

# Chapter 4

## The Actor-Enacted: Cumbrian Sheep in 2001

John Law and Annemarie Mol<sup>1</sup>

### Introduction



It is a sheep. You can see the photo. But is it an actor? That is the question. Questions of this kind, questions about agency, are usually asked as part of a search for explanation. What is the origin of an event? It is as if the aim of scholarship was to write whodunits. Hidden in the background is a ‘structure’/ ‘agency’ divide. Are the determinants of this, that or the other event located in existing social structures or do they lie in original, reflexive human beings?

Obviously a sheep is not a human being. This means that like many of the other contributors to this book, if we ask whether or not it is an actor we are starting to destabilise the structure-agency dualism. For whatever it is, a sheep is not reflexive in the way usually imagined by social science. We also start to erode another common feature of the structure-agency dualism, a distinction between mastery and being-mastered. Does a sheep exert mastery, does it control? Or is it simply being pushed around? The answer, we will see, does not fit this division.

---

J. Law  
Centre for Science Studies and Department of Sociology, Lancaster University,  
Lancaster LA1, 4YN, UK  
e-mail: j.law@lancaster.ac.uk

<sup>1</sup> We would like to thank: Nick Bingham, Steve Hinchliffe, Ingunn Moser, Jeannette Pols and Vicky Singleton for help in thinking about agency, animals, and this paper.

One of the traditions that allows us to escape structure-agency dualism is that of material semiotics. This disentangles agency from intentionality. Within material semiotics, an entity counts as an actor if it makes a perceptible difference.<sup>2</sup> Active entities are relationally linked with one another in webs. They make a difference to each other: they make each other *be*. Linguistic semiotics teaches that words give each other meaning. Material semiotics extends this insight beyond the linguistic and claims that entities give each other being: that they enact each other. In this way of thinking agency becomes ubiquitous, endlessly extended through webs of materialised relations. But where to localise agency in such a web? Where to pin it down? This becomes a matter of attribution, *post hoc* and after the action.<sup>3</sup> In telling stories about events, some entities are detached from their background and called ‘actors’. They are made to conceal and stand for the web of relations that they cover. They become the place where explanation, moral, causal, practical, stops.

In the stories that material semiotics makes possible, an actor does not act alone. It acts in relation to other actors, linked up with them. This means that it is also always being acted upon. Acting and being enacted go together. What is more, an enacted-actor is not in control. To act is not to master, for the results of what is being done are often unexpected. This has been said before in the literatures on material semiotics,<sup>4</sup> but frequently this message fails to travel with those literatures and gets forgotten. Perhaps, then, it deserves to be argued again – and in this chapter we will try do this. We will show that acting may be told as a fluid event and that beyond the structure/agency divide the most interesting questions have little to do with mastery. In order to make a difference, a sheep does not need to be a strategist. Neither do you and I.

So, let us revisit our initial question: is a sheep an actor? In order to tackle this question we will unravel its terms. What, then, is ‘an actor’? And, at least as difficult: what is a ‘sheep’

## Sheep Enacted

The picture above is not of a sheep-in-general, but a specific sheep. Uncoincidentally, it comes from Cumbria and we will assume that we are in the middle of March 2001, March 15th, to be precise.<sup>5</sup> This was a special moment in the life and death of a Cumbrian sheep, for foot and mouth disease had taken hold in the UK and it was particularly virulent in Cumbria. It was the government policy to

---

<sup>2</sup> In this sentence we combine tropes from Latour (1988) who talks of actors as entities that act and Haraway (1991), who talks of making a difference.

<sup>3</sup> Callon (1986).

<sup>4</sup> See, for instance, Akrich (1992) and (Law: 2003).

<sup>5</sup> It was difficult to take photographs of Cumbrian sheep on that date, since the countryside was closed to the general public for disease control reasons.

eradicate the disease by slaughter. This meant that animals (sheep, cows and pigs) on ‘infected premises’ and those premises counted as ‘dangerous contacts’ were being killed.<sup>6</sup> The reasoning was that if you kill the animals, you kill the virus too. But notwithstanding the slaughter, the disease was still spreading like wildfire. A week earlier, 126 premises had been infected across the nation. On the 15th, the figure was 250. Government epidemiologists were privately saying that the epizootic was not under control.<sup>7</sup> And locally it was spreading through the farms and the hills of the Lake District. The government was in a panic. Policy was changing week by week. A three kilometre ‘pre-emptive cull’ of sheep was in the works,<sup>8</sup> and it was announced on the afternoon of the 15th.<sup>9</sup>

At this particular point, then, Cumbria, March 15th, 2001, the sheep in our picture is not only ‘in a picture’. It finds itself at the cross-roads of a diverse set of practices. In each of these practices ‘a sheep’ *is* something different. Each of these practices *enacts* ‘sheep’ in a different way. Let us present four versions of a sheep.

## The Veterinary Sheep

First, in veterinary practice the sheep is a potential *host* for the foot and mouth virus.

FMD is probably the most contagious virus known in mammals. . . . Cattle, sheep, goats, pigs and buffalo are the most important susceptible species. . . . In smaller ruminants, such as sheep . . . the disease often takes a mild [...] form in adult animals. In young animals . . . the virus can cause an acute myocarditis resulting in sudden death.<sup>10</sup>

But that a sheep is a *potential* a host to a virus, does not mean that it is easy to know whether or not a particular sheep is actually infected. The vet and the farmer may examine an infected sheep very carefully and yet see nothing strange.

Recognition of the disease among stock remains the most important step and depends crucially on disease awareness by the farmer and good-communications between farmer and veterinarian. For FMD it requires examination of the visible mucous membranes of the conjunctiva, nose, mouth, tongue and eyes and the external surface of the body and limbs. Recognition in cattle and pigs is usually relatively easy but is more difficult in sheep, in which infection can be sub-clinical.<sup>11</sup>

---

<sup>6</sup> For general accounts of the early evolution of the policy see Foot and Mouth Disease 2001: Lessons to be Learned Inquiry (2002, pp 76ff). For a timeline see National Audit Office (2002, Appendix 1, pp 105–111).

<sup>7</sup> National Audit Office (2002, 61).

<sup>8</sup> Foot and Mouth Disease 2001: Lessons to be Learned Inquiry (2002, 88).

<sup>9</sup> The Minister muffed his lines by talking of ‘animals’ rather than ‘sheep’ to the horror and the anger of dairy and beef farmers. Cumbria Foot and Mouth Disease Inquiry (2002, 34).

<sup>10</sup> The Royal Society (2002, 18).

<sup>11</sup> The Royal Society (2002, 78).

In addition symptoms of foot and mouth are easily confused with those of a range of other diseases: sheep go lame for all sorts of reasons.<sup>12</sup> So the sheep-host of veterinary practice may look like an ordinary sheep.

FMD in sheep is difficult to diagnose. Farmers and vets can miss the signs. Infected sheep often display mild symptoms, if any, and suffer from other conditions that may be confused with FMD.<sup>13</sup>

Because clinical symptoms are not all that clear, in veterinary practice the gold standard for establishing whether or not a particular sheep is a host to the foot and mouth virus is a laboratory test. Technicians isolate the virus from a sheep's bodily material and grow it in a tissue culture but this is slow (it takes up to four days). An alternative laboratory test (an ELISA test for viral antigens in the sheep's blood) is quicker (only four hours) but less reliable.<sup>14</sup> In any case, sending samples off to a distant laboratory is time-consuming and in March 2001 time was of the essence: foot and mouth was spreading, sick animals needed to be slaughtered and any delay in slaughter favoured the spread of the disease. So when the vets looked at a suspect sheep, they did not wait for lab results. They ordered its slaughter. Thus while it is 'normal veterinary practice' to wait for lab results, in March 2001 the vets diagnosed the disease on the basis of a clinical inspection alone. They were not really supposed to do this – an official policy required laboratory confirmation of disease – but policy was lagging behind practice. In the heat of the moment, clinical diagnosis had elbowed the laboratory aside, even though sometimes the laboratory later showed that the wrong diagnosis had been made.<sup>15</sup> In veterinary practice, then, a sheep is a potential host for the foot and mouth virus. But there are two ways to decide whether or not a particular sheep is carrying the disease, by using clinical or laboratory means, and they do not necessarily lead to the same conclusion.

## The Epidemiological Sheep

In epidemiology the sheep is enacted differently. It does not come alone, as a body to be diagnosed. Instead, geographically located collections of susceptible animals are treated as the inputs and outputs of *calculations*.<sup>16</sup> In 2001 these calculations defined a collectivity (a premises, usually a farm), and then made

---

<sup>12</sup> This happened close to the beginning of the outbreak. See Department for Environment Food and Rural Affairs (2002, 22).

<sup>13</sup> Foot and Mouth Disease 2001: Lessons to be Learned Inquiry (2002, 49).

<sup>14</sup> Cumbria Foot and Mouth Disease Inquiry (2002, 49, 55). ELISA is the acronym for enzyme-linked immunosorbent assay. The Royal Society (2002, 76).

<sup>15</sup> Formal policy, in the form of 'slaughter on suspicion' fell into line with practice on March 15th. National Audit Office (2002, 61).

<sup>16</sup> For details see Kao (2002), The Royal Society (2002, 66–71), and Taylor (2003).

assumptions about the infective relations between those premises. They extrapolated from existing to future cases by making assumptions about possible policy interventions. The probability of infection for a given premise was determined by distance on the one hand (the closer the more likely the disease would pass) and a series of ‘heterogeneities’ including animal susceptibility to infection, length of infectious period, numbers of animals, farm size, the arrangement of fields on a farm and meteorology:<sup>17</sup>

All the models showed that culling farms neighbouring infected premises would reduce spread of infection and control the epidemic. This was based on the observation that, on average, animals on 34% of premises within a radius of 1.5 km of infected premises came down with FMD.<sup>18</sup>

So, in epidemiology any particular sheep was part of a larger collectivity of animals-on-a-premises that came with two probabilities attached: one, the likelihood of being infected in a unit time; and two, the likelihood of infecting other collectivities of animals, again in a unit time. This epidemio-logic had complex and multiple relations with the logic of veterinary practice.

One. Epidemiology *differed from* the clinical and laboratory practices of veterinarians by substituting probabilities of infection for clinical and/or laboratory diagnoses.<sup>19</sup> Two. But then again, it also *depended on* and included these, first to build its predictions and second, to confirm its findings. Three. The ‘slaughter on suspicion’ policy displaced laboratory logic and made clinical logic dominant on the farm and this was for epidemiological reasons. The lab was simply too slow to stop the epizootic from spreading. One might therefore say that epidemiology *decided* between the two variants of veterinary practice. Four. On March 15th, it was determined that all sheep within 3 km of infected premises would be slaughtered because calculations predicted that they ran a considerable risk of being infected.<sup>20</sup> For these sheep, slaughter not only did without laboratory diagnosis, but also the clinical diagnosis of the vets was made *irrelevant* as well. A purely epidemiological logic ruled.

Further complexities arose because epidemiology itself was not unequivocal. First, the models grew out of patchy and inadequate data produced in a bureaucracy that was more or less overwhelmed by events.<sup>21</sup> Second, they

---

<sup>17</sup> The list of possible heterogeneities is endless.

<sup>18</sup> Foot and Mouth Disease 2001: Lessons to be Learned Inquiry (2002, 96).

<sup>19</sup> The complex intersections of practices is explored in Mol (2002).

<sup>20</sup> ‘The justification for culling contiguous premises was founded on a statistical concept. All the models showed that culling farms neighbouring infected premises would reduce spread of infection and control the epidemic. This was based on the observation that, on average, animals on 34% of premises within a radius of 1.5 km of infected premises came down with FMD. Although culling contiguous premises was a blunt policy instrument, it had the benefit of speed in decision making. It did not depend on the epidemiological groundwork to identify dangerous contacts, which was resource intensive and time consuming.’ Foot and Mouth Disease 2001: Lessons to be Learned Inquiry (2002, 96).

<sup>21</sup> See, for instance, Shannon (2002, 5).

were produced in more or less inconsistent statistical models located in different computers.<sup>22</sup> Third, they were in part the product of a more or less ungentlemanly struggle taking place in the rooms of Whitehall between the proponents of the different models.<sup>23</sup> These differences did not have direct bearing on the fate of our Cumbrian sheep<sup>24</sup> but the struggle worked to increase the (already considerable) political temperature.

## The Economic Sheep

There were economic dangers too. To set the stage, it is likely that the UK lost around £130m net in meat and livestock exports as a result of the epizootic.<sup>25</sup> What about our sheep? There are a lot of them in the UK: in 1999 around 19 million.<sup>26</sup>

We having been the major exporters to other EU countries – we are the main supplier of lamb to other European countries – as soon as that volume of 100,000 tonnes or thereabouts is not available, they cannot immediately source additional supplies.<sup>27</sup>

These sheep come onto the market because farmers buy and sell individual sheep quite un sentimentally – this is a part of trying to make a living. But however large the overall numbers, many farming incomes are modest.<sup>28</sup> Farming in the Cumbrian uplands was (and is) marginal at best and in March 2001 farm incomes were much lower than they had been a few years earlier.<sup>29</sup> It was a

---

<sup>22</sup> There were one or two other models as well: here we are simplifying.

<sup>23</sup> The first was a quickly-calculated, relatively simple deterministic, pseudo-geographical model, developed at Imperial College, London. The other was a much more complex, GIS-based, stochastic model with many more heterogeneities that was being run at the government in-house Veterinary Laboratories Agency (VLA). In the middle of March these agreed that the epizootic is growing. Otherwise, they were very different. The VLA model predicted a total of 1000–2000 infected premises by the end of the outbreak. The epizootic would, it says, stop in due course. Much more alarmingly, the Imperial College model predicted 1000 new infective premises each day by mid May. See National Audit Office (2002, 61) and Foot and Mouth Disease 2001: Lessons to be Learned Inquiry (2002, 88).

<sup>24</sup> The 3 km precautionary cull was supported by the proponents of both models.

<sup>25</sup> During this period all exports of meat and live animals were stopped. Foot and Mouth Disease 2001: Lessons to be Learned Inquiry (2002, 133). This was only a small proportion of the cost to the overall economy.

<sup>26</sup> The Royal Society (2002, 12).

<sup>27</sup> House of Commons Select Committee on Agriculture (2001, Answer to Question 499).

<sup>28</sup> House of Commons (2001, Column 94 WH).

<sup>29</sup> Policy Commission on the Future of Farming and Food (2002, 13). See also the comments by Peter Atkinson MP ‘Before the foot and mouth epidemic, farming incomes, particularly those of hill farmers, were historically low. Some estimated their annual incomes just before the epidemic at about £4,000, although others would describe that as extremely optimistic. Since the outbreak, incomes have fallen even further..’. House of Commons (2001, Column 90 WH). See, in the same debate, the comments by Alan Beith MP: ‘Hill farmers cannot

bad moment for limiting the possibilities for making a profit, yet this was what happened. For buying and selling sheep, even healthy sheep, was constrained by restrictions on movement (no movement at all with out a licence). It was also affected by the fear of UK lowland farmers of introducing foot and mouth to their own farms and by the different tastes of consumers in different parts of the EU.<sup>30</sup> Market prices fell,<sup>31</sup> and for many farmers, coming after a number of years of economic (and often personal) depression, this led to an acute economic stress.<sup>32</sup>

To compensate for the poor financial returns for farmers (and also to increase overall EU agricultural production) there were EU CAP (Common Agricultural Policy) support payments.

In 2000 subsidies accounted for 50% for total output in hill flocks, 42% in upland flocks and 27% in lowland flocks.<sup>33</sup>

These 'headage' payments, the product of compromise between divergent European interests, thus represented a considerable proportion of the income per sheep.<sup>34</sup> They also led to a large national trade in sheep as farmers ensured that their flocks were up to size in the spring for the CAP subsidy.

And then, crucial to the economic enactment of sheep in March 2001, the Ministry paid compensation for sheep slaughtered. This was an important part of disease control policy (and also supported the farmers):

In some cases, it is likely that the compensation paid to farmers exceeded the amount which they would have expected to obtain for their animals in normal conditions, possibly by substantial amounts. It was judged necessary to pay farmers on a generous basis to ensure their co-operation in the slaughter policy.<sup>35</sup>

So slaughtered sheep were paid for whilst, given market conditions, those not slaughtered represented a considerable financial liability. If the sheep was enacted as an economic entity then slaughter was often a good.

---

continue taking less than the cost of production, which they are doing now and have sometimes had to do in the past.', House of Commons (2001, Column 94 WH) .

<sup>30</sup> Peter Atkinson, MP, in the House of Commons (2001, Column 91 WH).

<sup>31</sup> 'I was talking to a farmer who was selling horned Blackface sheep for carcass export at 270p a kilo before the foot and mouth outbreak; after the outbreak the price is 150p a kilo because there is no export market.' This is Alan Beith, MP. See House of Commons (2001, Column 94 WH).

<sup>32</sup> See the intervention by MP Peter Atkinson at House of Commons (2001, Column 90 WH), and the testimony of Ms Boundy at Mercer (2002, 52).

<sup>33</sup> The Royal Society (2002, 12).

<sup>34</sup> Ashworth, Palmer and Northen (2000, 97). 'Support payments for sheep and cattle under the CAP are paid on a headage basis, meaning that the more animals a farmer keeps, the greater the subsidy he receives. The number of breeding ewes in the uplands increased by around 35% between 1980 and 2000.' English Nature, quoted by the Policy Commission on the Future of Farming and Food (2002, 74).

<sup>35</sup> Foot and Mouth Disease 2001: Lessons to be Learned Inquiry (2002, 132).



## The Farming Sheep

But on a farm a sheep is not only an individual animal with an economic value. It is also a member of a flock. This drastically changes any assessment of slaughter. For there is pride in the history of breeding (selecting, caring) that goes into the raising of a flock. Here is a quote from Devon, but the sentiment was widespread in Cumbria too:

With my family I have been here since 1946, coming with my parents from my grandparents' farm also in the parish. We brought sheep with us as a nucleus for our flock. Although not a pedigree flock, every year the best ewe lambs were selected to replace culled ewes, as had been the practice from grandfather's early days in farming – so bloodlines went back to them.<sup>36</sup>

Flocks involve long lasting relations of care. The ewes care for the lambs,<sup>37</sup> and the farmers care for the individual sheep and for the flock as something that is more than the sum of its individual members. Note that care is not maudlin: it may be harsh too.<sup>38</sup> But such harshness has its limits. Here is a Cumbrian farmer:

We are not sentimental about sending our animals to the abattoir when they reach maturity and peak condition but the mass slaughter of young, some very young, animals seems very unnatural and it feels as if we are going to fail in our duty to them.<sup>39</sup>

A *flock* is a collective that cannot or should not be lost. One of the daily practices of farming is taking care of a flock. And that care is inseparable from geography, from topography and from meteorology.

In Cumbria the farmhouse and a few fields often lie at the bottom of the valley but there are also extensive unfenced upland and highland fells for grazing. The sheep live in those uplands and highlands for much of the year. However, since in winter the tops are covered in snow, conditions are harsh and there is little for them to eat, they are moved down in the autumn. Lambs for fattening that will be sold in autumn and the winter are kept on the lower slopes. Older breeding ewes or 'draught sheep' that can no longer live on the high fells are sold to lowland farmers or for slaughter. And then there are the breeding ewes that will lamb in the spring. More breeding ewes may be bought in the late winter<sup>40</sup> but it is the over-wintering breeding ewes and their springtime lambs that form the core of the flock and secure its continuity. These carry it from generation to generation. It is these that live the annual round of tugging,

---

<sup>36</sup> Mercer (2002, 77). This quotation comes from the Devon Inquiry and does not refer to a Lake District flock.

<sup>37</sup> 'One of the worst things was the twin lambs from a sheep that was giving birth as the sheep had been rounded up just minutes earlier. The sheep would have been a good mother as it was really reluctant to leave them and difficult to load.' (Jackson: 2001, 108).

<sup>38</sup> Mol (2006).

<sup>39</sup> Stockdale (2001, 114).

<sup>40</sup> This is in time for the CAP headage payment.



lambling and shearing. And if they are released in the late spring onto the uplands and the highlands, this also helps to care for the fields around the farm. These, after all, should not be overgrazed and it is good to allow them time to recover during the summer.<sup>41</sup>

But in March 2001, it was illegal to move sheep on or even across a public highway. As a result many were trapped on the lower fells and unable to come to the lowlands. Others were caught in lowland fields grazing on the pasture usually set aside for breeding ewes and their lambs.<sup>42</sup> They could not be sold but there was not enough pasture to go around. This was not only another economic strain on the farmers, but it was also bad for the welfare of the flock.<sup>43</sup>

The foot and mouth epidemic, with the threats and the restrictions it brought, harmed the welfare of every Cumbrian flock. And some flocks, those that were slaughtered to prevent the epizootic from spreading, were permanently destroyed.

The only thing worse for a farmer than sending his entire healthy flock for slaughter must be to see his flock come down with foot and mouth and to have them shot in front of him and then to be piled up in his farmyard waiting to be burnt or buried.<sup>44</sup>

Farming practices, then, enact sheep as animals tied to time, place, sex and age. No individual sheep matters very much, but as a flock they are of immense and irredeemable value. The worst thing it did, then, this disease, was not to kill individual sheep, but to eradicate entire flocks of them.

## Sheep Acting

You cannot learn what a sheep is by staring at a picture. It helps more to unravel the practices in which sheep figure, in which they are enacted in one way or another.<sup>45</sup> If we do this then we do not discover a sheep that is unified and coherent. Instead we find a ‘sheep multiple’.<sup>46</sup> This is because a slightly different sheep is done in each practice. Even so, this multiplicity is not a plurality. Instead there are complex and intricate relations between the various versions

---

<sup>41</sup> It cares much less well for the uplands where there is substantial overgrazing, encouraged, according to the critics, by the CAP headage subsidy for breeding ewes. See English Nature, quoted in Policy Commission on the Future of Farming and Food (2002, 74).

<sup>42</sup> They could also be used for cows that were wintering in the byre, but this is just another of the many complexities we leave out.

<sup>43</sup> Hence the importance of the welfare slaughter scheme. For an account of the difficulties faced by hill farmers, see David Curry MP at House of Commons (2001, 96 WH).

<sup>44</sup> Jackson (2001, 109).

<sup>45</sup> There is a small body of work which explores the character of animals and micro-organisms in the context of situated and multiple practices. See Haraway (2003), Bingham (2006) and Hinchliffe (2001). The work of Laurent Thévenot (2001) on moral complexity in practice also touches on relations with animals and indeed sheep.

<sup>46</sup> Mol (2002) talks of the ‘body multiple’. For related arguments, see Law (2002).

of a sheep. So the (simplified!) stories of the different versions of the Cumbria sheep in March 2001 both exclude and include each other. The farming sheep was invaluable, outside value, whereas the economic sheep had a price on its head. The farm flock deserved protection, whereas a sheep enacted as an economic entity was more valuable dead than alive. And the epidemiological sheep and the veterinary sheep simultaneously clashed with and depended on one another. At the same time, however varied the ‘sheep’ they enacted, on a day-to-day basis all these practices somehow came together. Economic accounts and epidemiological calculations appeared on similar kinds of spread sheets and policy took both into account. The vet visited the farm while the farmer, besieged by foot and mouth was isolated and did not move far. Some members of the family went to live in distant holdings to limit the coming and going.<sup>47</sup>

So, if sheep were enacted in different ways, the different ‘sheep’ also held together. These are sheep *multiple*: more than one but less than many.<sup>48</sup> But if we say that they were ‘being enacted’ does this mean that they were passive? Here we hit a linguistic obstacle. The English language makes it easy to write sentences that are active or sentences that are passive. But writing somewhere in between ‘doing’ and ‘being done to’ is much more difficult. The divide between ‘mastery’ and ‘being mastered’ is thoroughly embedded in English and in its neighbouring European languages. Active or passive, control or slavery, the division is an enduring and central Western concern. And it is precisely this way of building the world that here we seek to interfere with. Sheep enacted also act. If sheep are enacted in different versions, this also means that they act in different ways. But how? What is it that a veterinary sheep, an epidemiological sheep, an economic sheep and a farming sheep actually *do*? How does this animal-multiple make a difference? As we answer this question, we will gradually learn more about the second term we are after, the ‘actor’.

## Sheep and Vets

We have seen that in veterinary practice sheep are enacted as potential hosts for the foot and mouth virus but that it is difficult to know whether a particular sheep is indeed host to the virus or not. Let us look again at one of the quotes we used above to illustrate this:

FMD in sheep is difficult to diagnose. Farmers and vets can miss the signs. Infected sheep often display mild symptoms, if any, and suffer from other conditions that may be confused with FMD.<sup>49</sup>

---

<sup>47</sup> For a diary account of an away posting during lambing, see Buckle (2001).

<sup>48</sup> For discussion of the complex character of partial connections, see Strathern (1991).

<sup>49</sup> Foot and Mouth Disease 2001: Lessons to be Learned Inquiry (2002, 49).

The sheep is enacted in a specific way here (i.e., as a potential host for the virus) but this does not mean it is passive. Instead, in these sentences the action shifts. First, FMD (foot and mouth disease) is called upon as an actor: it is difficult to diagnose. Then farmers and vets do something: they *miss* the signs. And then, finally, the infected sheep themselves appear to be stubborn and specific as well. They *display* symptoms in a mild way only and *suffer* from other conditions that may be confused with FMD. So the fact that it is hard to establish whether or not a specific sheep hosts the virus is the result of joint action. Disease, farmers, vets and sheep, all make a difference to the end result. To attribute all the agency to just one of these actors would be to miss the point.

It is not even easy to separate out the contribution made by each individual actor to what is jointly being done. Sheep, we just saw, may either display symptoms or hide the virus without showing it. But when farmers and vets want to act in their turn, they need the sheep to collaborate. If farmers and vets want to try to *not* miss the signs of the disease the sheep needs to open its mouth. So when they act themselves, again they do not act alone. As a farmer writes:

He [the vet] had a good look round and all cattle, pigs, and sheep were given a clean bill of health even though one of last year's pet lambs trotted over with froth all round it's mouth! Goodness knows what it had been up to but it must have been a bit surprised at the reaction it got: grabbed, turned on its back and three people trying to look into its mouth. It may decide to skip the pleasantries next time I go into the shed.<sup>50</sup>

If a sheep is grabbed and turned on its back then it is being done to, but even a sheep brutalised in this way is not passive. To begin with, it is *surprised*. And, let us face it, it also *allows* the human beings around it to act in this brutal way. It does not, for instance, respond by biting them, as it would if it were a zebra.<sup>51</sup> What is more: this sheep is active in remembering its man-handling. It may have been a pet lamb last year, a lamb fed with bottles that learned to trust human beings, but next time the farmer enters the shed, it may well *decide* to skip the pleasantries. It is not stupid!

## Sheep Un/counted

Sheep do not catch foot and mouth as easily as some other species, and neither do they transmit it so fast. This means that they made difficulties for the epidemiological models and for the modellers. For we may say that in epidemiology sheep are enacted 'as inputs and outputs of calculations', but if they are to be enacted in this way, the calculations need to take sheep-data into account. Extrapolation from other statistics is not enough. This was a problem in 2001 because earlier foot and mouth outbreaks were not driven by a reservoir of infection in the sheep population.

---

<sup>50</sup> Stockdale (2001, 223).

<sup>51</sup> This is why zebra never got domesticated. For discussion see Diamond (1997).

Dr Donaldson had criticisms of the scientific basis of the mathematical models and the influence they had had on disease control policy. He strongly disagreed with the conclusions of the modellers about their forecasts for the development of the epidemic. The predicted epidemic curves had been based on parameters from the 1967/8 epidemic which had been cattle-driven;<sup>52</sup>

Because cattle and sheep respond to the foot and mouth virus in different ways, epidemiological models based on data about cattle were of questionable utility in 2001. Models based on pigs would have not been good enough either. Not only are their bodies different, but also are their habits. A pig's body emits more virus than that of a sheep and picks it up more easily. And while sheep in Cumbria live spread out across a hillside for many months of the year and are not in especially close contact with one another, pigs are often crammed together in sheds.<sup>53</sup> It is not difficult to understand why the virus might spread faster among the latter than the former.

But if sheep act in their own specific way in an epidemiological model, this does not mean that they are able to force modellers to take them into account. If some models just skip them and their specificities, what can they do? And this is what happened, in March 2001. The Imperial model did not attend to what sheep do differently.<sup>54</sup> No amount of bleating would have made any difference to this. Sheep can act directly in various ways but not in Imperial College and its computers. They need someone to transport their actions and someone to open Imperial's doors for them. As it is elsewhere, so too it is for epidemiological models: sheep do not act alone. They only act if others collaborate with them.<sup>55</sup>

In March 2001 the data fed into the models, probably adding new infections in cattle and pigs to old infections in sheep, arrived at an overinflated and excessively alarmist conclusion about rates of infection. And policy was based on the latter. On March 27th, less than two weeks after the 3 km cull of sheep in Cumbria was put in place, a general and much more severe policy of slaughtering all animals on 'contiguous premises' was announced. If the 3 km cull had met with resistance, this new policy was even more controversial. Many farmers thought it was quite unnecessary. In an effort to avoid compliance, they began to hide their sheep and to avoid all contact with officialdom.

We heard of vets being paid to ring round their clients and 'spy' on who might have animals left and might be trying to hide them. I got to a stage where I would not answer the phone unless I recognised the number on the caller display. Through all of this, our sheep, 'the girls', lived locked in the barn. The gate to our property was permanently locked.<sup>56</sup>

---

<sup>52</sup> Donaldson (2002).

<sup>53</sup> Dring (2001).

<sup>54</sup> Scudamore (2002, 13).

<sup>55</sup> For a fascinating account of the need for collaboration in action, see Callon and Rabeharisoa (2004).

<sup>56</sup> Taylor (2004).

One might say that the Cumbrian sheep along with their farmers took revenge for being ignored by the most influential epidemiological modellers. The farming specificities on the ground did not match the policies based on the models. Outrage led to clashes and scarcely disguised disobedience. Indeed, in practice the cull was often voluntary and the sheep handed over for slaughter were from farmers who also had cattle which they wished to protect or from those who most wanted or needed compensation.<sup>57</sup> So things did not turn out in the way the government had hoped or expected. Having been ignored in the dominant epidemiological model, the sheep found other ways of acting. And thus, in their own fluid way, they became politically dangerous.<sup>58</sup>

## The Price of Sheep

Enacted economically, sheep yield a price. However, the particular price paid for a particular sheep does not depend on that sheep alone. As is obvious, it reflects whatever comes together at the point of buying and selling in, or indeed outside, the market.<sup>59</sup> For Cumbrian sheep in March 2001, it was partly a matter of taste (why do consumers in Spain, Italy and the South of France like the light lamb of the northern fells, while British customers do not?<sup>60</sup>). It was partly a matter of international regulation (since no exports were possible in 2001, the price of lamb fell for farmers in Britain, while, as a result of the consequent shortages, they rose in continental Europe.<sup>61</sup>) It was partly a matter of European policy. (The CAP headage payments, calculated on the basis of market prices in continental Europe, were unusually low precisely because those market prices were high.<sup>62</sup>) It was partly a matter of the exchange rate between the euro and the pound (the CAP headage payment is calculated in euros, but the pound was high in 2001, so the payment was low). It was partly a matter of domestic regulation. (On 2nd March, after a complete standstill, it was announced that animals could be taken under licence directly to the abattoir but since the number of hours permitted for drivers was limited, in practice the abattoir needed to be within 160 miles of the farm.<sup>63</sup>)

So, it is not 'the individual sheep' in and of itself that yields a price. Instead, it is an embedded sheep. Earlier we said that a sheep does not act alone but that

---

<sup>57</sup> Heaton (2002).

<sup>58</sup> For agency understood as fluidity, see de Laet and Mol (2000).

<sup>59</sup> There is fine work on the specificities of markets, and the enactment of commodities in Callon (1998b). See, in particular, his (1998a).

<sup>60</sup> House of Commons (2001, 90 WH).

<sup>61</sup> House of Commons (2001, 94 WH).

<sup>62</sup> House of Commons (2001, 94 WH).

<sup>63</sup> See Peter Atkinson MP at House of Commons (2001, 91 WH) and National Audit Office (2002, 102).

action moves around in a fluid way. Then we added that if a sheep *may* act (say, in a model), this does not mean that it will actually do so. It may well require the collaboration of other actors. Now, we add that the other elements of the web in which it is embedded, not only allows a sheep to act (or not), but also influences *what* exactly it may do. They afford it in specific ways. In March 2001, consumer taste, international regulations, European policy, exchange rates and abattoir distance, to name just a few of the relevant (f)actors jointly afforded a Cumbrian sheep with a price.

This is *not* to say that these (f)actors *determined* its price. There were so many of them that their activities interfered with one another in an unpredictable way. And, in any case, the sheep itself also made a difference. It acted too. For instance, if it died before it came to market (of disease or at the hands of slaughter men as part of the cull), other factors came into play. A carcass might yield nothing at all or it might attract a (better or worse) compensation payment.

The average compensation values for sheep rose from an initial £100 to £300 in July and then also declined. A standard rate card was introduced in March 2001. To encourage its use the standard rates were based on the upper quartile of market prices before the February outbreak. The rates ranged from ... £32 to £150 for sheep.<sup>64</sup>

Enacted as an economic entity, a sheep acts in an economic way. It does something that fits into economic calculations: it yields a price. But since it does not do so alone, it cannot begin to control the level of the price. Action is very different from control.

## A Flock on the Hill

Sheep have cohabited with humans for millennia<sup>65</sup> and they have done so in many different modes. Shepherds no longer live in the Lakeland hills with their summer sheep, but even so farming practice in Cumbria still enacts sheep as animals in need of care. Yet even as they are being cared for, sheep also take care of themselves. Of course they actively graze and even if some lambs are bottled at the farm, most are nursed by the ewes. However, the most striking self-care activity of Cumbrian sheep is that even though they wander across the hills without a shepherd, they know where to go.<sup>66</sup>

The heafed or hefted flocks of hill sheep, to the best of my knowledge, are unique to Great Britain and Ireland. From my own experience, having established a new flock on a hill, it takes three to five years for the flock to learn their boundaries. During this time sheep are lost through straying, from drowning in streams and bogs because they don't

<sup>64</sup> Foot and Mouth Disease 2001: Lessons to be Learned Inquiry (2002, 132).

<sup>65</sup> At least nine to ten thousand years. See Clutton-Brock (1999, 74).

<sup>66</sup> The former care of shepherds may well lie at the origins of hefting that can thus be understood as a form of self-care. See Smart (2001).

know the safe passages and buried in snow because they haven't learned the good shelter areas.<sup>67</sup>

This particular Cumbrian farmer adds that a flock needs at least five years to become knowledgeable enough to be safe. So knowing how not to wander does not come easy to Cumbrian sheep. But the fact that they do had far reaching consequences in March 2001. The extraordinary ability of flocks of hefted sheep to learn about the landscape, fed into the next change in policy:

Hefted sheep result from years of careful breeding during which knowledge of the parcel of land, the 'heft', is passed on from ewe to ewe lambs. As part of the policy adjustments announced on 26 April, rare breeds and hefted sheep were exempted from the contiguous cull provided that strict biosecurity was maintained.<sup>68</sup>

This tells us that how hefted sheep act in relation to the fells was reflected back in what was being done to them. Not directly, for others had to make the arguments, but even so the actions of the sheep made a difference to government policy.

Policy was decided in London, so this was a case of acting at a distance.<sup>69</sup> The point is not that the sheep *sought* to affect others far away or that they tried to protect themselves but that they did so. Hefted sheep are influential far beyond their own immediate reach in other ways as well. This is because they do not only *know* the landscape they live in but also actively *interfere* with it:

Dr. Bardgett of Lancaster University has carried out research into what happens when the grazing animals are removed from a hill. Within ten years it is fast reverting to scrub. First the dominant grasses will swamp the sward. Bracken will encroach even faster. Gorse, and in some cases brambles, will seed and spread unchecked. Seeds of Silver Birch, Ash, Sycamore, Willow and Alder carry on the wind and will germinate and grow unmolested. Rare plants, that thrive because of and not despite the grazing pressure, will disappear.<sup>70</sup>

So, hefted sheep helped to make and maintain the Lake District landscape. And this is the original landscape of the English romantic imagination. Largely unwooded and largely unfenced, with its sudden open vistas of distant valleys and lakes, it is kept in this state in part by the actions of the hefted sheep as they graze evenly across its slopes. But this implied that the romantic imagination was under threat in 2001 and doubly so. In the short run, the fells were out of bounds for walkers. The fear was that the latter might spread the virus. In the long run, there was the danger that denuded of its hefted flocks, the landscape would start to change. That scrub would start to grow and trees and that if sheep returned at all, fences would be needed:<sup>71</sup>

---

<sup>67</sup> Mawdsley (2001).

<sup>68</sup> Foot and Mouth Disease 2001: Lessons to be Learned Inquiry (2002, 128).

<sup>69</sup> On action at a distance, see Latour (1987).

<sup>70</sup> Mawdsley (2001).

<sup>71</sup> And indeed in certain areas of the fells, for instance around the Old Man of Coniston and Wrynose Pass, there are now fences to keep the sheep in place. The hope is that they can be removed once the sheep have learned where they may safely graze.



For hundreds of thousands, perhaps millions, rambling is an escape from regimentation. They have lost the right to roam. They are being told that the slaughter of Herdwick sheep will transform the open fells of the Lake District into a scrubland no one who has loved Wordsworth or followed a Wainwright guide will recognise – and that the Peak District could follow.<sup>72</sup>

Without the action of its knowledgeable flocks of sheep, the open fells would disappear and with this the possibility of a specific kind of romantic ‘escape from regimentation’. The sheep, to be sure, know little of this as they teach their lambs where and where not to go. They graze. So far as we know, they care little about nature lovers, walking boots and Wainwright guides. Yet their actions inform the romantic imagination and its activities which tells us that even in order to act at a distance, one does not need to be a strategist.

## What Is Done

We set out to answer the question: ‘do sheep act?’ And we have suggested that they do. But along the way we have interfered with and changed the terms of the question. Both the words ‘sheep’ and ‘act’ now mean something different.

A sheep, to begin there, is not a figure given with the space-time co-ordinates that we tend to use for geographical and historical localising. We need to say that the sheep we are talking about was found in Cumbria in March 2001. But this is just a beginning, for then there are practices, a whole variety of them, to be examined. So we have tried to show that veterinary, epidemiological, economic and farming practices each enacted ‘sheep’ in different ways which tells us that what a ‘sheep’ *is* can only be known if we explore these practices – that it is not given outside them. But this is not to say that exploring a few practices in a few pages gives us an exhaustive answer to the question ‘what is sheep?’. Our inquiries are necessarily partial. We might say a lot more about veterinary, epidemiological, economic and farming practices and we might also go on to investigate practices to do with tourism, animal rights, slaughter and the disposal of the carcasses. The list is endless. The reality of an entity is never exhausted. Imagine it as a fractal: if you magnify a fragment you discover an image that is as complex as the first one. And it is the same if you shift your attention to another fragment.<sup>73</sup>

So, a sheep-enacted does not *exist* all by itself and neither does it *act* alone. Indeed, an actor-enacted acts in collaboration with others to such an extent that it is not always clear who is doing what. Action moves around. It is like a viscous fluid. What each actor does also depends on its co-actors, on whether they allow it to act and on what they allow it to do, on rules and regulations. But this is not to say that an actor-enacted is determined by its surroundings. It has

---

<sup>72</sup> Cohen (2001).

<sup>73</sup> This argument is explored in Strathern (1991).

its own stubbornness and specificities: it is full of surprises. So the difference an actor makes is not predictable. Indeed, on the contrary: what actors-enacted do is essentially indeterminate. So much comes together in the collaborative webs of complex practice. How might one begin to know beforehand how it adds up, how the various tugs and pulls intersect and interfere with one another?

So, the actor-enacted is complex. And that complexity only increases if we also attend explicitly to the *normativity* of all the activities in which it is involved. We have not said a lot about this but it is obvious that stories about foot and mouth disease are far from neutral. The disease brings dis-ease. It also affects what is appreciated. Take the mundane activities of farming. In normal times these are hard work. Periods of grind. lambing in the middle of the night. hand feeding a number of lambs. But suddenly, when those activities are no longer needed, they look different:

Since the start of lambing in early January I had been waiting for the day when the kitchen windowsill would be free from bottles, teats, jugs and a box of milk powder to feed orphan lambs. When that day came, how I wished them back again.<sup>74</sup>

And foot and mouth was terrible for many:

What do you say [says an MP] to men, big men with hands like shovels and hearts like an ox who are broken down on the phone? They say, 'Eeh! I canna talk to you any more lad. Can you speak to the wife?'<sup>75</sup>

But this does not mean that nothing good happened in Cumbria in March 2001. Again we discover complexities. In every specific context and at every moment, there are ways of handling things that are better and ways that are worse.. Goods and bads are being done at every level of scale. They also get mixed up and what is more, there are ambivalences.<sup>76</sup> So that, for instance, even at the worst moments for farmers, when their animals were slaughtered, there were nuances. Farmers sent bunches of flowers to the vets,<sup>77</sup> and good slaughter men could still be recognised as good slaughter men:

It sounds like it is very tense work, arriving on farms and not knowing what the handling facilities are going to be like, or the people – vets and farmers. But George and his team obviously feel a sense of responsibility to both farmer and livestock and have been managing to keep the stress on the animals to a minimum.<sup>78</sup>

Here, the slaughter men are appreciated for their 'sense of responsibility'. But often the normativities of action have little to do with intentions. They are unintended because they were not predicted or because where the action was being taken no one had thought his consequences through:<sup>79</sup>

---

<sup>74</sup> Mercer (2002, 77).

<sup>75</sup> Maclean (2001, 55).

<sup>76</sup> On ambivalence, see Singleton (1996).

<sup>77</sup> Frost-Pennington (2001, 7).

<sup>78</sup> Stockdale (2001, 114).

<sup>79</sup> The classic essay on unintended consequences comes from Merton (1957, 60–69).

structural changes in the sheep industry which over a period of years have resulted in an increase in the size of the national flock, a reduction in the farm labour force resulting in greater reliance on shared or contracted labour and the fact that >50% of livestock holdings have sheep on them at some time of the year.<sup>80</sup>

An increase in the size of the national flock is good for farmers, if it increases their incomes. But epidemiologically it is bad: that increases in size, together with the trading that goes with it, increases the likelihood of an epizootic. Indeed it can be argued that one of the contributory factors of the size of the 2001 outbreak was the sheer scale of the (partially CAP related) trading in sheep in late February.<sup>81</sup> An increase in the number of sheep is also bad for the landscape:

Environmentalists argue that the highlands bear too much grazing, in part because of the CAP headage payments for ewes.<sup>82</sup>

The landscape depends on the sheep – but if there are too many of them, it gets destroyed. Activities have complex and often unpredictable effects. And the interfering webs that make up assemblages lead to surprises, too. All of which means that what emerges is hard to predict. For assemblages, like actors, are *creative*. They have novel effects and they make new things. However, to say that they make new things tells us nothing about the desirability of those new things. Indeterminacy and novelty are indifferent to the human condition – or, for that matter, to that of the sheep or the hills. But this creativity leaves us with a possible definition of an actor. We might say that an actor is a *moment of indeterminacy* that generates events and situations. It does this together with other actors that enact it and that it, in its turn, enacts. And it does so for better, or for worse, or both. Or, then again, we might say that an actor is the site where we situate what surprised us *post hoc* when we tell stories about events and situations. It is the creative limit where our stories stop.

But if we define the actor in this way, then this suggests that determining whether this or that is or is not an actor is of secondary importance. More interesting than the fact that things may act is what they do. Anything is, or might be, or might be said to be, an actor. So the point is not *who* has done it.<sup>83</sup> Instead, what become more urgent are questions about *what* is happening. What do actors *do*? How are they creative? How do their underdetermined activities help to create or to destroy? What are the possibilities that they condition? Or, to speak as a walker in the Lake District hills: where does this path come from and where might it lead?

---

<sup>80</sup> Department for Environment Food and Rural Affairs (2002, 2).

<sup>81</sup> Foot and Mouth Disease 2001: Lessons to be Learned Inquiry (2002, 30).

<sup>82</sup> Policy Commission on the Future of Farming and Food (2002, 73).

<sup>83</sup> No wonder that even in the most beautiful social science ‘whodunit’, the author, Latour cannot find the answer to the question: ‘who killed Aramis’ (see Latour (1996)).

## References

- Akrich, M., 1992, The De-Description of Technical Objects. In *Shaping Technology, Building Society: Studies in Sociotechnical Change*, edited by E. Bijker and J. Law, pp. 205–224. MIT Press, Cambridge, MA.
- Ashworth, S., Palmer, M., and Northen, H., 2000, *An Economic Evaluation of the Sheepmeat Regime as Applied in the United Kingdom*, Auchincruive, Ayr: SAC, also available at <http://statistics.defra.gov.uk/esg/evaluation/shpmtreg/>.
- Bingham, N., 2006, Bees, Butterflies and Bacteria: Biotechnology and the Politics of Nonhuman Friendship. *Environment and Planning A*, 38 (3): 483–498.
- Buckle, M., 2001, No title. In *Foot and Mouth: Heart and Soul. A Collection of Personal Accounts of the Foot and Mouth Outbreak in Cumbria 2001*, edited by C. Graham, pp. 34–47. Carlisle: BBC Radio Cumbria.
- Callon, M., 1986, Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of Saint Brieuç Bay. In *Power, Action and Belief: a new Sociology of Knowledge?* edited by J. Law, pp. 196–233. Sociological Review Monograph, 32, Routledge and Kegan Paul, London.
- Callon, M., 1998a, Introduction: the Embeddedness of Economic Markets in Economics. In *The Laws of the Markets*, edited by M. Callon, pp. 1–57. Blackwell and the Sociological Review, Oxford and Keele.
- Callon, M. (ed.), 1998b, *The Laws of the Markets*, Blackwell and the Sociological Review, Oxford and Keele.
- Callon, M., and Rabeharisoa, V., 2004, Gino's Lesson on Humanity, *Economy and Society* 33: 1–27.
- Clutton-Brock, J., 1999, *A Natural History of Domesticated Animals*. Cambridge University Press, Cambridge.
- Cohen, N., 2001, Well, Goodbye Dolly. *The Observer*, 8th April, 2001, also available at <http://politics.guardian.co.uk/footandmouth/comment/0,9236,470361,00.html>.
- Cumbria Foot and Mouth Disease Inquiry, 2002, Report. Cumbria Foot and Mouth Disease Task Force, Carlisle. [http://web.archive.org/web/20021016132125/http://www.cumbria.gov.uk/news/footandmouth/inquiry/f&m\\_inquiry\\_report.pdf](http://web.archive.org/web/20021016132125/http://www.cumbria.gov.uk/news/footandmouth/inquiry/f&m_inquiry_report.pdf), updated 16th October, 2002, (accessed 29th August, 2003).
- de Laet, M., and Mol, A., 2000, The Zimbabwe Bush Pump: Mechanics of a Fluid Technology, *Social Studies of Science* 30 (2): 225–263.
- Department for Environment Food and Rural Affairs, 2002, Origin of the UK Foot and Mouth Disease Epidemic in 2001. London, <http://www.defra.gov.uk/corporate/inquiries/lessons/fmdorigins.pdf>, updated June 2002, (accessed 29th August, 2003).
- Diamond, J. M., 1997, *Guns, Germs and Steel : a Short History of Everybody for the Last 13,000 Years*. Jonathan Cape, London.
- Donaldson, A., 2002, Note of Meeting 8 April 2002. Lessons to be Learned Inquiry, London. [http://archive.cabinetoffice.gov.uk/fmd/fmd\\_report/documents/B-MeetingNotes/Institute%20of%20Animal%20Health%20-%20Dr%20Alex%20Donaldson.pdf](http://archive.cabinetoffice.gov.uk/fmd/fmd_report/documents/B-MeetingNotes/Institute%20of%20Animal%20Health%20-%20Dr%20Alex%20Donaldson.pdf), (accessed 28 February 2006).
- Dring, J., 2001, My Involvement with the Waughs. DEFRA, London, <http://www.defra.gov.uk/footandmouth/pdf/dringstatement.pdf>, updated 16th March 2004, (accessed 9th August 2004).
- Foot and Mouth Disease 2001, Lessons to be Learned Inquiry, 2002, Report, London: London, The Stationery Office, <http://213.121.214.218/fmd/report/index.htm>, (accessed 28th August, 2003).
- Frost-Pennington, P., 2001, Into the Valleys of Death. In *Foot and Mouth: Heart and Soul. A Collection of Personal Accounts of the Foot and Mouth Outbreak in Cumbria 2001*, edited by C. Graham, pp. 7–8. BBC Radio Cumbria, Carlisle.

- Haraway, D. J., 1991, Situated Knowledges: the Science Question in Feminism and the Privilege of Partial Perspective. In *Simians, Cyborgs and Women: the Reinvention of Nature*, edited by D. Haraway, pp. 183–201. Free Association Books, London, also available at <http://www.hsph.harvard.edu/rt21/concepts/HARAWAY.html>.
- Haraway, D. J., 2003, *The Companion Species Manifesto: Dogs, People, and Significant Otherness*. Prickly Paradigm Press, Chicago.
- Heaton, S., 2002, Cumbria Public Meeting. Lessons to Be Learned Inquiry, London, [http://archive.cabinetoffice.gov.uk/fmd/fmd\\_report/documents/A-Submissions/Ref%20414.pdf](http://archive.cabinetoffice.gov.uk/fmd/fmd_report/documents/A-Submissions/Ref%20414.pdf), (accessed 21 February 2006).
- Hinchliffe, S., 2001, Indeterminacy In-decisions: Science, Policy and Politics in the BSE Crisis, *Transactions of the Institute of British Geographers* 26: 182–204.
- House of Commons, 2001, Upland Farming, *Hansard* 372: (23), Cols 96 WH, (18 July 2001), also available at [http://www.publications.parliament.uk/pa/cm200102/cmhansrd/vo010718/halltext/10718h02.htm#10718h02\\_spnew4](http://www.publications.parliament.uk/pa/cm200102/cmhansrd/vo010718/halltext/10718h02.htm#10718h02_spnew4).
- House of Commons Select Committee on Agriculture, 2001, *Minutes of Evidence: Examination of Witnesses (Questions 480–499), Wednesday 25 April, 2001*, The Stationery Office, London, also available at <http://www.publications.parliament.uk/pa/cm200001/cmselect/cmagric/363/1042508.htm>.
- Jackson, H., 2001, Foot and Mouth. In *Foot and Mouth: Heart and Soul. A Collection of Personal Accounts of the Foot and Mouth Outbreak in Cumbria 2001*, edited by C. Graham, pp. 108–109. BBC Radio Cumbria, Carlisle.
- Kao, R. R., 2002, The Role of Mathematical Modelling in the Control of the 2001 FMD Epidemic in the UK, *Trends in Microbiology* 10 (6): 279–286.
- Latour, B., 1987, *Science in Action: How to Follow Scientists and Engineers Through Society*. Open University Press, Milton Keynes.
- Latour, B., 1988, *Irréductions, published with The Pasteurisation of France*. Harvard, Cambridge, Mass.
- Latour, B., 1996, *Aramis, or the Love of Technology*, MIT Press, Cambridge, Mass.
- Law, J., 2002, *Aircraft Stories: Decentering the Object in Technoscience*, Duke University Press, Durham, N.Ca.
- Law, J., 2003, *Traduction/Trahison: Notes on ANT*, University of Oslo, Oslo, TMV Working Paper, 106, also available at [www.lancs.ac.uk/fss/sociology/papers/law-traduction-trahison.pdf](http://www.lancs.ac.uk/fss/sociology/papers/law-traduction-trahison.pdf); 1997.
- Macleay, D., 2001, Foot and Mouth. In *Foot and Mouth: Heart and Soul. A Collection of Personal Accounts of the Foot and Mouth Outbreak in Cumbria 2001*, edited by C. Graham, pp. 53–57. BBC Radio Cumbria, Carlisle.
- Mawdsley, R., 2001, Diary. *Heart of Cumbria*, <http://web.archive.org/web/20020123225817/www.heartofcumbria.com/diaries/mawdsley1.htm>, (accessed 26th July 2004).
- Mercer, I., 2002, Crisis and Opportunity: Devon Foot and Mouth Inquiry 2001. Tiverton, Devon Books, <http://www.devon.gov.uk/fminquiry/finalreport/>, (accessed 28th August, 2003).
- Merton, R. K., 1957, *Social Theory and Social Structure*. Free Press, New York.
- Mol, A., 2002, *The Body Multiple: Ontology in Medical Practice*, Duke University Press, Durham, N. Ca., and London:
- Mol, A., 2006, *De Logica van het Zorgen: Actieve Patiënten en de Grenzen van her Kiezen*, Amsterdam: Van Gennep; (forthcoming in English as *The Logic of Care: Active Patients and the Limits of Choice*).
- National Audit Office, 2002, The 2001 Outbreak of Foot and Mouth Disease. National Audit Office, London, HC 939, [http://www.nao.gov.uk/publications/nao\\_reports/01-02/0102939.pdf](http://www.nao.gov.uk/publications/nao_reports/01-02/0102939.pdf), updated 21st June 2002, (accessed 15th September 2003).
- Policy Commission on the Future of Farming and Food, 2002, *Farming and Food: A Sustainable Future*. Cabinet Office, London, also available at <http://www.cabinet-office.gov.uk/farming/pdf/PC%20Report2.pdf>.

- Scudamore, J. M., 2002, Note of Meeting 10 April 2002. Lessons to Be Learned Inquiry, London. [http://archive.cabinetoffice.gov.uk/fmd/fmd\\_report/documents/B-MeetingNotes/Jim%20Scudamore%20First%20Meeting.pdf](http://archive.cabinetoffice.gov.uk/fmd/fmd_report/documents/B-MeetingNotes/Jim%20Scudamore%20First%20Meeting.pdf), (accessed 26 February 2006).
- Shannon, D., 2002, Note of a Meeting on 8 April 2002 with Dr David Shannon, retired Chief Scientist, DEFRA. Lessons to Be Learned Inquiry, London. [http://archive.cabinetoffice.gov.uk/fmd/fmd\\_report/documents/B-MeetingNotes/Dr%20David%20Shannon.pdf](http://archive.cabinetoffice.gov.uk/fmd/fmd_report/documents/B-MeetingNotes/Dr%20David%20Shannon.pdf), (accessed 24 February 2006).
- Singleton, V., 1996, Feminism, Sociology of Scientific Knowledge and Postmodernism: Politics, Theory and Me, *Social Studies of Science* 26: 445–468.
- Smart, K., 2001, Herdwick Sheep – the Irreplaceable ‘Wild’ Sheep who are the Lake District’s Gardeners. *News and Star*, 24 March 2001, also available at <http://www.visitcumbria.com/herdwick.htm>.
- Stockdale, M., 2001, Foot and Mouth. In *Foot and Mouth: Heart and Soul. A Collection of Personal Accounts of the Foot and Mouth Outbreak in Cumbria 2001*, edited by C. Graham, pp. 112–117. BBC Radio Cumbria, Carlisle.
- Strathern, M., 1991, *Partial Connections*. Rowman and Littlefield, Savage Maryland.
- Taylor, C., 2004, Coleen’s Story. *Farmtalking*, <http://web.archive.org/web/20020411165451/http://www.farmtalking.com/coleenstory.html>, updated 19th July, 2004, (accessed 5th January 2007).
- Taylor, N., 2003, *Review of the use of Models in Informing Disease Control Policy. Development and Adjustment*, Reading: Veterinary Epidemiology and Economics Research Unit (VEERU), School of Agriculture, Policy and Development, The University of Reading, also available at <http://www.defra.gov.uk/science/documents/publications/2003/UseofModelsInDiseaseControlPolicy.pdf>.
- The Royal Society, 2002, Infectious diseases in livestock. Scientific questions relating to the transmission, prevention and control of epidemic outbreaks of infectious disease in livestock in Great Britain. Royal Society of London, London. <http://www.royalsoc.ac.uk/inquiry/>, (accessed 29th August 2003).
- Thévenot, L., 2001, Which Road to Follow? The Moral Complexity of an ‘Equipped’ Humanity. In *Complexities: Social Studies of Knowledge Practices*, edited by J. Law and A. Mol. Duke University Press, Durham, N.Ca