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Robotic milking technologies and renegotiating situated ethical relationships on UK dairy farms

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Introduction

Drawing on Science and Technology Studies (Hinchliffe 1996), geographers researching technologies are increasingly interested in examining the place-based specificities of how technologies are encountered and used (Dixon and Whitehead 2008), and in how inserting a technology into sets of relationships (including human-nonhuman relationships) transforms those relationships in complex and sometimes unexpected ways (e.g., Holloway et al. 2013). In this paper we focus on the renegotiation of human-bovine agricultural ethical relationships in dairy farming, following a move to the use of robotic or automatic milking systems (AMS). Because robotic milking involves the replacement of 'conventional' twice-a-day milking managed by people with a system that supposedly allows cows the freedom to be milked whenever they choose, some people claim that AMS improves cows' health and welfare, increases productivity, and has lifestyle advantages for farmers (e.g., de Koning 2011). Such claims are contested, but the installation of AMS clearly establishes new forms of relationships between cows, technologies, and farmers. The basis of this paper is that established, if not uncontroversial,

ethical relations on dairy farms are unsettled by the intervention of a radically different technology such as AMS, and that the renegotiation of ethical relationships is an important dimension of how the actors involved are re-assembled around a new technology.

We draw on the results of in-depth research on UK dairy farms. The research included interviews with 24 farmers and detailed on-farm observational research on three farms including video recording of human-animal-technology relations. To allow comparison, we included farmers using conventional milking technologies as well as those using robots. Twelve farmers using AMS, still a relatively small proportion of UK dairy farmers, were identified by approaching representatives of three AMS manufacturers for interview, and asking them to suggest farmer customers whom we could talk to. This approach was successful in producing a diverse sample of farms and farmers. We asked each AMS farmer interviewed to suggest a neighboring farmer using conventional milking technology. The logic was to interview conventional farmers who had some knowledge of AMS via seeing and discussing it on neighboring farms. They would thus be in an informed position and able to make comparisons between technologies. The three farms used for detailed observational research were drawn from the sample of AMS users. One was an established AMS farm, the second was an agricultural college farm that had robotic and conventional dairies side by side and was thus interesting for comparison, and the third was a farm in the process of converting from conventional to AMS technology. Drawing on these interviews and observational studies, we aim to explore ethical relations emerging on farms that have installed or are installing AMS, focusing on the contingent, contested nature of human-animal-technology interactions.

We argue for an approach that regards ethical relations as situated and emergent (Lynn 1998), showing that as the identities, roles, and subjectivities of humans and animals are unsettled through the intervention of a new technology, ethical relations also shift. In such conditions, grounded empirical research can begin to map out the emergence and negotiation of new human-animal-technology relationships. We do not claim that the adoption of AMS *causes* changes in ethical relations, or that as a result of adoption *the same* ethical relations develop on all farms with AMS. Because farms and farmers differ widely, even in those cases where the decision has been made to convert to AMS, there are still differences in ethical relationships and in farmers' attitudes towards technologies, cows, and the practices of dairy farming. Nevertheless, farmers adopting AMS have in common that a decision was made to use this

technology, and we argue that, while recognizing difference and specificity, it is still possible to make valid general points about the implications of AMS for human-cow relations and dairy farm situated ethics.

There is a long history of farmed animals being affected by changes in agricultural technologies and farming practices, and thus to an extent AMS is just one further example of a technological intervention that affects agricultural human-animal relations and the situated ethics of livestock farming (see, e.g., Coppin 2003; Franklin 1999; Holloway and Morris 2008; Holloway et al. 2011; Woods 2012). However, some of the particular characteristics of this technology, and its particular implications for human-animal relations, make it worthy of sustained analysis and allow the paper to make a novel contribution to debates about agricultural ethics. More detail on the characteristics of AMS is provided below, but we note two key points here. First, AMS is novel in claiming to empower cows and to allow them freedom and choice. It thus works with a notion of bovine subjectivity. We argue that this is in practice problematic, but the fact that it is a central part of the discursive framing of AMS is crucial. Second, and more widely, AMS exemplifies a recent technological trend in livestock agriculture towards automation and the intensified use of computer and information technologies. These are not unique to dairy farming and neither is the use of computers new, yet AMS represents a moment in which the combined use of these technologies is producing a change in what some AMS manufacturers are calling the ‘philosophy’ of farming, enabling concepts such as the ‘management by exception’ of individuals rather than groups of animals (Holloway et al. 2013).

First, we introduce AMS in more detail. Second, recognizing the co-evolution of technologies and ethics in agricultural situations (Heutinck and Driessen 2007), we outline our theoretical perspective on exploring situated ethics. Third, we examine our empirical material from two different perspectives as a means of drawing out a detailed understanding of the renegotiation of situated ethical relationships in robotic dairy farming. From the first perspective, we cut across our research on sets of conventional and AMS dairy farms to discuss some of the ethical themes that emerged, and in particular focus on some of the practical ethical dilemmas negotiated in shifting from conventional milking to AMS. Here, we attempt to represent the views of the 24 dairy farmers interviewed, and to take into account the perspectives of AMS manufacturers. From the second perspective, we explore two more detailed farm studies, taking one conventional and one AMS dairy farm to produce detailed accounts of the renegotiation of

situated human-animal-technology relationships. In both empirical sections we draw on interviewees' comments concerning human-cow-technology relations in dairy farming, interpreting these in terms of the negotiation of situated ethics and the emergence of ethical subjectivity. The paper ends with conclusions that discuss the value of the situated ethical perspective developed by the paper and emphasize the ethically transformative effects of technological interventions into human-nonhuman relationships in agriculture.

Robotic or automatic milking systems

Several social scientific investigations have begun to explore AMS as a technological intervention into the lives of dairy cows and farmers (e.g., Butler et al. 2012; Holloway 2007; Holloway et al. 2013; Porcher 2006; Porcher and Schmitt 2012; Stuart et al. 2013). AMS assign new roles to both cows and farmers. Cows are expected to voluntarily and regularly attend for milking, while farmers are expected to respond to data collected by the AMS and to input their 'stockmanship' to cow management and welfare. AMS have six main components (Hogeveen et al. 2001). These include the milking stall, teat detection system, robotic arm that attaches the cups to the teats, teat cleaning system, electronic monitoring and recording system, and milking machine. Competing manufacturers configure these elements in different ways—e.g., deploying different teat detection technologies—but in essence all AMS work in similar ways. The system relies on cows attending to be milked individually, in contrast to conventional systems in which cows are brought into a milking parlor as a herd and milked in batches. As cows can sometimes be reluctant to attend for milking, various strategies are used to encourage them (see Holloway et al. 2013). However, many systems allow so-called 'free cow traffic' and do rely on cows voluntarily visiting the robot several times a day.

Cows are identifiable to the AMS via individual radio tags. The robot distributes individualized feed rations during milking and collects a complex array of data about each cow's milk yield, milk composition, and indicators related to health. Farmers are alerted to issues such as health problems, system breakdowns, or particular cows not having been milked, and the system is highly dependent on high standards of stockmanship and an ability to understand and use the AMS data, despite the frequent representation of AMS as a technology that can relieve

farmers of much of the work associated with dairy farming (Butler et al. 2012; Owen 2003; Seabrook 1992; Spahr and Maltz 1997).

Manufacturers claim that AMS benefit cow health and welfare, can increase milk yields through more frequent milking, and reduce labor demand. AMS ideally releases farmers from the twice or three times daily routine of milking, allowing them to perform other work or have more leisure time. For cows, arguments for improved ‘freedom’ and quality of life are also made (e.g., Lely n.d.). AMS are seen as according cows choice about when to be milked, thus reducing the need for cows to be driven as a herd, which many experience as stressful. These claims, as incontrovertible outcomes of introducing AMS, are contested. Nuanced reviews (e.g., Jacobs and Siegford, 2012) of the wealth of contradictory agricultural science research findings (see, e.g., Hogeveen and Meijering 2000; Meijering et al. 2004) point to the complexities of assessing the benefits and problems associated with AMS, and to how the specific conditions of individual farms, and the characteristics of individual farmers, are likely to contribute to the success of the technology.

AMS is still relatively unusual in UK and North American dairy farming, but has become popular in Northern Europe and is increasingly regarded as an option for UK dairy farmers considering investment in new milking equipment. At the European scale, recent research reported from a European Dairy Farmers Benchmark Survey suggests that AMS will become a significant component in dairy farming, with the proportion of cows being milked by AMS increasing from 9 percent at present to an estimated 18 percent in 2016 (Pugh 2011). The adoption of AMS is driven by a number of factors (Butler et al. 2012; Holloway et al. 2013). First, many dairy farmers report difficulties in recruiting suitable workers to carry out milking. Labor is also relatively expensive and demands management time. AMS provides a substitute for labor, in particular providing a means for smaller-scale, one-person dairy farms to continue as viable businesses. Second, as suggested above, AMS is positioned by manufacturers within a context of rising industry and consumer concern for animal welfare. Although the concept of welfare, and AMS’s contribution to welfare, are both open to critique (as we show below), AMS draws very strongly on discourses of improving farm animal welfare as a way of legitimizing this radical technological intervention. Our examination of AMS as a technology that restructures the ethical relationships between humans and nonhuman animals is thus timely.

Human-animal relationships, situated ethics, and technological change

Approaches to thinking about the ethics of human-animal relationships in agriculture have taken a number of forms. Much of this work is concerned with the objectification of animals in industrialized livestock farming (e.g., Franklin 1999; Franklin 2007; Emel and Wolch 1998; Noske 1997; Thierman 2010) and with the effects of this on how animals are treated. We briefly discuss animal welfare approaches and approaches associated with a wider ethics of care and response-ability, before outlining the notion of situated ethics.

Animal welfare approaches

Within agriculture and agricultural science, the ethics of livestock agriculture have tended to be framed around discourses of ‘animal welfare’, a concept critically analyzed by, among others, Buller and Morris (2003), Burton et al. (2012), Cole (2011) and Miele and Boch (2007). In agricultural science, research has centered around two areas. First, there are questions of how animals’ welfare can be measured and represented (Fraser 2003). Such assessments have included, for example, observations of animal behavior in different conditions that can be deemed to indicate either better or worse levels of welfare conditions. They have also included a focus on animals’ productivity, with the assumption being that if animals reproduce or gain weight, then welfare conditions must be acceptable. Second, and following from this, research has focused on trialing and comparing different farming systems, housing conditions, veterinary interventions, and so on, in efforts to ‘improve’ or ‘optimize’ animal welfare. Two further points concerning the animal welfare approach are relevant. First, the ethical ‘rightness’ of animal agriculture per se, and even of quite intensive forms of animal agriculture, tends not to be questioned (Twine 2007, 2010), and indeed can be seen to be bolstered where attention is paid to ‘welfare’ (Cole 2011). Productivist animal agriculture is to a great extent accepted. What matters is assessing and improving ‘welfare’ within that agriculture. Second, there have been attempts associated with the welfarist approach to provide tools for assessing how ‘ethical’ particular farming systems are. For example, the ethical matrix developed by Mepham (2000; see Millar

2000 for case of robotic milking) is designed as a tool for bioethical analysis. It attempts to assess the health and welfare, autonomy, and social justice implications of a farming system for the different interest groups (including animals) involved. Although welfare-led approaches have had important effects on how animals are farmed, the limitations of such formal welfarist approaches to thinking about the ethics of livestock farming are summarized well by Twine (2007, 2010), who argues that they are confined by anthropocentric thought, in that “welfare ethics ... buttress the symbolic power of the human-animal hierarchy and are protective against more fundamental challenges to human-animal relations and patterns of consumption” (Twine 2010, p. 24). Given this, this paper follows a different trajectory in thinking about how we might understand a situated, emergent ethics of human-animal relationships in farming.

Ethics of care and response-ability

In the social sciences, the ethics of farming animals has become caught up in wider discussions surrounding ethics of care and relational ethics, and with debates concerning how nonhuman animals should be taken into account in analyses of social relationships (Donovan and Adams 2007). Rather than ethics being a distanced, normative realm, social relationships are seen as sites for the emergence of an ethics that emphasizes care and responsibility (McEwan and Goodman 2010). Referring to the feminist ethics of Popke (2006), and in contrast to the often atomized relationships assumed by normative ethical philosophy, McEwan and Goodman (2010, p. 103) argue for an “expanded, relational and collective vision of the social.” For those interested in the nonhuman as well as the human world, what counts as the social goes beyond the human to include nonhuman animals in their associative relations with people. The social is seen as co-produced by humans and nonhumans (Bingham 2006), and the complex ethical entanglements of humans and nonhumans within co-produced social situations have been increasingly studied (Panelli 2010). This perspective is inspired in part by actor network theorists, such as Latour (2006), with their focus on the relational emergence of agency within networks of diverse human and nonhuman entities, and in part by discussions of care, of taking responsibility in and for a more-than-human world, and of an ethics of companionship or sharing (e.g., Haraway 2008; Whatmore 1997, 2002). Broadly, understandings of ethical relationships

which emerge from these perspectives depart from a procedural, abstract, formal version of ethical philosophy, to think instead about how humans should be ‘response-able’ in diverse, sensitive, and practical ways to and for the needs of nonhuman others (Greenhough and Roe 2010; Brown and Dilley 2012). As one example of how this response-ability perspective influences thinking about how we should engage in human-animal relationships, Fraser (2012) articulates several ethical principles that include an imperative to provide ‘good lives’ for animals in our care, to treat suffering with compassion, and to be mindful of possible unseen harms resulting from human action. Although each of these is complex and problematic, the crucial point here is that people should consistently pay attention to how their practices affect animals, and should accord animals moral considerability in their capacity to be affected by human activities.

Situated ethics

From a geographical perspective, a key corollary of these approaches to thinking about the ethics of human-animal relationships is that analysis should take into account their *situatedness*. The idea of situated ethical relationships is thus one way of beginning to explore a richer ethical terrain in livestock agriculture than that suggested by animal welfare approaches (Holloway 2002; Lynn 1998; Whatmore 1997). Brandth (2006), for instance, emphasizes the embodied, caring, and emotional dimensions of working with farmed animals. Discussions of ethics of care demand a focus on the specificity and contingency, and hence the immanence, of always enmeshed ethical relationships and embodied encounters. We should also pay attention to *difference*—between different species of animals, and between different animals of the same species, rather than maintaining a dualistic distinction between the human and the animal (Bear and Eden 2011; Lulka 2009; Wolfe 2013). Building on this conceptual acknowledgement of nonhuman difference, in this paper we additionally focus on technology to further emphasize the importance of taking into account nonliving alongside living entities. As such we are interested in exploring three-way relationships between humans, cows, and robotic technologies. Nonhuman as well as human differentiation is an essential aspect of the specific, situated ethical relationships to be explored, as our empirical focus on cows as a group and on differences

between cows, and on cows on different farms and in relationships with different humans and technologies, demonstrates. The concept of situated ethics suggests that it is possible to identify often implicit ethical positions specific to particular situations. As such, this approach to ethical relationships does not involve a normative concern with deciding what *ought* to be the case in any relationship, but instead focuses on describing what in practice actually *is* the case, even if the ethical relations described are shifting, contradictory, or problematic (Proctor 1998). Although ‘situatedness’ might imply fixity, we emphasize the fluidity or emergence of ethical relationships. Places and ‘situations’ change constantly; this change produces change in ethical relationships, but simultaneously changes in ethical relationship are part of the ongoing making of place and situation.

The empirical research we report on in this paper adds a further dimension to the attention paid to the ethics of human-animal relations in livestock farming by its focus on the three-way encounters between humans, cows, and milking technologies. Dairy farms are frequently restructured when AMS is introduced so that the micro-geographies of different spaces and flows around the farm are reorganized. A key part of the ethical dynamic of the situatedness focused on here is thus technological. We therefore attend to how emergent, situated ethical relations are bound up with particular spatial and technological relations governing the bodies and conduct of both humans and cows on robotic milking dairy farms. As Heutinck and Driessen (2007) put it, “the development of the AMS can be seen as part of a process of (the automation of) dairy farming in which ‘good farming’ is changing from *caring for the animals*, towards *allowing the animals to take good care of themselves*” (p. 253, emphasis in original). This has particular ethical implications for human-cow relations on dairy farms. Technological change is particularly important to our empirical example here, and requires a little further consideration.

Agricultural technologies are not ethically neutral, and new technologies pose new ethical problems because of how they intervene in and change existing relationships (Anthony 2012). In exploring the implications of AMS, we are thus particularly concerned with how the ethics of human-cow relations are contingent on the changing technological conditions of dairy farming. We look at how ethical relationships emerge in practice, focusing on the emergence of situated ethical relationships as new technologies intervene in and change established ethical relations. However, a technology is not simply a piece of equipment. As Wolfe (2013) argues, following

Heidegger (1977), a technology frames the world: it becomes a means of disclosing the world to us and of making it available in particular ways. Importantly, the process of technologically framing the world tends to be instrumentalist, reducing the world to a set of resources and cutting us off from other relationships with it (Wolfe 2013). This clearly resonates with the point made at the start of this section concerning the objectification of livestock, and indeed Anthony (2012) argues that contemporary agricultural technological systems focus on productive efficiency above all, simultaneously ‘disburdening’ us from more affective or caring relationships with farmed animals. Although we can point to studies that suggest the persistence of more complex and affective relationships with farmed animals (e.g., Brandth 2006; Convery et al. 2005; Holloway 2001; Wilkie 2010), it is doubtless the case that at a systemic level a technological framing that instrumentalizes animals pertains (Rollin 1995). Anthony aims to counter such a framing by positing instead what he refers to as an Environmental Virtue Ethic of Care (EVEC), which we might see as an attempt to deliberately ethically ‘re-burden’ ourselves. In farming animals, for Anthony (2012), we should be attentive, responsible, competent, and responsive. However, we differ from Anthony’s position in that he allocates responsibility as “caretakers” for implementing an EVEC to “industry technocrats” (Anthony 2012) and to consumers who should demand that their food is produced more ‘care-fully’. Farmers themselves are given the more marginal role of “caregivers,” meting out care on behalf of consumers, policymakers, and business within particular farming situations. However, the assigned subordinate role of “caregivers” seems to us to too easily disburden farmers from the responsibility to be responsible, and we argue instead that farmers, together with “industry technocrats” and consumers, are part of a network of actors who have a co-responsibility for caretaking. Returning to ideas of situated ethics, what remains important here is that for different actors within this network, human-animal ethical relationships and the negotiation of what caretaking means in particular circumstances, are situated, complex, and shifting. Driessen (2012), in his writing on how farmers’ situated ethical views and practices should be taken more seriously by social scientists, refers to this as a ‘mosaic of concerns’ surrounding farmers’ relationships with livestock. This metaphor creates a sense of sets of ethical fragments (e.g., moments of practice, decision making, or encounter) that can nevertheless cohere, if only temporarily, into recognizable patterns, which we might refer to as a situated ethics. Driessen (2012) effectively positions

farmers as caretakers too, while acknowledging the ethical entanglements and multiple ethical positions farmers get into in their relations with livestock.

Having outlined our theoretical perspective on human-animal-technology relationships in agriculture, we examine some aspects of the situated ethical relationships that emerge in particular farming contexts, positioning farmers as co-caretakers rather than simply as caregivers. In this empirical material, we describe ethical positionings and negotiations that are largely implicit, rather than conceptualized by respondents in overtly ethical terms. We look first at three themes that cover key issues emerging from the set of farms studied, and second at two comparative farm studies. The former section allows us to outline some of the situated ethical issues that have to be addressed on farms using AMS; the latter section explores in more depth the situated ethics of two sets of human-animal-technology relations.

Stockmanship, animal welfare, and bovine subjectivity

In this section we draw on the set of 24 dairy farmer interviews to look at how the ethics of human-animal relationships in AMS emerge around situated understandings of stockmanship, animal welfare, and bovine subjectivity. These situated ethics contrast with those that have co-emerged with conventional milking parlors and the very different human-animal relationships they are associated with. As we were told by manufacturers, AMS require farmers to adopt a new philosophy of dairy farming. This implies the need to negotiate new ethical relationships around AMS in the ways discussed below.

Stockmanship

The concept of stockmanship¹ is an important component of livestock farmers' identities, and of the situated ethics of livestock farming. It relates to issues such as knowledge of animals, practical skills in their management, the fostering of their productive capacities, and an ability to

¹ The gendered term 'stockmanship' is generally used by practitioners, although references to 'stockwomen' alongside 'stockmen' are not uncommon.

identify problems such as illness. Although stockmanship has positive connotations, it is not necessarily benign and can be associated with reductive perspectives on the appropriate relationship between farmer and animals. One farmer, for example, expressed a particular normative value as part of a situated ethical view of the animals on his farm. He referred to analyzing milking data to decide whether or not to cull a particular cow from the herd:

And when you start analyzing things...she's either in or she's out. It's abject, cold, and callous but it's the way that it should be done and it's the right way to manage cows.
(Farmer A)

More widely, stockmanship is seen as an essential quality of the good (livestock) farmer, as a practical and experiential set of knowledges and skills. It relates to the notion of situated ethics in these ways: in the constitution of the 'good farmer', in the way that it allows farmers to manage their farms and animals effectively, and in its association with care. Use of AMS, however, can change understandings of what constitutes good stockmanship. In conventional milking, stockmanship can be seen as the knowledge and skills that come from prolonged contact with animals (particularly during milking in the parlor). For the robot user, stockmanship instead becomes associated with checking computers, interpreting data to determine problems, and responding to issues suggested by the data. The stockman/stockwoman thus potentially becomes more distanced from the cows, with the robot and computer acting as intermediaries. For some, this challenge to conventional notions of stockmanship is ethically problematic in that the cow becomes 'hidden' in the technology. This hiding is partly literal, in the sense that the cow becomes absorbed into the technology. A Dutch developer of AMS, referring to talks he gives to groups of farmers, said:

But this is also an experience I have in one of the first presentations I give about automatic milking, then we talked about technology and how it works and at the end there was some guy at the back in the audience, he says "Mr. [name], do you see the cows between all that iron?"

In addition, the hiding of cows is partly more figurative, with the suggestion that the ‘reality’ of cows’ bodies and behaviors becomes invisible if farmers focus simply on robot-generated data. A farmer who had experienced both conventional and robotic milking systems said:

I don’t think you can ever replace a human looking at an animal and seeing she’s bright, alert, you know cudding, all things like that. A robot will pick up milk drop or mastitis in the milk...it can’t sort of look at the general health of a cow. (Farmer B)

There is a tension apparent here which becomes expressed in the emergence of different sets of situated ethics on different farms. As one farmer using conventional technology said:

I heard a lot of farmers say that when they get a robot they spent more time with the cows, they still spend the same amount of time working with the cows as they did before and I think that’s madness! Why would you automate a job just to stand in the cowshed? But you see some people are like that. They’re mad on cows, which I’m not you see. (Farmer C)

For some, the time spent not milking should be used observing and managing cows in a qualitatively different, and better, way than was possible during conventional milking. For others, that time was better used doing other work or having more leisure time while the cows, effectively, managed themselves.

Welfare

The situated ethics of cow welfare were expressed in relation to several issues, including the differences between conventional milking and AMS on cows’ health and their ‘freedom’ to express behaviors. As an example, we consider the issue of grazing, and how a shift to continuous housing, with cows living in barns all year with feed brought to them, is legitimized by farmers as part of an emergent situated ethics of AMS dairying.

There is acknowledgment that grazing cows contribute to a positive public perception of dairy farming, and for some there is a feeling that grazing is normatively the 'right' thing for cows' welfare. As such, continuous housing is ethically problematic. However for those who house their cows all year with no or very little access to grazing, an ethical case can be made for continual housing from the particular situations farmers occupy.

On the one hand, justification can be provided from a practical, managerial perspective. An alternative, ethically weighted justification is to represent cows as better off inside, because it removes them from exposure to adverse weather and because the ability to control the environment and consistently provide sufficient food improves cows' welfare, quality of life, and, to the benefit of the farmer, productivity. The following comment was made by a farmer who regularly hosted visits from people interested in observing the management of an AMS dairy:

[To] all these visitors we've been selling our image across that you've got a cow that's got an environment where she's happy...we're providing them with feed all the time. Do they want to go and see the cows on a howling day of wind like it is today and rain, standing in the corner of a field with their backs to the wind, do they want to see that, when they don't get enough dry matter intake, when they're wading in gutters and they're lame? ... I don't have an issue with cows being in all the time...because our welfare standards are high. It's in our interests to have a happy, healthy cow. If we don't have that we might as well just quit now. (Farmer D)

This emergent situated ethical position reconciles a particular sense of cow welfare that emphasizes the comfort, security, and consistency of indoor conditions with meeting commercial needs for productivity. The grazing issue is returned to in our detailed farm studies.

Bovine subjectivity

An emergent if implicit understanding of bovine subjectivity is key to the situated ethics of AMS dairying. Promoted by AMS manufacturers, the shift from conventional to automated milking is

associated with a shift from the view that farmers have to intensively manage their cows, to a perspective that puts the onus on cows to care for themselves. AMS is thus marked by a redistribution of responsibility within human-cow relationships. This can be seen in changes in how farmers were response-able to their cows. Many comments were made, for example, that cows were happier and calmer in AMS dairying than in conventional milking herds, and this was put down to a reduced need for herding, cows' ability to choose when to be milked, and a reduction in 'herd-like' behavior which was associated with bullying. Some interviewees said that since beginning AMS milking, they tried to disturb their cows as little as possible, as their mindset had changed from wanting to control production to providing for the cows so they can achieve their 'natural' potential. As one said:

I find that the less you can be in the shed actually messing with the cows the better things seem to go...they don't like being handled much...they like to be on their own and travel through the robot themselves. (Farmer E)

This implies an important, ethically weighted change in perspective on cows' assigned roles, subjectivities, and responsibilities. In contrast, one interviewee marked a different shift in cow behaviors related to the fact that, quite unusual for AMS dairying, his were allowed out to graze. His description of their behavior implies an alternative shift in bovine subjectivity (his adult cows behaved like young heifers) and in human-cow relationship:

When you go with the motorbike and round them up they come running up, skipping, bucking, it's like you're rounding young stock up...which we'd never seen cows do before because whenever you went to round them up they were all busting with milk, uncomfortable, whereas now you would be rounding cows up that had only been milked an hour before. So yeah, it was a pleasure to fetch the cows in. (Farmer F)

However, shifts in representations of changing bovine subjectivity can be given a different ethical slant. When cows are made responsible for attending the robot for milking, those who do not face sanctions. The comment below was made by the farmer we last cited, pointing to the complexity of the situated ethical positions that are negotiated in specific conditions:

There's probably another five or six cows that we've sold because mentally they couldn't take it. [The cows have to] make their mind up when they're going to go and get milked which is a bit like us going to work.... Well, we felt there were five cows that we could have spent the next two years trying to train but they just wouldn't...they just didn't like the fact of having to go and milk themselves. (Farmer F)

From this ethical perspective, the attribution of freedom, choice, and responsibility to cows has become associated with behavioral expectations and the attribution of certain qualities to 'problem' cows. We see this in the farm studies below where cows can be labeled 'lazy' for not coordinating their behaviors with the demands of the robot and the farm business.

Farm studies: from conventional to robotic milking

The preceding section outlined some aspects of the ethical relations being renegotiated on dairy farms using AMS. To more fully explore the emergence of situated ethical relationships, however, it is necessary to examine the emplaced interplay of the different aspects on specific farms. To this end, we discuss two farm studies, both in Yorkshire, UK. Both farms also participated in the set of interviews referred to above. The first farm uses conventional milking technology and the second farm uses AMS. We use the farm studies to explore in more depth the situated ethical relationships and subjectivities emerging in different technological contexts, and to show how they are part of the ongoing constitution of place.

Conventional milking in North Yorkshire

David (a pseudonym) farms on the North Yorkshire coast, milking around 300 cows in a conventional milking parlor. He is the fourth generation of his family to work as a dairy farmer. The farm uses very little automatic or computerized dairy technology. The aim of the parlor is to get through the milking as quickly as possible so the cows can go back to producing more milk.

The parlor is “just to get milk out of a cow as fast as possible so they’re either back in the field eating grass, or sitting in the grass, or in the shed, or eating silage.” Partly, this reflects a concern for the cows’ welfare, as it is not beneficial for them to be standing on hard surfaces for long periods of time. But it is also led by a belief that the cows are on the farm to be “useful”:

My main aim is not to have cows [standing] more than two hours waiting to be milked on concrete because they’re just [standing] there waiting. They aren’t [sitting] down making milk; they aren’t eating to make milk. They’re just [standing]. There are a lot of farms with eighty cows; the cows are [standing] for three hours. And...that’s three hours of the day [standing] on their feet not doing anything useful, so they’re in and away, or they’re laid down, or into the field.

This comment expresses part of David’s ethical position on human-cow relationships; cows have a use or productivity value. This objectifying ethical identification of cows is an important part of the situated ethical relationships on this dairy farm (and, presumably, most others), legitimizing the discipline and exploitation of cows’ bodily capacities. One of the main reasons for avoiding robotic milking machines and sticking with an ‘old fashioned’ parlor is David’s belief that a good stockman knows his animals by looking at them. The time spent in the milking parlor is time to look at the cows, get to know their individual traits and preferences, and consequently be able to spot problems. In contrast, he argues, AMS users spend too much time looking at computers and lose traditional skills such as judging cows’ health by looking at their bodies and behaviors. Part of David’s ethics of good farming is thus observation of individual cows, dependent on the close proximity necessitated by conventional milking practices.

Like this big parlor we put in it was a monster you know.... [People said] “oh you’re stupid, you’ll never look after all that number of cows!” Yeah but we aren’t tinkering on looking at a screen saying oh she’s given this much milk! She’s had this much feed! She’s this temperature...if the cow’s not well she’s out of sync when she’s coming in to milk². If she’s a front cow she comes in at the back. And if she’s a back cow she comes in at the front. So you know...and then there’ll either

² This refers to the way that cows will tend to go through the milking process in the same order each day.

be no milk in the [udder] or it's a bit slack and you think there's something wrong here.

When you're milking, you know your cows, and you know their temperament...and if they're out of character we have a pen at the end of the parlor. We segregate them out, they might be just bulling³, they might be just in season, but we segregate them out and then we can just check their temperature. But...if everything's flowing alright which is...nine times out of ten, they're milked, and they're back in the field. You aren't [standing] looking at a [computer] because it's there, you're going to look at it and start to press buttons and it will tell you the butter fat and all sorts now. I don't want to know that!

Staring at a computer screen, associated with AMS, is thus represented as disrupting the 'rightness' of proximal human-cow relationships. The observational skills described here contribute to an ethical notion of stockmanship that involves caring for the animals by applying knowledge of what is best for their welfare. Stockmanship is very much part of an ethical subjectivity constructed in relation to the cows being farmed. David prides himself on being able to recognize every animal and has affectionate nicknames for them; he enjoys their idiosyncratic behavior and the differences he observes between breeds. He is also determined not to put his own lifestyle choices ahead of cow welfare.

Such attitudes suggest the existence of an additional layer to the situated ethical relationships established on the farm, contrasting with the earlier comment emphasizing cows' use value. This 'alternative' ethic suggests that there is, simultaneously, a relation of care based on a 'closer' and more sympathetic understanding of cows tied to particular farming knowledges and practices. The emergence of the situated ethics of a farm thus tends to center on attempts to negotiate resolutions to ethical tensions, for example between the commercial needs and the comfort and well-being of cows. Talking about automatic manure scrapers—almost universally installed alongside robotic milking machines because of the difficulty of moving cows to use a tractor or hand-operated scraper—David argues that they are a convenient tool for the farmer but at the expense of the comfort and well-being of the cows:

³ Bulling is displaying behavior associated with readiness for mating.

Automatic scrapers, yeah they're fine, [but] what do you do when it breaks down on Christmas Day and you can't even scrape them out? So they're up to their neck in muck, a cow goes down because she's bulling and she's slipped and hurt herself. She's getting harassed by the scraper, um...no! [Laughter] It's ten minutes at each end of the day to do the shed, scraping out, job done!

As well as the resolution of ethical tensions on individual farms, the negotiation of situated ethics might also refer to sets of 'external' conditions affecting dairy farming. For example, David's care for his cows is tempered with concern that some trends in the sector may be actively harmful to the animals. The desire for ever increasing production levels—as reflected in David's desire to have cows out and eating soon after milking—has led to intensive breeding that is detrimental to the health of the cows. Like other farmers, David expressed ambivalent feelings about his attempts to breed a more productive herd:

They've been bred for the milk...frightening what they do really.... If anybody wanted to be jumping on the welfare they'd be jumping on Holsteins. They've pushed the breed; it's like us doing twenty hours a day, that's the problem. Fertility has dropped, their feet are like cheese...mature cheddar is harder to cut than a Holstein's foot, they're white, they're soft.

Farmers like David are caught between feeling that they know what is best for their cows, and persistent doubts that some of their (particularly financially driven) decisions about the management of the herd are undermining care. Such examples demonstrate the ambiguity and complexity of a situated ethics which can embody conflicting ethical positions as well as tensions between a desire to farm 'ethically' and circumstances that make 'ethical' farming difficult.

Indeed, similar fears were discussed by other farmers who send their cows out to graze, but worry that they are doing it for personal, intuitive reasons, rather than because it is best for the cows. They like to see cows in fields and know the value of this to public perceptions of dairy farming, but know that the 'modern' dairy cow cannot necessarily meet her nutritional

needs from grass alone. This reflects a rather different ethical tension that is important to the negotiation of the situated ethics of this farm. This is a tension not simply between production and welfare, as seen earlier, but between the acknowledgment of an almost aesthetic ethical sensibility concerning what is appropriate for cows (they *should* graze) and a knowledge that because humans have bred cows with particular nutritional needs then grazing is actually insufficient. This situated ethical tension is quite complex. In David's comments, the insufficiency of grazing was balanced against welfare concerns (cows should graze *even if* grazing is insufficient for meeting the productivity demands of the farm). However, breeding with a particular objective (high milk yields) has proceeded regardless of the knowledge that this would produce cows that could not subsist by grazing (as such, cows *cannot just* graze even if they should, because of other human interventions in their lives). Such breeding practices have thus produced a secondary ethical concern on top of the primary ethical dilemma concerning how to negotiate the twin aims of productivity and welfare. There are thus several layers of ethical problematization surrounding these interconnected issues of breeding and feeding cows as animals that are supposed to be productive units and experience high levels of welfare, itself a many layered and problematic term.

Robotic milking in East Yorkshire

Our second farm study focuses on a farm in East Yorkshire with 120 pedigree Holsteins. Simon (a pseudonym) is the third generation to work on the farm, and took over management of the herd after returning from agricultural college. Problems with staff and a general labor shortage in the agricultural sector prompted Simon to buy robots in 2006. This involved completely remodeling the farm to include a barn with the robots in which cows are housed year-round. Here, we discuss the renegotiation of the farm's situated ethical relationships following the introduction of robots.

The introduction of AMS is linked to the establishment of new human and bovine ethical identities, which re-articulate what it is to care for cows, in part by suggesting that cows can be given a freedom (or perhaps a responsibility) to care for themselves. AMS users frequently contend that cows know best how to meet their own needs, and consequently the role of the

farmer should be to provide for those needs—through creating the right environment, providing ample food and milking opportunities, and so on—rather than dictating to the cows how often they should eat, be milked, etc. This relates to beliefs that cows have ‘natural’ behaviors that are suppressed in conventional systems. Ethically, allowing cows to express such ‘natural’ behavior is unproblematically represented by AMS manufacturers and many farmers as a good thing and a good reason for switching to robots. Comparisons are drawn between how a cow would rear a calf—with the calf suckling milk throughout the day—and the twice-a-day milking system that is designed for the convenience of the farmer but which puts strain on the cows’ udders. Robotic milking is seen as a solution to this problem by allowing milking when cows choose. As Simon explains, he chose a ‘free access’ system because ‘forced traffic’ methods of directing the cows through one-way gates to ensure they are milked regularly runs counter to his ethos of encouraging cows’ self-expression:

I don’t think that’s a very good way of...letting cows express themselves really, it’s forcing cows to do something...you may as well go back to milking cows in a parlor because you’re forcing them to go into an area and then they’re having to go through...so that’s their way of doing it.

For Simon, the benefits of robotic milking are evident in the changed behavior of the cows, who he says are happier and more content when left to their own devices and able to manage their own lives. The situated ethical relationships that emerge on this farm focus on a re-identification of cows as living independently of much of the human intervention they would experience on conventional dairy farms. The emergent ethical relationship here implies a reduction of the direct human-cow interaction that was, conversely, so important to the situated ethics of the first farm study. For Simon, quiet and productive cows are an indication that they are being well cared for and that they are beginning to lose any association between human contact and stressful milking or herding situations:

From day one they were just quieter, just chilled out and happy. You’re not forcing them to do anything that they don’t want to do. If I’d have gone into a shed...before the robots with cows in [it] with a crush the cows would have been running around the shed all over

the place, running around, coming up knocking around all the equipment. If you'd have been walking into it, standing at the gate, there would have been half a dozen cows running up and down. They're just so quiet. I've had study tours of people, thirty or forty people in the shed, and the cows haven't batted an eyelid... which before that would never have happened just because you're not herding them around. They're individuals not a herd anymore. That's the difference of milking in this system.

Despite this belief that cows should have freedom to express themselves, there is a tension between trying to allow this while maintaining the levels of production and efficiency needed to run a profitable farm. Conflict emerges between the ideals of cow freedom and the reality of needing to maintain a degree of control over cows' behavior. The situated ethics of the robotic dairy farm thus tend to embody a contradiction between an ethic of bovine autonomy and a requirement for agricultural productivity. Talking about the design of the shed, Simon explained that the most successful designs encourage cows to move between eating, ruminating, and milking smoothly and consistently:

Just to get the cows to go around in circles, basically that's all you want. So they'll get up and go to the robot, they'll go and eat, they'll have a drink, go and lay down, they'll go to the robot, they'll go and eat, go and lay down, that's all you want them to do.

This is perhaps at odds with the notion that robotic milking should mean allowing the cows to do whatever they please, even though this might not mean engaging in 'productive' behavior. The ethical responsibility ascribed to the cows in this situated ethics in part prescribes an expectation that they will behave in certain ways concomitant with productivity (i.e., that they will 'care for themselves' by eating appropriately and regularly attending the robot). One of the most fraught areas for farmers using AMS is the question of whether to let their cows out to graze. For many farmers, until they buy robots the cows have gone out to grass, but switching to AMS necessitates keeping the cows housed all year-round because of the difficulty of ensuring that they regularly come in from the fields to be milked. For Simon, keeping the cows indoors is largely a matter of being able to control what they eat, and thereby increasing their productivity.

He acknowledges that it is partly for his own convenience, to save the trouble of bringing cows in from the field if they have not been milked:

People like to see [grazing] but I don't think there's any need for it and I can't control what a cow eats so I can't control my inputs and outputs. Whereas if I've got them inside they're on the same diet everyday and I know exactly what they're doing and I don't get any stomach upsets and the cows are the same everyday whether its summer, winter, whatever, which for me is better. Also out at grass I would have to go and fetch them in, fetch the other cows that didn't milk, which I haven't got time to do.

Simon here emphasizes the additional control given by keeping cows inside, a control which reduces interruptions and irregularities in the productiveness of their bodies. This perspective has the ethical effect of a reductive representation of cows as entities that consume inputs and produce outputs, both of which have to be carefully controlled. In this sense, then, cows do not necessarily know how best to care for themselves in this regime, as the farmer feels it is necessary to closely control what they eat, rather than allowing the cows to choose when and what to consume. Likewise, the act of fetching cows when they have not been milked as often as the farmer would like runs contrary to the rhetoric of bovine free choice.

Simon explains this by arguing that certain cows are lazy. While they do 'know' that they should be milked they choose not to because they would rather continue lying in the cubicles. The farmer has to re-assume responsibility for these animals because otherwise they will at best be less productive than required, and at worst suffer health problems as a result of their refusal to be milked:

There are two cows that won't go through; if you left them they'd just lay there and not do anything. They're just lazy! They're not lame, there's nothing wrong with them, they're giving plenty of milk but they're just lazy.... They just lay there and let it drip out. They just won't go through without you putting them in.

There is thus an alternative dimension to the ethical subjectivity ascribed to cows expressed in this comment, involving an anthropomorphic, moral judgment concerning the

behavior of some, contrasting them unfavorably with the productive, appropriate behavior of others. In these cases, the ethical relationship between humans and cows has to be renegotiated. The situated ethical relationships between humans and cows on robotic farms can be differentiated according to the ethical subjectivity accorded to individual cows (e.g., as either productive or lazy). Some farmers take this idea to its extreme and cull certain cows in the belief that they will never be able to thrive in the robotic system⁴. They want to give the cows ‘freedom’ but recognize that in practice there are some that simply refuse to take this opportunity for autonomy and must instead be herded and monitored in order to fit the farmer’s expectation of the behavior of a productive dairy cow. A technology associated with what has become an ethical position centered on bovine ‘freedom’ thus produces fresh ethical problems in those cases where cows ‘resist’ actively playing out the productive roles ascribed to them, and do not internalize the ascribed responsibilities that come with being part of a robotic milking dairy herd. The ethical subjectivity of the cows as autonomous entities conflicts with the need for them to be at the same time productive units, such that there is a need for re-establishing new modes of discipline and ways of differentiating between ‘good’ and ‘bad’ cows in this particular system.

This second farm study has focused on a farm that has adopted AMS and explored how the situated ethics of this farm contrasts in some ways with that of the farm using conventional milking technology. The different ethical subjectivities of the cows and humans in these systems are associated with different (ethical) human-cow relationships. The intervention of robotic technology to some extent disrupts established human-cow ethical relationships and ethical identities, forcing the renegotiation of these on-farm situated ethical positions, which redistributes expectations and responsibilities in ways that also produce new ethical tensions and ambiguities.

Conclusions

⁴ At the same time, some breeding companies supplying dairy bull semen for artificial insemination are now starting to offer semen from bulls selected as likely to father cows highly suited in body and temperament for robotic milking. See, for example, Semex’s promotion of ‘Robot Ready™’ semen (Semex 2012).

A focus on situated ethics illustrates the complexity of the relational ethical negotiations being played out on particular farms. Although the ‘ethics’ under consideration may be implicit, and because the concept differs from approaches derived from conventional ethical philosophy, situated ethics is nevertheless central to thinking about how humans understand and treat other entities in specific, grounded situations. In the example studied in this paper, the negotiation of human-bovine ethical relationships associated with technology and technological change emphasizes the need to take into account multiple human and nonhuman (including nonliving) entities in examining the ongoing emergence of particular situated ethical relations. In these circumstances, the intervention of a technology, with its particular reframing of human-cow relationships, unsettles existing ethical relations, and they are not always easily re-settled; they are complex, with several layers, and are sometimes contradictory, as some of our examples show. Here, we are drawn to reflect on the way that all uses of animals in agriculture are, have been, and will continue to be ethically problematic and complex. Although we have focused on a particular new technology in this paper, it is evident that the particular nature of agricultural human-animal relationships and ethics has long been scrutinized from different conceptual perspectives. For some, for example, the subordinate legal status of farmed animals, as property or commodities, provides a focus for understanding the very limited ability of welfare law to seriously question how animals are treated in agriculture (Francione 2007). The limits of welfarist approaches, already mentioned in this paper, mean that their associated regulation of animal agriculture tends to actually support and justify continued animal commodification and exploitation in capitalist agriculture. From another perspective, Stuart et al. (2013) apply Marxist social theory to the “labor” performed by cows in dairy farming. Their approach allows them to explore the pertinence of the concept of cows’ “alienation” from their work, from their bodily products (milk and calves), and from their bovine natures, because they cannot associate in herds ‘naturally’ comprised of a mix of male and female animals of different ages. Writing such as this indicates the importance of taking into account wider historical, geographical, social, cultural, and economic contexts in which the treatment of farmed animals, and the situated ethics of human-animal relations, are always unsettling. As such, we do not argue that a technology such as AMS causes more, or more difficult, ethical problems than conventional milking technologies (indeed, both are associated with problematic human-cow relationships). Instead we suggest that technological change produces a need for an ongoing negotiation of difficult, practical ethical

issues, within a social context in which farmed animals remain exploitable commodities. One way of viewing AMS is thus to see this technology as a means for re-articulating, or perhaps intensifying, the ‘use’ made of cows in dairy farming. On the one hand, as the paper emphasizes, AMS depends on the production of a bovine subjectivity that centers around cows managing, or ‘caring’ for themselves (Holloway et al. 2013), by negotiating their own routines, regularly attending the robot to be milked, and so on. In this way, AMS is reliant on a reconstitution of cows’ daily behaviors: while this is represented as giving cows ‘freedom’, in practice requirements are placed on them by the robot which can be enforced by other technologies such as one-way gates, or by human intervention. On the other hand, and simultaneously, AMS collect, analyze, and represent more data on cows’ behaviors and productivity than is normally available. This permits individualized knowledges of cows to be available to farmers, creating opportunities for new types of intervention in cows’ lives and bodies.

Although the implications of AMS as a technological intervention in dairy farming can be described in these terms, the approach taken in the paper allows us to focus on, crucially, how the situated ethics of each farm will be different, specific, and variably negotiated. Myriad differences in (for example) farmers’ life histories and personal circumstances, particular farm microgeographies, the characteristics of the cows involved, farms’ business structures and their relations with markets and prevailing agricultural policy regimes, will be implicated in situated ethical relationships, and because all of these ‘factors’ are in flux, the (re)constitution of ethical relationships must also be ongoing. As just one example of what this means, the ability of AMS to collect and represent great amounts of data, which can potentially be analyzed and used by farmers, is taken advantage of to highly variable degrees. For some, intensive use of the data has become key to their farming practices. For others, they are either unaware of what data is available, or unwilling or unable to fully engage with the data. In this way, there are some parallels with wide variations in farmers’ knowledges about other technologies they might be using (see, for example, the very different case presented by Stahlman and McCann 2012). Although it is possible to draw out some more general comments about the implications of technological change, it is clear that we cannot claim that technological change simply drives or necessitates changes in ethical relationships. As illustrated in our two farm studies, the specific emergent relational ethics in each situation will be particular to that place and human-animal-

technology assemblage. At the same time, recursively, ethical relationships are part of the ongoing making of place and assemblage.

While acknowledging such difference, the paper illustrates how the insertion of a technology into a farming situation has important ethical effects, for example on the notion of care and farmers' "mosaic of concerns" (Driessen 2012) relating to their cows and farms. AMS changes the corporeal relationships between humans and cows, and also effects change in farmers' knowledges of and perspectives on their cows—what the cow *is* to the farmer becomes something different. Similarly, both cows and humans become subject to new expectations. These changing knowledges, perspectives, and expectations are associated with the technological change. Farmers, for example, are expected to care for their cows and demonstrate stockmanship and response-ability in new ways, mediated by the AMS. Cows, in turn, while also subject to discourses of freedom and choice, are expected to care for themselves, and to behave in ways that are demanded by and embedded into the design of the AMS (for example, by attending for milking at regular intervals). The AMS too is part of the network of entities involved in care for the cows. In this way, in automatic milking, cows can be understood to 'become bovine' in different ways, while 'revealing themselves' to the farmer in new technologically mediated ways as the AMS collects, stores, and presents complex data about their bodies, their productivity, and their milk. AMS thus redefines the notion of care in dairy farming, redistributing responsibilities and effecting ethical 'reburdening' within a network of human and nonhuman (including bovine and technological) entities.

Finally, although we have focused on the situated ethics of particular farms, it is important to avoid a myopic neglect in thinking about the constitution of human-nonhuman ethical relations, of how farms are positioned within wider networks of institutions. We allude to this above, in noting the importance of, for example, farms' relationships with their markets and with agricultural policy. We need to see technologies, such as AMS, as bound up with discourses and practices of dairy farming that are systemic, influenced by policy makers and technological research and development, as Anthony (2012) suggests. On-farm situated ethics emerge in relation to such systemic discourses and practices, but give them specific inflections in particular circumstances. On this basis, further research into the situated ethics of human-animal-technological relationships is required, particularly as automatic and information technologies become more deeply embedded into livestock agriculture. Research that pays attention to

different livestock species, in different farming situations in geographical locations, and associated with different automatic and information technologies, will be important in exploring the emergence of differently situated ethical relationships and in continuing to critically examine the problematics of negotiating different ethical positions in contemporary capitalist modes of agriculture.

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