

This vision disrupts the geometric configuration of the world as a single grid-like surface and the inscription of general theoretical claims as omnipresent, universal rationalities. Therefore, rather than conceiving such a *tabula rasa*, a *topological* spatial imagination is envisaged, emphasizing the *simultaneity* of multiple and partial space-time configurations of social life, and the *situatedness* of social institutions, processes and knowledges as always contextual, tentative and incomplete, however long their reach. (Whatmore, 1999: 31)

Each chapter in this study has systematically traced the extension of different networks of science to show how *each yields a different configuration of the farm space*. For the purposes of this final chapter, I have termed these configurations the ‘agri-panopticon’, the ‘agri-laboratory’, and the ‘agri-oligopticon’. Each network contributes a different ‘farming experience’ and each entails different inclusions and exclusions. Different collectives give different testimonies of science. Bringing these experiences together provides a more complete guide to what the practice of ‘farming-science’ entails. In terms of translation, the inside-outside distinction was dissolved in each chapter. The idea of obligatory points of passage is key to understanding of how such translations ‘work’ on the farm. Latour (1983, 1988) alerted us to the routing of Pasteurian vaccination science through ‘obligatory points of passage’, since it was only by enrolling particular elements of the laboratory (as Pasteur had configured it) that successful scientific experiments (what the scientists’ intended) could be conducted. This concept also helps to re-conceptualise power on the farm. The proliferation of hybrids and their associated translations meant that the pathway options were multiple; in animal health and conservation sciences in particular the multiplication of sciences was evident. It is therefore the distribution of power in a network, operating by excluding some hybrids and including others, that determines which pathways are followed. In terms of the farm space, the agri-panopticon is controlled from outside, the agri-laboratory is controlled from inside, and control in the agri-oligopticon is dispersed between inside and outside. It will become evident that these points of passage, in combination, circulate about the
space of the English farm as their reference. This is because each of these points of passage derives its meaning from associations embedded on the farm. It is in this way that the farm is increasingly the laboratory, the centre-point of reference for the translations constituting farming-science. I shall now illustrate how these ideas are so vital for each of the three farm space configurations.

**Agri-Panopticon – the standard farm**

Chapter 2 showed how policy organised by governmental and organic certification bodies was implemented through the processes of documentation and surveillance and embedded in the farm site: processes akin to Foucault’s concept of discipline and working at a site similar to the panopticon. In the agri-panopticon, the agri-environmental policy and policing framework is organised through a structured series of translations. For the experiences of the interviewee organic farmers in Dorset, this formation has been called the normal-farmer-standard-farm (NFSF) model. This is specifically a network of farming relations and it is ordered by an established – although changeable under the direction of policy – set of obligatory points of passage. A legal (certification and verification) and economic apparatus accompanies these. For example, the farmer must complete an Integrated Administration and Control Scheme (IACS) form as directed and supervised by DEFRA is s/he is to receive a set of subsidy payments. Farmers in this study emphasised the importance of these payments to their businesses more than they stressed their concerns about legal rules. Together these comprise the convention because they comprise the formally established framework. This is a blueprint that stipulates where scientists should work and how these networks are structured from control-sites outside the farm space. It is a project of policy and specified procedures more than of practical know-how and creative experience. And there is a constant switching between macro- and micro-scales, from the control-site – the central regulatory and surveillance institutions – to the implementation-site – the individual farm.

By conforming to this NFSF model, the normal farmer is constructing his/her laboratory so that science is practiced according to a set of normal codes and processes; or, in
Latour's terms, so that the translations are enacted through certain points of reference involving certain hybrid allies. The process of documentation entails first recording the events on the farm [section 2.2.2]. These are made recordable through procedures of tagging, labelling, and segmentation. Each of these procedures enrols different machines, knowledge and apparatus, but they are all observable by an agent not residing in the farm space. In the case of organic farming, these procedures constitute the practice of certification [section 2.3.1]. By law, only certain procedures and black boxes are selected for this organic farming code, and these are often distinguished as permitted, restricted or prohibited. But a policy-making process that uses different experts to account for each part of the farm-laboratory sets these standards of practice, and so they are not set in direct relation to farming experience on farms [section 2.3.2]. The problem is that as the scientific claims are made in the distant realms of public policy, the farm space becomes increasingly remote and abstracted. Therefore, policy prescriptions for what should be embedded in the farm space are based on the lengthy deliberations of 'experts' and not on the ongoing experiences of farming. The real farm space is therefore poorly referenced, both in terms of temporal change and practical experience. But the standards are rigorously policed. This disciplining is in fact internalised to varying degrees by farmers, and therefore interviews with farmers revealed that at times they followed and performed 'by the book' of the NFSF model.

The operation of the agri-panopticon has many similarities to Foucault's conceptualisation of power. Such a configuration of the farm space is more a code for laboratory practice than a description of how farming science and scientists work. The normal farmer is being structured to operate in a certain manner by the processes of normalisation, surveillance (or 'threat of surveillance'), and observation. This is similar to Foucault's notion of 'disciplinary power'. The normal farmer is not expected to resist by adopting non-normal characteristics, but to follow the programme: "our society is not one of spectacle, but of surveillance. ... We are neither in the amphitheatre, nor on the stage, but in the panoptic machine" (Foucault, 1977: 217). The NFSF sequence constitutes a mandate of rules, standards, and grant-schemes according to which operations must be set. This is a network based on normative science and compliant
farm-scientists and is arranged over the top of the farm space as a supra-structure. The normal farmer is the sponsored operative on the ground putting convention into practice. Boundaries are produced and policed and embedded in social practices and farm behaviour; these are efforts to squeeze out the non-normal. This explains why during conversion to an organically registered practice, the farm and farmer are enrolling into new networks with new obligatory points of passage and breaking ties with some of their old points of passage. The presence of surveillance and the 'threat' of an inspector visiting the premises pressures the normal farmer into adhering to the procedures prescribed. This impinges on the process of science-in-the-making and channels the farmer’s practice towards this ready-made-science.

As Latour contends: “There is no outside of science but there are long, narrow networks that make possible the circulation of scientific facts” (Latour, 1983: 167). But the NFSF model only allows certain ‘scientific facts’ to circulate. The process of exclusion is therefore of paramount importance to the NFSF project. The model aims to restrict heterogeneity and in this way it marginalizes or even erases other actor-networks. The normal farmer must not conduct certain practices, has little input in public policy-making, and must make the whole farming system transparent for the visiting inspector (the scientific adjudicator). These processes of exclusion are fundamental to the scheme’s ability to control. It has black-boxed the way farming should be enacted by making all these obligatory points of passage mandatory and enforced. It is what Latour (1987) would call a ready-made-science. But since the agri-panopticon is a system where the NFSF modellers are directing operations from a control-site outside of the farm premises, they require the compliance of the normal farmer to actually do the work and put the rules into practice. It is the normal farmer who has to manage animals as conservation tools and producers of meat. And the NFSF sequence cannot account for the ‘unusuality’ of a farm space. This is where the model breaks down because on the farm there are many other sciences – many other actor-networks – that are negotiated.
Agri-Laboratory – the practiced farm

The ‘agri-laboratory’ is the space of the farm organised from inside the farm premises and structured by the work performed by the farmer and the series of translations coextensive with these practices. This is why science – here as elsewhere – has to be mutable and cannot be simply applied. The agri-panopticon is too focused on rules, a rigid programme and inflexible practices, and the practices of farming are weakly referenced to the empirical context, even though they are rigorously policed. But each farmer, to different extents and in different ways, constructs his own farm-laboratory by selecting which aspects of a particular science – the ‘points of passage’ – are to be enacted in his/her practice of farming. This does not necessarily comply with the NFSF sequence and may even resist it [section 3.1.1]. Rule-books tell the farmer what is permitted, restricted and prohibited – by establishing a set of obligatory passage points that lead farmers towards agri-environmentalism –, but they do not tell him/her how to get there, what is most economical, and what other points of reference – the non-obligatory points of passage – can be made along the way. This is a mutable science where the farmer is reflexive in his/her practice and draws on personal experiences and non-standard stocks of knowledge. The meanings of ‘cultivating science’ are highly variable, negotiated and contingent rather than universal or transcendent. The agri-laboratory networks are extended from a control-site within the farm space [section 3.1.2]. In effect, the farmer is making the farm space conformable to him rather than working to make it conform to the NFSF sequence.

Although translations in the agri-laboratory do pass through the some of the points of passage of the standard farm, therefore, often in order to collect subsidy payments, they also entail other translations outside the boundary and border of normal science. The NFSF sequence is therefore not always an obligatory point of passage. The control in the agri-laboratory configuration is apparently rests with the farmer. It would seem that s/he really is a scientist, a ‘maker’ of science, rather than merely an implementer, a technician whose actions are all translated back through the NFSF sequence. Farmers in this study did not just adhere to norms; by engaging with other points of passage, they revealed the importance of behaviours, of intentions, of heterogeneity. They are not just food
producers or just profit-driven in decision-making. Because they set their own protocols, these may appear to those outside as 'ideologies' more than 'methodologies', belief systems more than technologies. Interviewee farmers showed detailed local knowledge and volunteered informed scientific opinions. The science they practice is truly embedded in the space of the farm. In this way, the farm is in fact its own control-site. Networks are also extended from the inside to the outside, as I showed in my discussion of the dissemination of homoeopathy [section 3.2.2]. And the activities of veterinary surgeons take place at many scales but all refer back to the farm-laboratory through farmers and their animals [section 3.2.1].

Within the farm conceived as agri-laboratory, then, the farmer is on the ground, the working scientist who is selectively engineering his/her laboratory daily and mixing natures-cultures is all part of his/her practice of farming. The farmer is domesticating that space to 'suit' his/her abilities and needs. Within the farm premises itself, farmer control often decreases from the central axis of farmhouse to the farm perimeter as his/her own powers of surveillance are spread. This is particularly evident in the processes of decision-making involved in managing farmland for conservation [section 3.3.2]. Scientists produce order by methodically organising observations and experiences so that sense can be made of them (Latour and Woolgar, 1979: 37). The farmer constructs his/her own farm-laboratory as much the NFSF modellers construct the farm-laboratory for him/her from outside the premises. But the way the farmer constructs the space produces an order inside the farm space. The farmer does not attempt to impose their regime of science on other farmers, although s/he is willing at times to help another farmer by sharing knowledge, machines, and even livestock. This challenges the idea of an ordered and replicable NFSF sequence: there is not always a straight-forward progression from doctrine to indoctrination. Whereas the control centre of the agri-panopticon is the Department for Environment, Farming and Rural Affairs (DEFRA) in London, the control centre of the agri-laboratory is the farmer's office. As I have shown, science has to be mutable and so its practitioners have to be reflexive. But there is a far longer and more disparate network in the case of the agri-panopticon that must be negotiated before the NFSF model can respond.
There is a change in the method of analysis between the agri-panopticon and the agri-laboratory from straightforward ‘networked’ science to a more inclusive science studies approach that acknowledges the role multiple knowledges. This change helps to understand farming-science as practice. Even then, a weakness remains. For the agri-laboratory configuration ignores the spaces outside of the farm premises and the threats to the possibility of undertaking uninterrupted experiments. Similarly, the agri-panopticon cannot close its knowledge to the possibility of new networks. For this reason it is necessary to examine the way points of passage are configured inside and outside the farm-laboratory and, most critically, outside of human control.

Agri-Oligopticon – the infected farm

Nonhumans are vital constituents of both the agri-panopticon and the agri-laboratory through the ways in which they hybridise through being enrolled to assist farming science. But the ‘agri-oligopticon’ illustrates how such movements cannot all be controlled, how not all microbes and their associations can be excluded, and how new (increasingly obligatory) points of passage are constituted. Unlike the ‘farm infrastructure’ – the farm apparatus of fencing, buildings and so on – the nonhuman ‘infra-structure’ is often quite literally performing below the gaze of the farmer. The identities of the complex microbes outlined in this study are in many ways less important than the hybrids that they potentially constitute. This is because they do not act alone to produce ‘disease’ but rely on many hosts and vectors and so it is only in combined form that agency is configured and epidemics produced. For this reason I introduced Latour’s term ‘oligopticon’ which implies that networks are too complex and untraceable to be surveyed in the way suggested by Foucault’s discussions of the ‘panopticon’.

Conventionally a laboratory is conceived of as a space where the microbe is weak and the scientist is strong; it is always the scientist looking down the microscope at the microbe and not the microbe looking up the microscope to the human eye. Scientists favour a proliferation of laboratories so that laboratories can specialise and so have particular strengths vis-à-vis the microbes they experiment on and also each other. And yet what
has been apparent in the sequencing of the farm disease events is that the relationship of power between microbe and scientist can be reversed [section 4.1]. The scientist must therefore appreciate that these nonhuman agents are no longer contained in a black box because they are effectively organising spaces in the farm-laboratory. In this way, the ability to reverse scale in the laboratory is not always a characteristic of the scientist, and so a laboratory is not always the place where the microbe is weak and the scientist strong since the microbe can take control of farming practice.

In the agri-oligopticon, farm space becomes not only a space where humans and nonhumans are cohabiting but also a mix of contaminated and quarantined spaces. This configuration makes the idea of a farm border almost absurd. The way these microbe-vector hybrids reverse scales through their activity illustrates how the laboratory cannot be made to exclude everything and is certainly open to infection. Diseased livestock are referred to as waste, as contagion, are so are expelled from the farm collective and switch from the food to the non-food chain. The networks extended are ordered through a series of passage points but appear to be nonlinear and disorganised to those outside. In fact, in the agri-oligopticon, there really is no inside or outside because the associations extend from the local to the global; for example, from a BSE-infected beef herd in Dorset to a CJD victim in Canada who had eaten that beef when in Britain years earlier.

This is a world where the circulation of hybrids breaks open the black boxes that hide the true repercussions of agro-chemical farming techniques. In the sagas of BSE and FMD, the points of passage were at first unseen but were then made visible as familiar hybrids were identified. In the case of BSE, the prion-bovine hybrid was detected after a long conversation of sciences debating the cause of the degenerative condition. The practice of introducing scrapie-infected matter into the bovine food chain that caused BSE illustrates that a legacy of intensive agro-chemical farming can still affect British farming today [section 4.2.1]. In FMD, the agent was known to science, as a 1969 report into the outbreak testified, but the virus and its potential to cause an epidemic was not recognised by all scientists in 2001 [section 4.3.1]. The way this virus was re-mobilised illustrated how "the past remains and even returns" (Latour, 1993a: 74). Willems-Braun alerts us to
the 'residual traces' of natures-cultures that remain endemic in the everyday fabric of the present – in his case ‘buried epistemologies’ of colonialism and (post)colonialism (Willems-Braun, 1997). The FMD virus was in fact inside the farm-laboratory before farmers, vets, and government officials realised and that is why their response was one of trace and erase rather than predict and vaccinate. FMD exposed the way the farm perimeter cannot be policed and both BSE and FMD revealed that black boxes were entering the system via the farmgate and the porous standard farm border. The events that have occurred disrupt the matrix of everyday living on the farm but at the same time make the network more visible; for example, a national web of sheep dealing was revealed by FMD.

Policy-makers and farmers responded to the epidemics of BSE and FMD, enacted through the movements of the prion and viral microbe respectively, by extending the network of farming practice through new regulations and practices. In effect these measures were an attempt to make the translations ordered by the microbes more visible. They thereby established a new set of obligatory points of passage for the farm space and in this way farming-science was further extended and complicated. This explains why farmers claimed that there was no post-BSE or post-FMD era. And this also supplies another reason why the analogy of the laboratory is so suitable for describing the farm.

We have begun to understand ... that the pair human-nonhuman does not involve a tug-of-war between two opposite forces. On the contrary, the more activity there is from one, the more activity there is from the other. The more Pasteur works in his laboratory, the more autonomous his ferment becomes. (Latour, 1999: 147)

For example, the ‘traceability’ legislation enforces a strict point of passage through the centralised government veterinary database [section 4.2.2], and ‘biosecurity’ demands transparency in livestock, human and chemical movements [section 4.3.1]. The disease control team, similar to the team of Pasteurian scientists, are not performing ‘miracles’ as they attempt to remedy the farm and free it of infection. All they are doing is identifying the points of passage through which the microbe and its associations have routed so that they can enacted the same translations with new rival translations set up in tandem. This team enters the same premises that the microbe had done but also establishes practices of
disinfecting and quarantining. These new points of passage are again differentially adopted by the agri-panopticon and agri-laboratory configurations.

Each successive ‘infection’ – disruptive nonhuman experiment – changes the laboratory further and further. Immunity is short-lived or at least only builds up against known pathogens and is unable to predict new sources of danger. The government may introduce new bureaucracy to reduce the prospect of new infections and to trace the activities of farming in order to trace microbes:

Every farmer in Britain should have a computer with a link to Whitehall to ensure that they comply with ministry decrees, according to plans drawn up after the foot and mouth crisis. The plans ... also confirm that the Government is working on a licensing or registration schemes for farmers or farming activity. ... The scheme would require every farmer to draw up a business plan encompassing the total assets of the farms – the soil, water, trees, stock, pastures, crops and wildlife – with details of how they propose to make best use of them in sustainable farming terms. This ‘e-enabled whole farm plan’ would have to be lodged electronically with Defra, giving the ministry an unprecedented insight into every farmer’s activities. (The Daily Telegraph, 15 December, 2001: 1)

Latour suggests that laboratories become powerful enough to define reality; that is to resist, as a collective, trials of strength offered by dissenters (Latour, 1987: 93). But it is clear that microbes are powerful enough to disrupt the farm-laboratory collective. Farming-science has, and has had, so many black boxes that are still being opened, or waiting to be opened, that ‘infection’ will happen again. Also, the microbes are difficult to defend against because they respond differently to different contexts and enrol their own allies – the British media was critical to how knowledge of FMD was created and disseminated [section 4.3.2]. And despite new knowledge of microbes, farmers are still unlikely to know when another FMD virus, or even a promiscuous GM gene, might enter their premises and the network of agents on their farm. This is because farmers are still not in control of everything outside or even inside their farm-laboratories. And even if farmers aim to avoid black boxes altogether, their farm-laboratory is not isolated and so the possibility of infection is not erased.
5.2 Working out a Consensus from the Conversation

5.2.1 Working with Farming Science

I have repeatedly emphasised the truly muddied development of scientific protocols as they are debated and experienced on the organic farms in this study. The events and debates that have unfolded on these farms are clearly out of my control and beyond my scope to comprehend in their entirety. But this is how networks truly operate. This is why science has to be mutable and adaptive to a variety of scenarios when it is transformed into practice. By addressing farming as an eclectic project of science in this way, I have provided a glimpse into the working space of the English farm and illuminated the ongoing restructuring of British agriculture. The routing between points of passage is a process of selection and therefore involves processes of exclusion and inclusion. The shifts in power, through the propensity to route through different points of passage, suggest an interesting way to reconceptualise the processes of agricultural restructuring as they are made in farm spaces.

The agro-chemical regime of farming was eminently well suited to the NFSF model. This is because its overriding agenda of increasing food production, which became a national prerogative in the 1970s, arranged farms as sites conscripted to a devised arrangement of obligatory points of passage. Black boxes of policy, chemicals, rules, and interventions were delivered to the farm gate, along with a guarantee of economic sustainability, and in return farmers were expected to produce food to export. The farm space therefore was simplified towards production. The 'success' of this arrangement was evident in the over-production of dairy, meat and cereal produce in Britain and Europe in the 1980s. Networks were therefore extending a long way from the premises.

But now there has been a key change. Under a regime of agri-environmentalism, food is no longer the only product of the farm; so too is farmed landscape and hence the farm-laboratory itself is also a product [section 3.3.1]. The agri-environmental system is therefore much more concerned with the networks inside the farm space since these are also the product of the farm. A farm enrolled in an agri-environmental scheme, such as
an organic farm, is on show and its practices must be kept visible if they are to be subsidised by the government. Food circulates outside of the farm whereas farmed landscape is inside the perimeter, and hence the networks inside are now as much a product of the farm as the networks outside. The agri-environmental project entails less outside sourcing of inputs and more fostering of network interactions inside. Its schemes and networks are made durable on the farm by embedding in local ecologies; for example, when ‘biodiversity’ is promoted, the linkages between actors within the farm collective are being fostered. Livestock therefore become more than simply numbers and meat because what they perform on the farm premises is important. Livestock as animals are an essential tool in conservation management, are an essential performer of the farm-laboratory space. Farmers are now reluctant to import black boxes of knowledge, drugs, or livestock. In this way, the farm border becomes a place of more careful negotiation and farmers increasingly have to collaborate to protect their interests.

Agri-environmental policy emphasis is therefore not about a ‘national farm’ that is regulated with the over-arching aim of production and supplied with pre-packaged black boxes. It is instead a system based on transparent linkages where the farmed landscape is put on display to a public audience – and so it is not just food that is displayed publicly – and tied to more local centres of production and consumption – a process that links food to place. “Food ‘quality’ is closely linked to ... the embeddedness of supply chains in local ecologies” (Murdoch, Marsden and Banks, 2000: 107). In this way, although food is exported similarly to how it was in the agro-chemical arrangement, that mobility is predicated on points of passage embedded in the farm space. What this means is that each food product is made referable to a particular farm space in a particular farmed landscape, usually by labelling. The consumer of the ‘quality’ food product may be the same agent who spends leisure time in the same farmed landscape in which that food was produced, and this is how organic farming is increasingly marketing itself. Black boxes are being routinely scrutinized before they enter the farm-laboratory, but also before they enter the human body. By enlisting a particular set of legislation determining the criteria

1 ‘Food’ circulates outside because the animals on the farm are mostly unimportant to the regime that demands food production, and it is only when they leave the premises as meat that they become important.
of ‘quality’, other actors can be excluded from the networks, such as chemical fertilisers, modern veterinary medicines, steroids, and promiscuous genes. This has entailed a shift of control making the farm more of a control-site in its own right and not just a place for prescriptive policy to be embedded and embodied.

Ken’s prognosis of how farming should change reflected this shift in power:

Mixed practices have got to be the way forward. The government has manipulated farming into monoculture – its pushed it that way. They’ve got to draw away from that now and assist in rotational farming and getting it back into mixed farming.... Your inputs you have to buy in are less. You’ll certainly not be popular with the chemical boys. And the big farming enterprises will find it a lot harder to actually manage – they’ll have to think for themselves more. [Ken]

There is therefore a need for policy to be less prescriptive and top-down and instead to foster local knowledges and linkages: The technique of management has got to change. It’s taking these staff onto the farms so that they can understand the context and see the linkages themselves’ (Ken).

The problems of trying to control farming science from outside, by means of a NFSF-type sequence, helps to explain why it may be argued that:

Almost ten years of agri-environmental schemes have had virtually no effect when it comes to making fundamental changes to European agriculture. The central focus of agriculture policy is still to encourage modernisation, ‘rationalisation’ (i.e. concentration) and ‘restructuring’ of the industry to make it more competitive in global markets. ... In the more remote, less intensively managed parts of the UK [such as Dorset], farming (often based on livestock farms) is still relatively well integrated with the environment, and supports more functioning semi-natural systems, and the biological diversity is already high. Here, superimposing over-complicated and highly prescriptive measures on an already diverse landscape does not enhance biological diversity but, instead, can rather reduce it. Anyone who knows such areas will tell you that the character of these landscapes reflects to a high degree the idiosyncrasies of individual farmers: their aspirations, finances, interests and family traditions. (Bignal, Jones and McCracken, 2001: 17)

And so the economically attractive policy packages may be encouraging greater homogeneity of practices across farms rather than the retention of existing heterogeneity.

Wallace recognised the need for this changed emphasis and suggested that this was already taking place:

It’ll take many years and many different initiatives for farming to change. If you look in Farmers Weekly, you’ll find every week that there is something about project-based approaches, collaborative ventures. Last week there was a 3-page spread on one example of someone taking a partnership approach to reducing their input costs and searching the markets. And that's in almost every single week. The Farmers’
Guardian occasionally does it. And it's that drip drip drip drip that's got to be in there. [Wallace]

But ideas of integration and education must be emphasised amongst more than just farmers:

The key objective of public policy should be to reconnect our food and farming industry: to reconnect farming with its market and the rest of the food chain; to reconnect the food chain and the countryside; and to reconnect consumers with what they eat and how it is produced. (Curry, 2002: 6)

Latour discusses the balance of power between 'the politician' and 'the scientist' in terms of laboratories:

The politician has no laboratory and the scientist has one. So the politician works on a full scale, with only one shot at a time, and is constantly in the limelight. He gets by, and wins or loses 'out there'. The scientist works on scale models, multiplying the mistakes inside his laboratory, hidden from public scrutiny. He can try as many times as he wishes, and comes out only when he has made all the mistakes that have helped him gain 'certainty'. No wonder that one does not 'know' and the other 'knows'. The difference, however, is not in 'knowledge'. ... The specificity of science is not to be found in cognitive, social or psychological qualities, but in the special construction of laboratories in a manner which reverses the scale of phenomenon so as to make things readable, and then accelerates the frequency of trials, allowing many mistakes to be made and registered. (Latour, 1983: 165)

But, contrary to Latour, on the farm the 'scientist' is not so 'hidden from' the public and, more critically, s/he is in fact dependent on the 'politician' for much of the funding that enables him/her to practice science in a laboratory at all. 'Mistakes' mean fines and even jail sentences.

In summary, as a hybrid collective, the farm and its spaces extend through complex sets of associations well beyond the farm perimeter. The farm is composed of relations part natural, part social, that embody a multiplicity of historical-geographical processes. But the associations and processes are embedded and connected with spaces inside, outside or on the border of the farm premises (Figure 23). Firstly, within the farm space, the interactions of agents local to the farm are being fostered more and more towards both food and non-food – including 'farmed landscape' – production. This is a shift away from 'remote' farming of monocultures and towards a regime that promotes diversity of both species and specialist food production.
Figure 23: A comparison of agro-chemical and agri-environmental farming systems

'Open' Gate Policy

Distant sourcing of chemicals and 'unknowns'; agricultural byproducts released; poorly monitored

Towards: local sourcing of inputs; localised production-consumption networks; farm cooperatives
Secondly, beyond the space of the farm, the networks are being simplified and made more traceable. There is an emphasis away from sourcing fertilisers, chemicals, and ‘unknowns’ from multinational agro-chemical companies, away from releasing agricultural byproducts into the wider environment, and away from unmonitored nationwide livestock movements. Instead, inputs such as feedstuffs are sourced more locally, there are new localised production-consumption networks, and farm businesses are increasingly forming cooperatives for marketing and production. And thirdly, at the interface, the farm border is being policed more and more rigorously. This is visible not only in the more vigilant inspections of the farm perimeter and farm gate by the farmer, patrolling with added ‘attention to detail’, but also in the replanting of hedgerows and the like. The farm border is porous to commodity and information flows and to (real and potential) surveillance, is rigid in administrative and economic terms, and constitutes the threshold of the farmer’s jurisdiction and authority.

5.2.2 Working with Latour and Foucault

The conversation that I have staged on the farm between Foucault and Latour on the farm has been illuminating. Latour’s approach to science studies has helped draw attention to the relational and collective mobilities and agencies of both human and nonhuman actors in farming. Foucault’s insight into the way disciplinary power is distributed has focused attention on the way normality is produced and policed through the way national policy is implemented on farms. But I have also sought to go beyond both Latour and Foucault to show that the farm space is both a locus for conversation of many sciences and that a series of translations described by the practice of farming have become embedded and embodied in the farm laboratory space.

However, the empirical context has also raised questions about the contradictions and weaknesses in both Latour’s and Foucault’s approach. I want to focus on the significance of legal, economic and historical contexts, the importance of processes of both inclusion

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2 The formation of cooperatives for marketing and production is partly a response to the dire economic circumstances in the British farming industry.
and exclusion, and the need to analyse both the spaces between the macro-scale and the micro-scale and the boundaries of laboratories.

The legal and economic context of farming-science is important, not least because the farm is an economic unit with a legally recognised border.

The growing red-tape phenomenon of the post-BSE era means that paperwork within the context of the ominously-named Integrated Administrative Control systems has greater priority than ever... for there is often more money coming to the farm through the DEFRA cheque than from the market. (Plumb, 2001: 241)

Although it is unwelcome to many farmers, regulation is an essential part of any attempt to add value. It is necessary to ensure that one bad producer does not undermine a market for all. (Curry, 2002: 48)

Foucault's idea that disciplinary power is worked through central regulatory and surveillance institutions and into 'society' does help to understand the institutional context of regulation in British agriculture. But Latour tends to disregard both economic and legal factors: in his discussions of vaccinations he never mentions patenting laws and he suggests that Pasteur's science is free of charge. But subsidised policy frameworks have become an essential component to farming-science and are what encourages the adoption of agri-environmentalist programmes as points of passage. As Harry told me: 'I don't think anybody wants subsidies in agriculture because I'd rather just get a fair price for the product I produce and as long as you can make a living, that's all I want'. Because farming-science is so dependent on this funding, it helps explain the complexity and asymmetries of farming politics. Farmers who chose to experiment outside of the NFSF sequence work with different risks and costs because these translations are not so well supported. But at the same time, we are reminded by the costs of FMD recovery that the economic fate of farms is also linked to networks woven by nonhumans.

It is this sort of complexity that can be erased by an actor-network approach that does not account for the trajectories of different networks over a wider timescale. Latour accepts that the "past remains or even returns" (1993: 74), but then takes a flask of anthrax as his starting-point in his discussions of Pasteurian research without describing the history of this disease in France and how the bacteria had got to Pasteur's Parisian laboratory in the first place. It is beneficial to follow a science studies approach within a living space.
(observing practice of present) rather than of a historical place (re-staging practice of past through selective historicism). This is also important because of different ways science is interpreted and contextualised. Latour's concept of the immutable mobile does not seem to account for the changes of context into which a document is brought. In the case of farming – and perhaps in other domains too – I suggest that empirical studies should investigate a longer time period than theorists like Latour usually attempt. Legacies of previous decisions and practices interfere with current farming-science, and these result from actions, such as the way prions were distributed through feeding practices [section 4.2.1], and also inactions, such as the way national and farm borders poorly scrutinized the imports of FMD infected animals and animal products [section 4.3.2]. Such relics of the 'past' are not only material but also cognitive through a particular ingrained mindset, as was revealed by the importance of the experiences and knowledges of farmers and vets in this study [section 3.2.1].

A related point to the issue of historical sequencing is that of selection. Each chapter traced the extension of different networks through translations. These translations involve different processes of exclusion and inclusion and therefore different actors. The performance of any particular actant, including the farmer, is conditioned by the relational power and hence its situation in the collective; but that 'relational power' is only possible if, for example, the farmer polices his farm border effectively. When Latour selects the focus of his science studies cases, he is effectively including one group of agents but also excluding another and yet he rarely recognises this latter group. Processes of selection are common to all investigations, including this one, but it is as important to discuss what is included as it is to discuss what is excluded. Exclusion therefore involves geometries of suppression, erasure and proscription. There is need for more than just an active narrative if these excluded actors – the 'other' – are to be made visible.

My observations of farming practice depend on fieldwork and site visits without which the agri-panopticon configuration may have been the only model in view. And I did not undertake an anthropological study of farmers as an inside-outside observer, but instead
investigated farm spaces as sites where many different sciences are put into conversation. Through these site visits I was effectively working at the meso-scale, the scale between the macro-scale of national agricultural restructuring, and the micro-scale of an individual agricultural science. Latour (1988) never steps onto the farms of Pouilly le Fort himself, never experiences this scale, despite the focus of his narrative. His knowledge was collected from past experiences, from archives. Latour describes how Pasteur entered the premises of farms, notably in Pouilly le Fort, to perform the ‘miracle’ of vaccinating certain animals in a herd against the anthrax bacillus. We are told how this was a reversal of scale, between inside and outside, macro- and micro-, but there is little discussion of how easily the French farmers consented to the ‘invasion’ of Pasteur’s team on their farms and how they understood and practiced this science thereafter.

\textbf{Pasteur cannot just hand out a few flasks of vaccine to farmers and say: ‘OK, it works in my lab, get by with that.’ If he were to do that, it would not work. The vaccination can work only on the condition that the farm chosen in the village of Pouilly le Fort for the field trial be in some crucial respects transformed according to the prescriptions of Pasteur’s laboratory. (Latour, 1983: 151)}

Pasteur did not just introduce the anthrax vaccine into an unchanged social setting; he required serious changes in the practices and practitioners surrounding its introduction. But ‘Pasteurization’, following Latour, either takes place in France or in the spaces of the laboratory.

\textit{[O]n the condition that you respect a limited set of laboratory practices – disinfection, cleanliness, conservation, inoculation gesture, timing and recording – you can extend to every French farm a laboratory product made at Pasteur’s lab. ... Scientific facts are like trains, they do not work off their rails. (Latour, 1983: 152-5)}

But, borrowing his metaphor, there can be a difficult process of laying the tracks, involving different obstacles that must be negotiated, before the train is free to run anywhere. What Latour is neglecting here is the meso-scale, the scale of negotiation in-between the specific and the general. But this is more than an in-between scale. It describes the scale of other points of passage, both obligatory and non-obligatory, that route through farming and non-farming – often distinguishable as formal science and informal science – networks, constituted on and off farm premises. There is a negotiation

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3 I am not denying the importance of archival material, which of course enables a longer time scale of study. Instead, I suggest that science at the ‘meso-scale’ is better understood through actual experience because otherwise complexity can be erased through an ordering of science into ‘macro-scale’ or ‘micro-scale’. These criticisms are aimed at Latour’s work with Pasteur more than his later science studies.
and interrogation of claims to knowledge. The NFSF policy-makers are not so much ignorant of the realities of farming as they are neglectful of local experience. Latour has argued that the growth of networks through translations along ‘seamless webs’ replaces the differences of scale between micro-, meso-, and macrolevels. But, as we have seen, ‘seamless webs’ are rarely smooth because there are other points of passage – other sciences – that are available to route through.

Latour also tends to move between the inside and the outside of the laboratory too easily and suggests that laboratories can be ‘constructed’ with apparent ease. He frames the ‘laboratory’ to a large extent as a time-space where allies are recruited so that the balance of power between two collectives is reversed and what was invisible is made invisible. The microbe in the laboratory and the disease outside the laboratory are ‘nature-cultures’ woven into the peripheries of the same network of allies and dissenters. Latour suggested that the ‘diffusion’ of Pasteur’s ‘applications’ required certain of the elements, gestures, procedures of the laboratory to be moved or reproduced. But the form of the farm-laboratory is a sedimentation of many different ‘constructions’ that have taken a long time to develop and involved many scientists. In some measure, my approach is thus closer to Latour’s more recent observations.

I want to situate myself at the stage before we can clearly delineate subjects and objects, goals and functions, form and matter, before the swapping of properties and competences is observable and interpretable. Full-fledged human subjects and respectable objects out there in the world cannot be my starting point; they may be my point of arrival. (Latour, 1999: 182)

There is a boundary to different regimes of science and it is not possible to pass from the micro-scale to the macro-scale without acknowledging these. Boundaries of scientific legitimacy are embedded in social practices and different sciences have to negotiate these.

Boundary-work becomes a means of social control: as the borders get placed and policed, ‘scientists’ learn where they may not roam without transgressing the boundaries of legitimacy, and ‘science’ displays its ability to maintain monopoly over preferred norms of conduct. (Gieryn, 1999: 16)

The emphasis on points of passage, and the interactions between those sets of points, has important implications for boundary making. The standard farm, the practicing farm, and
the infected farm have control-sites with different boundaries and borders of science. In tracing these debates, we have passed into and out of the real farm space continuously. But we have not been aware of any one science enveloping all others:

The only way for a scientist to retain the strength gained inside his laboratory ... is in never going out. ... It means that they will do everything they can to extend to every setting some of the conditions that make possible the reproduction of favourable laboratory practices. Since scientific facts are made inside laboratories, in order to make them circulate you need to build costly networks inside which they can maintain their fragile efficacy. If this means transforming society into a vast laboratory, then do it. (Latour, 1983: 166)

No farm-laboratory is isolated from other sciences. The farm is the circulating reference in the centre experiencing the imposition, creation and exchange of knowledge. The farm is not a ‘closed unit’. Rouse (1987) reminds us that what ‘works’ in one laboratory may not work at all – or at least work very differently – in another. Science is this way has to be mutable. We have seen through the agri-laboratory that the farm border is in many ways the boundary of the farmer’s farming-science and in many ways the boundary of his existence as a ‘farmer’: “By artificially isolating and simplifying complex situations and introducing controlled disturbances, scientists come to understand events in their laboratory better than they can understand events outside” (Rouse, 1987: 1999). And with the average age of the British farmer at 58 and farm incomes at a new low, a new boundary on practicing science may appear faster than events on the farm can be understood. The proliferation of farming-sciences will continue because farms, farmers and farming will have to respond to new economic and legal contexts and to past relics.

[W]e may be as certain ... that we will live tomorrow in imbroglios of science, techniques, and society even more tightly linked than those of yesterday – as the mad cow affair has demonstrated so clearly to European beefeaters. (Latour, 1999: 200)

The farm space will undoubtedly keep changing in response to these pressures. And the way these sciences circulate between control-sites and embed in different spaces suggests that the farm-laboratory in practice will always inspire conversation.
Bibliography


