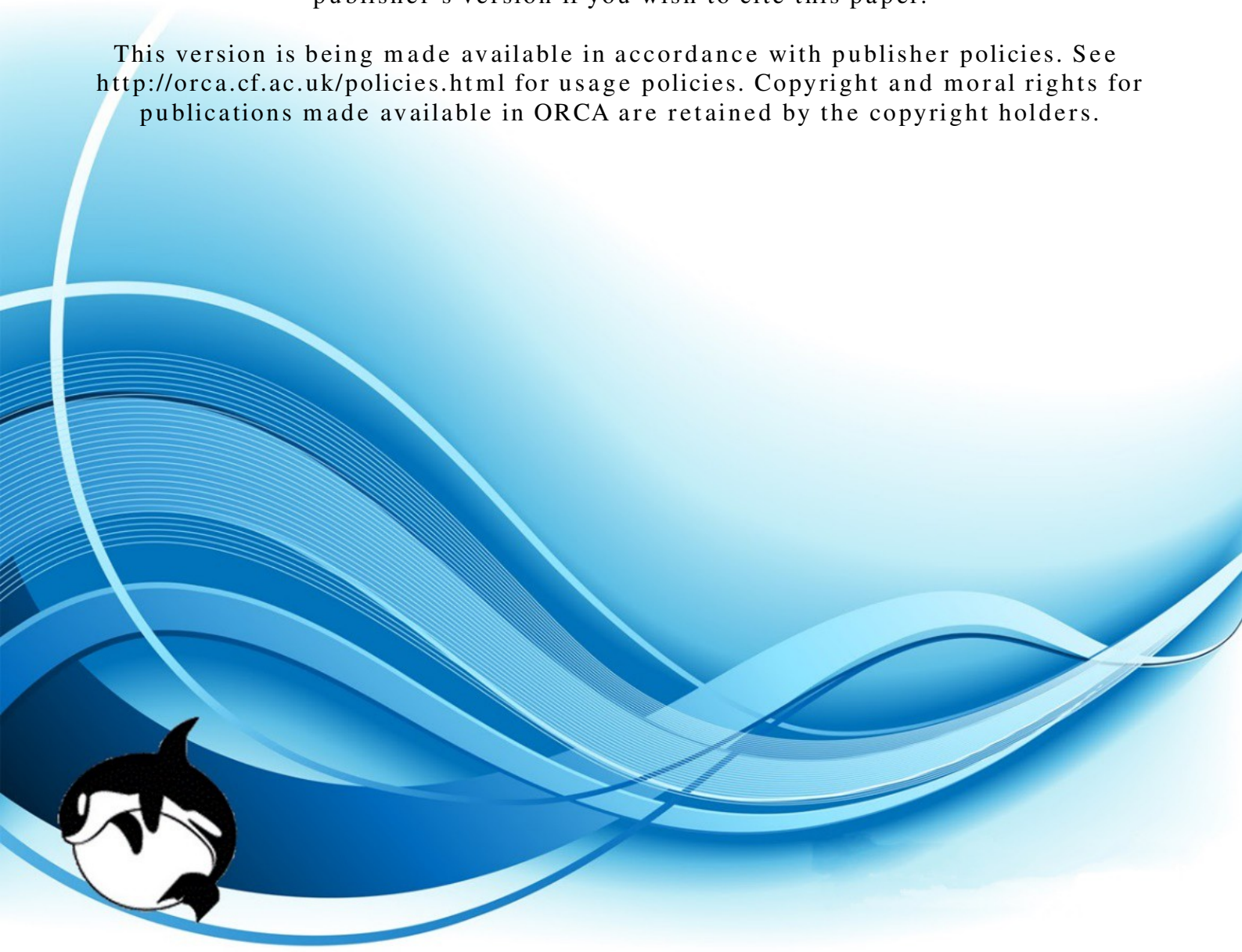


GeoHumanities

The Making of the Brave Sheep or . . . the Laboratory as the Unlikely Space of Attunement to Animal Emotions

Mara Miele

Cohen (2003) argued that animals, humans, and objects must be appraised together as they form various, temporary clusters of active beings. In this article, drawing on material semiotics and actor-network theory insights, I look at one such temporary cluster of animal scientists and sheep brought together in a specific experiment and a set of animal science practices dedicated to exploring sheep emotions. This experiment was carried out at an animal science farm and laboratory of the National Institute of Agricultural Research in Clermont Ferrand, France, as part of a project on farm animals' emotions (EmoFarm, 2010–2015). Here, I argue, the laboratory can be seen as an unlikely space of attunement to farm animals' emotions, and the sheep body, to borrow from Latour, is what leaves a dynamic trajectory by which she learns to register and become sensitive to what the world is made of (Latour 2004, 205). By looking at this temporary cluster of active beings and what they produce, I engage in a conversation with Agamben's (2009) theory of signatures and Ginzburg's (1989) signatorial method. Key Words: actor-network theory, animal emotions, animal welfare science.

God is in the detail.

—Warburg (cited in Ginzburg 1989, 96)

According to Agamben (2009), the essence of Paracelsus' episteme is the idea that all things bear a sign that reveals their invisible qualities: "Nothing is without a sign since nature does not release anything in which it has not marked what is to be found within that thing" (Paracelsus, cited in Agamben 2009, 33). In Paracelsus' medical treatises[1] signatura is the science by which everything that is concealed is revealed, the art to interpret the "signs" without which nothing of any importance can be done. This science, however, Agamben reminded us, like all knowledge, is a consequence of sin, insofar as Adam in Eden was absolutely unmarked, and would have remained so had he not "fallen into nature," which leaves nothing unmarked (Agamben 2009, 33, italics added). Every name given by Adam corresponded to the specific nature and virtue of the named things, (plants, animals, and minerals, as well as all the offspring of the four elements: water, earth, air, and fire). These names "were based upon a true and intimate foundation, not mere opinion, and were derived from a predestined knowledge, that is to say, the signatorial art" So when we say:

> This is a pig, a horse, a cow, a dog, a fox, a sheep, etc., the name of the pig indicates a foul and impure animal. A horse indicates a strong and patient animal; a cow, a voracious and insatiable one; a bear, a strong, victorious, and untamed animal; a fox, a crafty and cunning animal; a dog, one faithless in its nature; a sheep, one that is placid and useful, hurting no one. (Paracelsus, cited in Agamben 2009, 35)

With the arrival of the Enlightenment, Paracelsus' work[2] lost authority; the idea that the resemblance between a sign on a plant and an organ of the human body could be the basis for medical treatment was disregarded, even ridiculed in the Enciclopedie, and the concept of signature disappeared from Western science (Agamben 2009, 68).

What are animals then if we abandon a theory of signatures? Ingold (1988) argued that we cannot claim to be close to a final answer because "the question is not one of the kind that admits such an answer. The purpose of asking it is that it forces us to be more explicit about the assumptions that we carry into the search for answers to other, more limited questions, of a kind more amenable to empirical investigation" (xviii).

In this article, following Ingold (1988) and Haraway (1997, 2003, 2008), I argue that there is no way to define animals, their telos, their nature, or their virtue as given, because they are always effects:[3] They do not preexist the network that brings them into being, or, to put it differently and borrowing from Latour (2005), an animal "is what is made to act by many others . . . is not the source of an action but the moving target of a vast array of entities swarming toward it"(46). This implies, as Cohen (2003) argued, that no animal has meaning "without reference to the other forces, intensities, affects, and directions to which it

is conjoined and within which it is always in the process of becoming something other, something new" (76). In this perspective a "signatorial method" or signatorial strategy (Agamben 2009, 68–80) rather than a theory of signatures might be fruitful to address the search for answers to what Ingold called the more limited questions: those of a kind more amenable to empirical investigation.

Therefore the questions that I address are as follows: What are farm animals' emotions? How are they researched in practice? What are the conditions for the practices of science to become attuned to animals' emotions? Before I engage with these questions, I briefly introduce the concept of a signatorial method (and how it resonates with the much more recent actor-network theory [ANT] concerns and methods), in what I argue is a way to gain insight into how scientists are apprehending emotions in sheep.

Agamben (2009) reminded us that the concept of signature disappeared from Western science with the advent of the Enlightenment, but it reemerged under different names starting in the second half of the nineteenth century. He referred to the work of the Italian historian Ginzburg (1989) who described the "metodo indiziario," the 'evidential' epistemological paradigm (cited in Agamben 2009, 68), also known as the Morellian method.

Museums, Morelli stated, are full of paintings with inexact attributions because they lacked a signature or they were damaged. In these uncertain conditions Morelli's intuition was to look for those details of the artists' work that were least influenced by the mannerism of the artists' school. He asserted that the most noticeable features of a painting are easy to imitate (e.g., the eyes raised toward the sky in Perugino's figures, Leonardo's smiles, etc.), therefore they should be disregarded. On the other hand, the most trivial details (e.g., the fingernails, the shape of the earlobes, etc.), where arguably the artist's effort is least present, would be more revealing and should be used as clues for the attribution of authorship. As Ginzburg (1989) pointed out, "[Morelli] ended up proposing many new attributions for works hanging in the principal European museums" (97). He also drew attention to the fact that two contemporary figures, the writer Arthur Conan Doyle and psychoanalyst Sigmund Freud, acknowledged the influence of Morelli's signatorial method on their own work. The art connoisseur resembles the detective (Sherlock Holmes) who discovers the perpetrator of a crime or the analyst, who interprets the unconscious struggles on the basis of signs that are neglected by most people. Ginzburg explained this analogy by calling attention to two aspects. First, all three authors shared a training in medical science: "the model of medical semiotics is evident: that discipline which permits the diagnosis of diseases inaccessible to direct observation based on superficial symptoms, sometimes thought to be irrelevant in the eyes of the layman" (106). For Ginzburg, though, these shared biographies seem also connected to a broader trend: "Towards the end of the nineteenth century—more precisely in the decade 1870–80—a presumptive paradigm began to assert itself in the humane sciences that was based specifically on Semiotics" (106).

Nearly a hundred years later, an intimation of the Morellian method can be seen in the proposal of ANT with its rejection of "a stable theory of the actor" (Callon 1999, 181) and its assumption of the radical indeterminacy of the actor. This implies the need to adopt semiotic tools for grappling with the materially heterogeneous relations (Law 2008, 144) in practices of science, of market formation, of farming, and so forth.

By destabilizing the actor, ANT has opened up the possibility of acknowledging the liveliness of the nonhumans, the participation of animals, plants, technological devices, and other entities in the cofabrication of the sociomaterial world, which requires an engagement with more-than-human modes of enquiry and a search for the clues and signs "of the role of non-humans in action" (Callon 1999, 181). In this sense the ANT practitioners, by attending to those clues and signs neglected (by humanistic social theorists), share with the Morellian art connoisseur, the detective (Sherlock Holmes), and the Freudian psychoanalyst a signatorial method.

As Whatmore (2006) argued, "This shift of concern from what things mean to what they do has methodological consequences for how we train our apprehensions of 'what subjects us, what affects and effects us' or 'learn to be affected'" (Latour 2002, 140, cited in Whatmore 2006, 604).

ANIMAL EMOTIONS: A CONTESTED FIELD OF RESEARCH

Although in literature, philosophy, and poetry the agency and sentience of animals has been proposed and celebrated for a long time (see McHugh 2011; Despret 2004, 2013), in animal rights advocacy (Francione and Gardner 2010) and in animal welfare science[4] only recently has a line of research on farm animals' emotions been developed (see Duncan 2006; Fraser 2008; Veissier and Forkman 2008). There are different approaches to the study of animals' emotions; Veissier et al. (2009) used the following definition of emotions for informing their research:

> The word "emotion" comes from the Latin "emovere," to remove or shake, and "movere," to move. An emotion can be roughly defined as something that moves one's body and mind. Emotions are more often defined by their components: the internal-psychological component (what one feels), the neurophysiological component (how the body responds, e.g. by stress responses), and the behavioural component (what one shows to others, e.g. facial expressions and movements). Emotions differ from sensations, which are only physical consequences (e.g. heat), and from feelings, which designate only internal states with no reference to external reactions. (Veissier et al. 2009, 347)

Désiré, Boissy, and Veissier (2002) proposed to use a:

> behavioural approach based on cognitive psychology: emotions can be investigated in farm animals in terms of the individual's appraisal of the situation. This evaluative process depends on: (a) the intrinsic characteristics of the eliciting event (suddenness, novelty, pleasantness); (b) the degree of conflict of that event with the individual's needs or expectations; and (c) the individual's coping possibilities offered by the environment. The result of such an evaluation determines the negative versus positive emotions. (165)

Veissier et al. (2009), building on the results of several experiments on sheep, argued that "appraisal theories provide a useful framework for the study of the nature of subjective experiences in animals which could help us to understand their welfare requirements" (374). This is a contested line of research, however, and there are disputes on whether farm animals are able to feel emotions rather than simply react to them; that is, the contested issue is whether farm animals are similar enough to human beings to experience all three components of emotions as described in humans: "It is generally agreed that animals have emotional responses (neurophysiological responses, such as increased heart-rate . . . or release of corticosteroids in blood; behavioural responses such as startle or attempts to escape a situation) but the issue of whether animals feel emotions (psychological component) remains controversial" (347, italics added).

This discussion is still ongoing, as Buller (2013) argued there is a risk:

> of this becoming seen as "poor science," particularly in the science-ridden field of farm animal health and welfare. . . . We are not always very good at identifying animal feelings and emotions, particularly within farm animals, and are easily taken-to-task when using such arguments to promote specific actions that are likely to be strongly resisted by those working with animals. (166)

Notwithstanding this debate, in animal welfare science the "emotions" approach is becoming more relevant and influential in the policies for protecting farm animals (Fraser and Duncan, 1998; Duncan 2006; Fraser 2008; Miele 2011; Miele et al. 2013). My aim, however, is not to address this debate; I am more interested in exploring how the very unfolding of this debate is informing a line of research about farm animal welfare called cognitive ethology that is focusing on decomposing animals' emotions into specific aspects that can be investigated in practice. This research is producing a vocabulary for the range of emotions that can be described in specific farm animals, the events that elicit those emotions, and what these animals do as a consequence of those emotions in the specific context in which they live. An important aspect of this research is to develop reliable and validated measures of emotions that could be used to give advice on how to improve the quality of life of farmed animals. Here the geography of this debate is relevant: It involves scientific laboratories, national and supranational regulatory bodies, and many sites of public debate. Significantly it is mainly taking place in Europe and in North America,[5] where animal welfare science is more developed and more influential on animal farming regulation[6] than anywhere else in the world (Johnston 2013; Miele et al. 2013, 26–27).

Moreover, I am interested in the practical aspects of the scientific practices that investigate farm animals' emotions. As Latour (2001) pointed out, the actual practices of science about nonhuman animals are affected by many constraints and practical reasoning; they are more complex than the representation of

scientific achievements in science textbooks. Therefore I have looked at these practical aspects of "doing" research on farm animals' emotions, as I believe that they are insightful for addressing the complexity and the fractal and elusive nature of animals, and they help to illustrate how they are always effects of the practices that produce them.

I start with a story about a group of animals, a small flock of forty-eight sheep, and an experiment on their emotions in the animal science laboratory and farm near Clermont-Ferrand, France, where the animal science unit[7] of the Institut National de la Recherche Agronomique (INRA) research center demonstrated that sheep can feel emotions and then started a line of research (the EmoFarm project, 2009–2015) to explore the range of emotions that sheep can feel (Désiré, Boissy, and Veissier 2004). The project investigated whether sheep can remember their emotions, how they can best cope with negative emotions (e.g., fear), what is bringing about positive emotions (happiness), and how to measure the level of negative and positive emotions experienced by sheep.

EVENTS

Since 2009 I have been visiting the animal welfare laboratory in Clermont-Ferrand, France, at the INRA research center on animal science that hosts more than 700 animal scientists, some 300 cows, and about 200 sheep in two experimental farms (see Figures 1–3). I have been following the development of the EmoFarm research project and on several occasions joined the animal behavior team, a group of fewer than twenty scientists and PhD students, who are doing research on animal emotions. I carried out interviews with all members of the scientific team in 2009 and 2013 and I participated in the training associated with one of their experiments on stress and fear in sheep, shadowing the activities of the team members for six weeks on one occasion and for two weeks on a second occasion.

The specific problem that the research team wanted to address was whether the repeated experience of negative emotions such as fear would lead to negative bias (pessimistic) perception of the environment, and whether positive emotions would lead to an optimistic perception of the environment. Destrez et al. (2012) investigated the role of interactions between emotions and judgment of environment to better assess the affective state in animals. They used the drug diazepam as a way to pharmacologically manipulate the affective state of the sheep they were using in an experiment on cognitive bias. This drug is generally used to reduce negative affective states, mainly by reducing fearfulness. Here they investigated whether a reduction of fearfulness through a pharmacological approach could reduce pessimistic-like judgment in lambs. They tested the effects of this drug (known for its anxiolytic properties in many species), in Romane (Romanov × Berrichon du Cher) five-month-old female lambs.

This very specific test is part of a broader research project on fear in farm animals that has been carried out in the laboratory in the last fifteen years.[8] The experiment was meant to investigate whether the sheep can remember their emotions—that is, whether they can remember the location of a specific fear-inducing event (e.g., the sudden appearance of a red flag or a sudden noise) or a positive emotion (food reward)—and to test whether the memory or experience of positive or negative emotions affects the behavior of animals in ambiguous situations. The practical implication of this research (always in sight of the animal scientists working in this laboratory) was to identify measures of fear and practical advice for farmers on management procedures that would minimize the sources of fear and stress, as well as making a case for genetic selection of less fearful breeds of sheep. The results of the experiment are summarized next.

A

B

C

FIGURE 1 (A) The Institut National de la Recherche Agronomique farm in Clermont-Ferrand, France. (B) The sheep and lambs: Some of them are sold for meat and others are used for the experiments. (C) An animal carer feeding the lambs who do not receive enough milk. (Color figure available online.)

A

B

C

FIGURE 2 (A) The twelve sheep in the pen before the start of the training. (B) The smaller pen at the experimental theater where the pair of sheep are selected. (C) The object making a scary noise in the experimental theater. (Color figure available online.)

A B C

FIGURE 3 (A) Sheep with a heartbeat belt to monitor heartbeats during the training. (B) The animal carer taking samples of blood to check the level of cortisol in the sheep blood before and after the training. (C) A pair of sheep performing the training in the experimental theater. Their behavior and facial expression (especially ears' posture) is recorded by a fixed camera. (Color figure available online.)

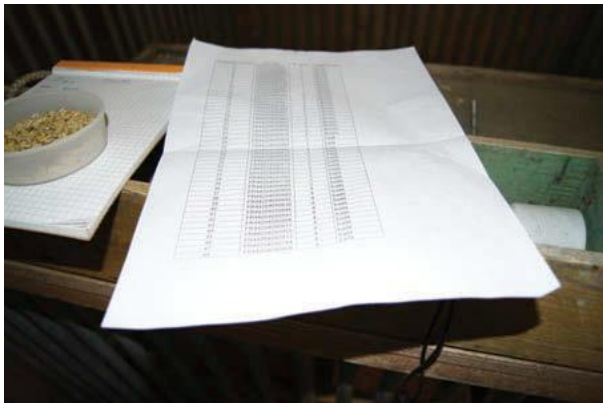
The lambs were first trained to perform a spatial location task to test for judgment bias in sheep. This task required a go/no-go response according to the location of a bucket in a pen, with one location being reinforced positively (with a feed reward) and the other negatively (with a fan-forced blower). Once trained, lambs (n = 16) were exposed twice (ten minutes and three hours after injections) to five consecutive bucket locations: the two learnt locations plus three unrewarded, ambiguous locations set between the learnt locations. Control lambs increased their latency to approach one of the ambiguous bucket locations ($p < 0.05$), while treated lambs maintained the same latency to approach this location. This difference may reflect a bias in judgment in relation to fearfulness: treated lambs seemed to display a more positive judgment of an ambiguous event than control lambs. Reduction of fearfulness may thus induce a more positive affective state. (Destrez et al. 2012, 233)

To conduct the experiment, forty-eight sheep were trained for several weeks to identify and remember the location of a fear-eliciting event and the location of a positive emotional event. These sheep were selected for high productivity (e.g., most ewes give birth to twins or triplets), but they were very fearful, and they would be unsuitable to live outdoors, because a simple noise or unexpected event would scare them and they would abandon their lambs.

During the training, the sheep were invited to go into the theater in pairs; at the beginning they were wearing a heartbeat belt (a monitoring device that records heart rate), and one of the technicians would take blood samples and saliva samples to check the level of cortisol. After the initial phase of observations and sample taking, the scientists were able to link the level of stress as indicated by the level of cortisol in the blood and in the saliva, as well as by the speed of the heartbeat, with the facial expression of the sheep: more precisely to the posture of the ears. Once this was accomplished, the research team did not need to record all the physiological measures anymore, as they were able to judge the level of fear or stress by looking at the ears' posture. The training sessions took about three hours for the entire flock of forty-eight sheep, and were repeated daily over a period of two or three months, before the experiment could be carried out (see photographs in Figures 2–5).

A

B

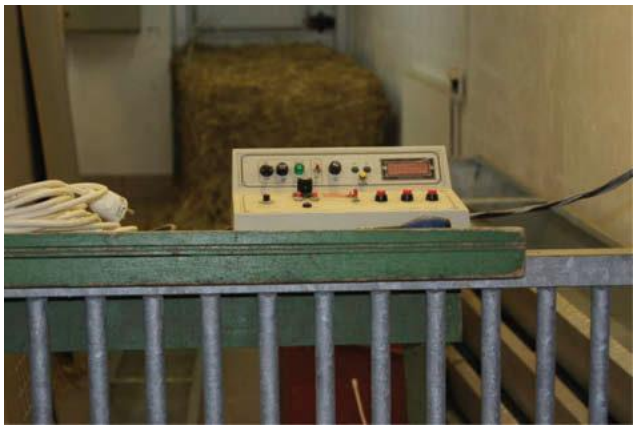


C

FIGURE 4 (A) A pair of sheep in the experimental theater. (B) The pair of sheep returning to the pen after the experiment. (C) The list of sheep pairs prepared by the PhD student. (Color figure available online.)

A

B



C

FIGURE 5 (A) The camera recording the facial expression and the behavior of the sheep in the experimental theater. (B) The monitor where the PhD student and the animal carer observe the behavior of the sheep in the experimental theater. (C) The equipment to register the heartbeat belt data. (Color figure available online.)

ORGANIZING RELATIONS: PEOPLE, ANIMALS, DEVICES, AND PLACES

Before the experiment started, there were several discussions and decisions involving the research aims, the research protocol, the training and the design of the experiment. The experiment design entailed that two sheep would be tested each time: This procedure was adopted to reduce the stress experienced by the sheep while carrying out the experiment; sheep are herd animals and do not like to be separated from their companions, and working in couples is less stressful. Moreover, this allowed the research team to test whether the presence of a dominant companion would reduce or enhance the feeling of fear. The fear-inducing events were designed to reproduce common events or conditions on farms: a sudden noise produced by a car or low-flying plane, wet bedding, delay in the distribution of food, herding with a dog, or shearing. The choice of these events was an open criticism toward more invasive types of experiments, for example, those modeled on experiments carried out on mice and using electric shocks or other invasive techniques to induce fear, which would be unnecessarily disturbing for the sheep. The training, which is the most time-consuming activity, involved the PhD student organizing the daily preparatory work for the experiment and collecting the data, and the animal carer working with the PhD student and handling the sheep. Then some of the materials collected in this phase of the experiment (e.g., blood samples) were taken to the physiology laboratory, and a technician processed the blood samples and calculated the level of cortisol for each pair of sheep at the time they were carrying out the experiment in the theater, for each event. The videos of the sheep behavior in the theater during the experiment were taken to the multimedia lab, where another technician, using dedicated software, analyzed the behavior of the sheep by looking at their facial expressions and ear posture. Finally, all these data were sent to

another building, where the chief scientists and the PhD student studied the data to find a correlation between a certain level of cortisol in blood and saliva, a certain facial expression (i.e., the ear posture), or other elements of sheep behavior.

The experimental theater was adjacent to the barns with the larger flock of sheep. Here there were only four small groups of twelve sheep each, and within these groups there were dominant and subordinate sheep. The experimental theater was equipped with technologies and devices including video cameras, animal feed, a colorful flag, an instrument for producing a loud noise, the bucket, the wheat, the TV monitor, barriers, and pens to keep apart the groups of sheep. Finally, there were documents: legal forms, ethical consent, protocol checklists, and labels for blood samples, labels for videotapes, valuation documents, and notebooks.

The work starts in the morning at around 9 a.m. when the PhD student and myself join the animal carer in the barn in which the experimental theatre is located. The PhD student introduces me to the sheep and shows me the procedure of the training, as meanwhile the animal carer checks the necks of the sheep. In the previous weeks they had an infection from the hay that they eat; this is very common and some of them still have swollen necks. This is a minor condition that might or might not affect the training, and the advice of the chief scientists was to go ahead with the training. The first twelve sheep are moved by the animal carer to a pen next to the experimental theatre and separated from it by a door. The experimental theatre needs to be prepared; both the PhD student and the carer attend to the various tasks: A bucket with wheat is located on the corner of the experimental theatre by the window closed with a sliding door where, at a later stage, a bright flag will appear. The video cameras need to be switched on, checks need to be made on the tapes, as well as the sliding doors that give access to the sheep in the actual experimental site, and a list of pairs of sheep needs to be prepared, with various combinations of "dominant" and "subordinate" animals. The PhD student chooses the first pair of sheep and the carer separates them from the others and brings them outside the pen. Then he opens the door that leads to the experimental theatre and shows the way to the sheep (they have done this task several times in the earlier weeks and they quickly go towards the experimental theatre). The PhD student, standing outside the Experimental Theatre (ET), watches carefully the first pair of sheep approaching. She says, "Doucement, doucement . . . [slowly, slowly]" to remind this first pair of eager sheep to slow down and avoid falling in the run to the experimental theatre. The sheep approach the bucket; one of them eats the wheat, and does not allow the other to get access to the bucket (this is clearly a dominant sheep). When the wheat is finished, the carer opens the sliding door and leads the pair of sheep back in the pen. The PhD student refills the bucket with a little wheat (just a handful, otherwise the sheep stay too long in the experimental theatre), and then she calls for another pair of sheep identified by numbers. I take photos and video clips of the whole process, which is repeated many times. (Field notes)

The coordination of all these heterogeneous materials and the synchronization of all the phases is important for the success of the experiment. So, for instance, the carer needed to separate and hold the couple of sheep that were called by the PhD student to perform the trial experiment. The PhD student needed to decide how to pair the sheep for each case of the training sessions. She had to acquire an intimate knowledge of the forty-eight sheep to remember the dominant and the subordinate ones. Then, she also needed to record the data and to refill the bucket with some wheat for the following couple of sheep. The coordination of devices is important, too. For instance, a fixed camera with a wide-angle lens to capture the whole theatre records the behavior of the sheep. A reliable film of the behavior of the sheep can be obtained only if the choreography of all those relations works.

The day of training ends at about 12 p.m., after all the relevant combinations (pairs) of the sheep have carried out the trial experiment. Then the carer leads the sheep back to their barn and starts cleaning the pen and the experimental theatre with the PhD student, who also collects the videotapes, her notes and makes arrangements for the following day. Then the PhD student goes to visit the sheep in their barn and checks that they are okay. The sheep greet her; they get close to her and she strokes them. They are curious, not worried or afraid; the PhD student shows me how they changed ear postures when we joined them in the pen: The ears' posture indicates that the sheep are attentive, curious, and not feeling fear. The PhD student points to n. 17, the braver sheep and her favourite, the one who is always keen and takes the lead in participating in the experiment. (Field notes)

LOOKING AT SCIENTIFIC PRACTICES WITHOUT SCIENTISTS: A SIGNATORIAL STRATEGY

This is a set of events and a sequence of scientific practices that offer insights on what the search for animals' emotions might entail in practice. This is the more modest and more limited question that I want to address, and this story suggests that the animals' emotions (fear, bravery) are precarious accomplishments rather than a matter of fact, already existing in the animal's body and mind and waiting to be discovered. They are best characterized by emphasizing the arrangement (agencement) of ordinary

materials and by looking at the role of objects in action, such as pens and red flags, TV monitors, or buckets (see the photographs in Figure 5), as they can play a central role in the configuration of human activity (Hutchins 1995; Latour 1996; Cochoy 2008, 2010; Law 2008, Higgin, Evans, and Miele, 2011). To emphasize the arrangement (agencement) of ordinary materials and the choreography of this experiment sheds light on the need for the coordination of the set of heterogeneous relations, the work of the animals' carer and the PhD student as well as the sheep in the experimental theater, and the coordination of different tasks in disparate sites (the barns, the physiology lab, the multimedia lab).

In tracing the associations forged (among the carer, the sheep, the PhD student, the equipment, the barns, the cameras, the laboratory technicians, etc.) or severed (the other lambs, the farm, the farm workers, etc.) between the human and nonhuman participants in this experiment, I have chosen to look at this scientific practice without scientists narrating the steps that led to their achievements; instead, I have focused my attention on what the PhD student, the sheep, the animal carers, the laboratory technicians, the heartbeat belts, the blood samples, the video cameras, and the many other devices involved do while taking part in this experiment, and how they get attuned to animals' emotions. Here I have borrowed insights from Callon (1986), Callon et al. (2007), Cochoy (2008, 2010), Czarniawska (2007), Cussin (1998), Higgin, Evans, and Miele (2011), Latour and Woolgar (1986) Latour (1987, 1988a, 1988b, 2005), Law and Lien (2012), Mol (2002), Mol and Law (2004), and other ANT practitioners, who, by looking at a range of different practices (shopping, scallop farming, salmon farming, the multidisciplinary study of the Amazon forest, medicine, and many others) have drawn attention to the performativity of all of the nonhuman participants in these practices.

The experimental theater is exposing the sheep to a number of devices that swarm toward them and arming them with the ability to feel emotions. The bucket with wheat eliciting positive emotions, the scary event from the sliding door eliciting negative emotions, the heartbeat belt recording the beat of the heart, the blood samples recording the level of cortisol, the video camera recording the movement of the ears and facial expressions, the gentle handling by the animal carer and the PhD student facilitating the smooth progress of the training and bond of working together, and the fearfulness-reducing drug capable of making a "braver" sheep all contribute to the success of the experiment. They are also instrumental in the production of another scientific article that will help the scientists make a case for addressing animals' fearfulness in future research in animal breeding as well as in practice and policies for improving animal welfare.

Shifting attention to the participation of objects in the making of science and paying attention to the most inconspicuous parts of a scientific experiment seem to hold the promise to comprehend this practice more fully and to show how an actant (here the sheep) can act; that is, how a sheep can feel fear and bravery and how these emotions are found in a scientific experiment, which is a great departure from those accounts of practices that take a Galilean approach (as Agamben 2009, 68, suggested) to describe scientific achievements.

TOPOLOGICAL SPACE: PRACTICES ARE EXTENDED

The elements of a scientific achievement are not all in the laboratory or the experimental farm, however; what makes a scientific experiment successful has to do with the capacity of this experiment to reach out to distant actors, through time and space, and it is mostly dependent on distant relations. What are these relations made of? Here a topological understanding of space (Latour 1996; Law 2002; Mol and Law 1994) that looks at connectedness of actors in the network rather than the physical distance between them might be insightful. We have seen that there is a video camera in the experimental theater and the recording of the sheep's reaction to the designed experiment makes sense in an extended context that includes transport systems, video laboratories, laboratory techniques, and meticulous forms of record-keeping. The videos are then analyzed with specific software and the results are presented in the form of graphs. So there is a lengthy relationality at work, and the patterns of those extended relations also need to be ordered, to a certain degree, if a result is to be generated: A paper needs to be written, published in a high-ranking scientific journal, and a new measure can be validated. Practices then are the relational model of ordering that reach distant actors and enable different versions of the sheep to emerge and coexist.

In short, three versions of the sheep are being enacted in this laboratory and the farm. First, there is a productive sheep, in the farm next to the laboratory. This breed of sheep (Romane) is the achievement of

another type of research, one informed to produce a sheep "as a body producing lambs" through selective breeding. This very productive breed of sheep is more fearful than her ancestors, who were used to life outdoors and knew how to cope with more unexpected fear-inducing events. Second, there is a suffering individual, the fearful sheep; she might be scared by common events in farming practices and might live under stress. The productive body has become a suffering animal with the help of the Treaty of Amsterdam (European Community 1997) affirming that nonhuman animals are sentient beings, with the nongovernmental organizations asking for a better quality of life for farm animals, and with European public opinion listing animal welfare among their main concerns (see Miele and Parisi 2001; Evans and Miele 2012). Third, there is a learning sheep: the sheep as a subject that can feel emotions. This sheep is learning from the experience of fear or positive emotions and the memory of these feelings is affecting her judgment of ambiguous situations. This enactment of the sheep is emerging with the help of a new line of research on farm animals' emotions and the scientific apparatus of the specific experiment described here. We could go on adding to this list. If we wanted to move beyond death, we could talk of the sheep when they become food, which would extend the practice to distant places and very different actors (food consumers, butchers, retailers, labeling schemes, food safety regulations, etc.). Here, in this experiment, the sheep is being enacted as a learning subject, a sheep that can become brave. If we were to trace the lab practices beyond the weeks in which this experiment took place, we would find other sheep–human practices to do with the daily checks of their diet and blood tests, just as we would find practices to do with biosecurity measures, bloodlines, breeding, routine veterinary inspections, vaccinations, and market trading. The stories that emerge from all the sheep–human relations that we can trace, all the practices that connect them, propose a multitude of specific, relational enactments of the sheep. The relations between these practices (either in science, farming, animal welfare campaigns, or animal food consumption) are uncertain, complex, and often incoherent (Latimer and Miele 2013).

CONSEQUENCES

All this suggests that the search for a holistic view of animals might be misleading. Thinking with Haraway (2008), Law and Miele (2011) argued, "In a performative world, the idea that practices might meld together for (within, around) the animal to generate the creature as a seamless whole makes little sense" (69). They went on to say:

> We need, instead, to imagine that animals, indeed like people, are more or less decentred.[9] That they are contingent collages, as subjects, as bodies, and as elements in collectivities.[10] For a performative theory of the animal tells us that any attachment to standard organic metaphors is likely to be deceptive. To understand animals in their complexity we will need to look beyond holism. (69)

Looking beyond holism, and abandoning the hope to find the animal telos or the very nature of animals, might lead to novel ways to attune to their emotions and to produce modestly promising enactments of nonhuman animals: the happy chicken (Miele 2011) or the fearful and the brave sheep, a sheep equipped with emotions that asks for more demanding relations with her carers than merely the sheep as "a body that produces lambs." These new figures might resemble what Haraway (2012) called "string figures":

> String figures are like stories, they propose and enact patterns for participants to inhabit somehow a vulnerable and wounded earth. My multispecies story telling is about recuperation and complex histories that are as full of dying as living, as full of endings, even genocide, the killing of kind, as beginnings. In the face of unrelenting historically specific surplus suffering in companion species, I am not interested in, nor do I believe it possible, to have reconciliation or restoration, but I am deeply committed to the more modest possibility of partial recuperation and getting on together. . . . So I look for real stories . . . of science and art. These are stories in which multispecies players who are enmeshed in partial flawed translations of difference re-do ways of living and dying, to the still possible final flourishing of maybe recuperation.

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NOTES

1. Paracelsus (1493–1541). Von den naturlichen Dingen in Bucher und Schriften. [1859] 1972. ed. J. Huser, vol. 3.7, 131. New York: Georg Olms; and Liber de podogricis, vol. 2.4, 259, in Agamben (2009, 36).
2. The work of Paracelsus, even though it was quite controversial and little known at the time of his writing, became important in the development of medicine in the Renaissance and the Baroque period, where the signatures of things were mostly interpreted as the codes of the remedial power of plants, as in the example of the Euphrasia, which has a marking that resembles the shape of an eye, and thus reveals its capacity to heal the diseases of the eye. His philosophy and medical work was inspired by a neo-Platonic conception that the whole of creation—the heavens, the earth, and all Nature—represented a macrocosm, and that its unity was reflected in a variety of possible microcosms, of which man was the most perfect (Pagel 1959; Goodrick-Clarke 1999, 23–24). Outside medicine his vitalistic view of matter was influential on the work of Leibniz, and his concepts of entelechies and monads resonate with the Paracelsian idea of all things being a microcosm that reflects the macrocosm. As Iltis (1973) pointed out, Leibniz's theory of matter is reminiscent of a Paracelsian dynamism, emphasizing the mutual relatedness of all things:

> Leibniz viewed the world as an organic whole in which all parts were interconnected and interrelated. Matter was alive and contained a force or a principle of change within it. . . . As Leibniz put it, "There is a world of creatures, living beings, animals, entelechies, souls in the smallest particle of matter. Each part of matter can be thought of as a garden full of plants or as a pond full of fish. But each branch of the plant, each member of the animal, each drop of its humors, is also such a garden or such a pond." (348–49)

3. For looking at animals as effects, see also Law and Miele (2011).
4. For a review on the development of this "young" discipline, see Blokhuis et al. (2008).
5. Western Europe (with North America and East Asia) are the regions with the highest industrialization of animal production, the highest concentration of animals reared for food in the world, and the highest levels of output per animal unit (Ruttan 1998, cited in Miele et al. 2013, 20).
6. Blokhuis et al. (2008) pointed out that a literature search on "animal welfare" in Web of Science in 2007 generated more than 35,000 hits, and 46 percent of the publications could be attributed to authors with an address in Europe, 38 percent were from North America, 10 percent from Asia, 3 percent from Australia and New Zealand, and 3 percent from South America. An enormous output such as this reflects the importance of animal welfare globally and the leadership of European research (Miele et al. 2013, 22).
7. INRA UR1213 Herbivores, Adaptation and Social Behaviours Team, Saint-Genès Champanelle, France.
8. For a review see Jones and Boissy (2011).
9. The logic is like that which, much more conventionally, talks of decentering the subject.
10. On this point see Diprose's notion of corporeal generosity. As Hird (2009) pointed out, Diprose's argument draws attention to the "unavoidable yet generally overlooked debt that any body owes to other bodies" (77).

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