Animals and Science

Animals and Science: From Colonial Encounters to the Biotech Industry

Edited by

Maggie Bolton and Cathrine Degnen

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A book like this one that seeks to reframe the relationship between anthropology, science and animals would arguably be remiss without also thanking the non-human animals in our lives. To Phoebe, the late Boris, Tigger and Dibley: thank your for offering unstinting solace when needed

and endless hours of shared contentment, punctuated at times by relentless pestering when our preoccupation with the computer meant that the food dish was in danger of becoming (unacceptably) empty. Sméagol who was not around for most of the volume's preparation, has since his recent arrival taken an uncommon interest in cursor movements on the computer screen and has keyed in some suggestions of his own for editorial changes to the volume's text.

—Maggie Bolton and Cathrine Degnen

INTRODUCTION

ANIMALS AND SCIENCE: FROM COLONIAL ENCOUNTERS TO THE BIOTECH INDUSTRY

MAGGIE BOLTON AND CATHRINE DEGNEN

Sirius: An Early Step into the World of Animals and Science

On reviewing some of the contributions to this volume, one of the editors was reminded of a work of science fiction she enjoyed as a teenager: a little-known novel called *Sirius: A Fantasy of Love and Discord*, by Olaf Stapledon, a published philosopher and lecturer at the University of Liverpool (Stapledon 1944). In a way, *Sirius* is a reworking of the Frankenstein story, as it starts with a scientist, Thomas Trelone, who creates a creature by artificial means. Rather than produce a monster of human form, the scientist of this story succeeds in producing super-intelligent dogs through introducing hormones into the bloodstreams of pregnant bitches. The book was written long before either cloning or genetic modification had entered the popular imagination, let alone become achievable realities. Trelone's first efforts produce enhanced border collies, "super-sheepdogs" prized by the hill farmers near his family home in Wales: dogs that are efficient workers, but still unambiguously canine. His life's work culminates with the birth of Sirius, a puppy who surpasses all his previous efforts and proves to have not only the intelligence, but also the pattern of growth and development of a human being.

Although the novel gives Stapledon a chance to explore what to human beings are acceptable and unacceptable outcomes of science, it passes overt moral judgment neither on the science of creating this anomaly nor on the individual scientist. Instead, through dwelling on Sirius's existential angst, Stapledon provides us with an exploration of what it means to be

human, and of the boundaries between humans and animals. The dog is torn between his yearnings to partake of human intellectual pursuits and pursue human relationships and his non-human "wolf-nature" that leads him to hunt, kill savagely and chase bitches.

The character of Sirius gives Stapledon the opportunity to comment on human relationships, prejudices and activities from a position outside the human species. Individual human characters display different reactions when faced with a transgression of the human/animal boundary and the resultant confusion of categories that Sirius represents. Trelone's daughter, Plaxy, with whom Sirius is raised and has an intense relationship, is torn between her love for him and resentment that her closeness to him has made her distant from her own species. Working relationships with Trelone's Cambridge colleagues are difficult, for Sirius at one time harbours hopes for a scientific career of his own, yet as an animal is an object of scientific inquiry for others.

Sirius is both like us and unlike us–as Mary Midgley (1994:36) notes, the term animal can be used both in inclusive and exclusive senses: as a category that includes the human and as the unhuman or anti-human. In the latter sense, "animal" becomes a symbol for the forces we fear in the world around us, that we regard as alien to ourselves. However, she comments, "the peculiar alarm they produce suggests that they are not altogether alien, that we too carry the seeds of them within our nature" (*Ibid.* 35). It is thus not surprising that the story ends tragically. Sirius encounters outright hostility from conservative villagers who have grown suspicious about the moral propriety of his relationship with Plaxy and from a non-conformist pastor convinced that the dog is possessed by Satan. Sirius, who has always regarded hunting and killing as part of his "wolf-nature", himself becomes hunted as he is pursued across the Welsh mountains and shot dead by humans.

We returned to *Sirius* while preparing this collection of essays from anthropology and related disciplines that focus on interfaces between animals and science. Stapledon published his novel almost twenty years before Claude Lévi-Strauss declared that animals are "good to think"[1], and seems not to have anticipated the work of the intervening generation of anthropologists eager to use animals to explore particular human social formations. He seems instead to be more in tune with the recent "animal turn" in the social sciences that rejects such symbolic reductionism and sees animal-human relationships in themselves as worthy subjects of study. *Sirius* also has clear resonances with a recent "turn to dogs" in scholarship at the intersections of animals with science (Haraway 2003, 2008; Smuts 1999). Although the essays included in this volume deal with

recent scientific innovations and address debates that simply did not exist half a century earlier, Stapledon's main concerns resurface in their pages. The contributions to this volume look at what it means to be human, the place of human beings *vis à vis* other species on this planet, our ideas of what is nature and what is culture, the limits to our ideas of kinship, the ethical debates that surround science along with their interpretation by both scientific communities and lay publics, and the moral comportment of scientists. They also add a dimension that Stapledon was unable to address in so short a novel: that of comparison between the knowledge practices concerning animals of people in different ethnographic settings and our own to which Western science always forms a backdrop.

Genesis of the Volume

This volume grew out of a three-day workshop held at the University of Manchester in June 2005 that Maggie Bolton organised together with Penny Harvey. The workshop was financed by the ESRC as part of a research fellowship Bolton held at Manchester at the time, during the course of which she had carried out an ethnographic study of llama herders in the Bolivian Andes faced with a scientifically informed livestock development project (see Bolton, this volume). This study had made her interested not just in how animals figure in scientific discourse, but also in the ways that scientific innovations work to reconfigure relations between humans and other species. She was inspired to organise the workshop by the thought of bringing together a variety of anthropologists and scholars from related social science disciplines whose work on animals, animal-human relations and science resonated with concerns that were surfacing in her own work.

During the same period of time Cathrine Degnen was likewise based at Manchester. Together with Ben Campbell, who also contributes to the volume, she was working as part of a team engaged in a large research project: a Europe-wide investigation of the public understandings of genetics, headed by Jeanette Edwards.[2] Both Degnen and Campbell were involved in a strand of this project that looked at public understandings of genetically modified food and the relationships between "non-expert" knowledge, food and genetics. Degnen decided to contribute to the workshop following a conversation with Harvey about British debates over the genetic modification of plants and crops. Harvey enquired, "Where are the animals?" and Degnen wrote her contribution to the workshop and later to the volume as a response to this question. Her

participation in the workshop later led to her joining the editorial team for the publication.

The workshop was attended by scholars representing a variety of disciplines from anthropology to veterinary science. The paper presenters ranged from established researchers such as anthropologist, Sarah Franklin, and cultural historian, Harriet Ritvo, presenting chapters from publications already in the advanced stages of planning (see for example Franklin 2007), to recent PhD graduates and postdoctoral researchers. An event that set the tone for the workshop on the evening of the first day was a tour of some of the animal exhibits in the Manchester Museum, given by Henry McGhie, then curator of zoology and now the museum's Head of Natural Environments. McGhie's discussions of taxidermy and taxonomy encouraged us to think through the biographies of animals to the relationships in which they had been entwined. Recalling Donna Haraway's discussion of taxidermy in the American Museum of Natural History (Haraway 1989a), his talk also illustrated to us the ways in which the remains of animals have been used to make statements about the position of humans *vis à vis* other living beings and about European society *vis à vis* the rest of the world.

Contextualising Animals in Anthropology: From Totemism to Biotechnology

Before embarking on a summary of the themes broached by this volume and how they are addressed by the different contributors, there is a need to sketch out some of the intellectual genealogy behind the perhaps unlikely combination of animals with science in a collection of essays that fall largely within the discipline of social anthropology. To start by contextualising animals in anthropology, one might note that although animal-human relations did not feature strongly in early ethnographies, anthropology has long paid considerable attention to various beasts, if not in the flesh, then through their appearances in myths and in the names of groups of humans in diverse societies.

The naming of human groups after animal species captured the attention of nineteenth- and early twentieth-century scholars who came to regard totemism as an important institution of so-called primitive societies (Durkheim 2001; Radcliffe-Brown 1952). This reification of the concept culminated in an essay by Lévi-Strauss (1963) that debunked it as a valid area of study, yet simultaneously declared that animals are "good to think" for humans (*Ibid.* 89). It should be added that Lévi-Strauss was not particularly interested in animals themselves. He was interested in them

only in so far as he saw the observable differences between animal species as a vehicle that permitted the embodiment of ideas and relations conceived in abstract human thought: in particular, of offering a way to naturalise the social distinctions and classifications of human society.

The different ways that humans mobilised the differences in form and habits between species of animals led to various influential works in anthropology on the subjects of classification and boundaries (Douglas 1966; Bulmer 1967; Leach 1964). Although the structuralist thinking of the 1960s has long since fallen out of fashion, a concern with boundaries and classification, and the place of animals in relation to humans, retains an importance in anthropological debate. This is particularly the case in discussions of the cosmologies of different peoples and the cultural specificity of the division between the things of nature and the culture of humans that undergirds Western post-Enlightenment thought (e.g. Descola 2005; Descola and Pálsson (eds.) 1996). It is fair to note along with Russell (2010: 17), however, that anthropology, as a study of human beings, has tended to take the human-animal boundary itself somewhat for granted and to draw it rather starkly–perhaps rather more starkly than do people in some of the societies that anthropologists study.

While animals were clearly important to anthropology in the early twentieth century they took a predominantly passive role in anthropological accounts. They were not treated as active subjects, and their presence was contingent upon them providing (through their names, or through the consumption of their bodies) significant insights into relations between different human beings or groups of humans. Classic examples of this are Evans-Pritchard's studies of the cattle-obsessed Nuer in the Sudan (Evans-Pritchard 1940, 1956).

Nevertheless, animals in other pastoral societies entered into scholarly work in a different way. Anthropologists and archaeologists from their respective disciplinary perspectives were interested in processes of domestication, particularly of herd animals (e.g. Clutton-Brock (ed.) 1989), and in the ways that human beings in different societies envisage their relations with the beasts they tend. Some extrapolated from this to explore the consequences of particular sorts of human-animal relations not only for animals, but also for inter-human relations in the societies in question, arguing that the domain of social interactions between humans cannot be separated from the domain of interactions between humans and animals. Following fieldwork with reindeer herders in Finland, Ingold (1980) considered the relations with animals of hunters, pastoralists and ranchers and the varying degrees of domination exercised by humans in those relationships. This led him to hypothesise that the transition from

hunting to herding (to which domestication was crucial) and eventually to ranching has been accompanied by a replacement of egalitarian and sharing relations, characterised by trust, with hierarchy and domination. Returning to our earlier point about the demarcation of a boundary between animals and humans, recent work coming out of both northern Aboriginal societies and Amazonia suggests that hunters not only conceptualise their relations with animals in terms of equality, but also find the human/animal boundary less stark or absolute than do members of other types of society (Willerslev 2007; Viveiros de Castro 1998).

Domestication has remained a subject of debate in anthropological studies of animals. Works on the subject written in the 1980s, reflecting theoretical trends in the discipline at the time, tended to emphasise the conversion of nature into property (Clutton-Brock (ed.) 1989). However, more recently scholars from a variety of disciplines have sought to shift the focus away from domination and property ownership, stressing instead the symbiotic and serendipitous character of processes of domestication (e.g. O'Connor 1997) and the active roles of animals themselves in entering the lives of human beings (Budiansky 1992). Ingold's view of domestication as linked to domination and the eclipse of sharing relations has been challenged, for example, by Penelope Dransart's (2002) work on Andean herding (see also her contribution to this volume) and more recently by the cross-disciplinary contributors to a collection of essays edited by Rebecca Cassidy and Molly Mullin (2007). As Donna Haraway has pointed out insightfully, stories of domestication or "co-evolution" function as powerful "origin stories" that define relationships between nature and culture and also "who and what counts as an actor" (Haraway 2003:27).

Although studies in cultural history in the 1980s started to take the roles of animals in society seriously in their own right (Ritvo 1984, 1998), a turn to animals in anthropology came somewhat later. Perhaps a precursor was Eduardo Archetti's ([1992] 1997) study of guinea pigs in Ecuador, a work initially aimed at increasing understanding of indigenous people among the Ecuadorian middle classes. Archetti makes these small domestic rodents, found scurrying around Andean kitchens, the focus of a study that culminates in conflicts of knowledge between indigenous people and developers. Although his work focuses on the symbolic dimensions of guinea-pigs, it also emphasises their embeddedness in Andean people's lives. In the years that followed, the designation of "Animal Studies" as a legitimate area of interdisciplinary academic inquiry turned studious attention further in this direction. Scholars became

more interested in the details of human-animal relations as *parts* of human society rather than just *symbols* of it (Knight 2005a).

In the last decade, various studies have emerged in which animals "get to count as actors" to a much greater extent than had previously been the case. Cultural geographers Philo and Wilbert (2000), along with their contributors, explore the spatiality of animal-human relations: the co-presence of animals and humans in human spaces and the assignment of animals to particular spaces where they are supposed to remain. In anthropology, the complexities, ambivalences and intimacies of relations between humans and animals are a focus of the contributors to the collection edited by John Knight mentioned above (Knight (ed.) 2005b) and recent years have seen the publication of essays and monographs focusing on humans and their relations with beasts of different shapes and sizes in different ethnographic contexts: thoroughbred horses (Cassidy 2002), rats (Edelman 2005), captured elephants (Locke 2008 and in preparation) and water buffalo (Campbell 2005) in Nepal, llamas and alpacas in Chile and Bolivia (Dransart 2002; Bolton 2006), dogs (Haraway 2003) and meerkats (Candea 2010) to name but few.

Nevertheless, the focus on relations with animals does not mean that thinking through animals has ceased to be useful for providing significant insights into those aspects of human culture that are the conventional concerns of anthropology, such as kinship or the ownership of property. In a way that parallels recent shifts in gender and kinship studies towards science, the arrival of new reproductive technologies, together with advances in biotechnology and genomics, have led science to play a prominent role in anthropological accounts of human-animal relations. This preoccupation reflects the to-ing and fro-ing of new reproductive technologies between animals and humans in the process of their development, and revelations from DNA analysis of how very small the biological differences are between humans and other animals. In such accounts, we begin to see how meetings between animals and science are starting to set new theoretical agendas for anthropologists

Anthropological discussions of notions of property where animals are concerned have drifted away from studies of domestication and towards accounts of the biological makeup of beasts. The idea that the bodies of animals contain a heritable substance, or template for future generations, that is a form of capital considered to be the intellectual property of animal breeders, forms the basis of Ritvo's (1995) essay on early sheep improver, Robert Bakewell. Sarah Franklin's (2007) study, *Dolly Mixtures*, inspired by Dolly, the sheep cloned at the Roslin Institute in Scotland, revisits notions of "capital" and "stock", noting along the way how these terms

originated with holdings of live animals. Franklin adds to current discussions of rights of ownership not only in biological materials, discussing cell lines and sequences of DNA, but also, and importantly, to discussions of innovation and intellectual property in techniques of manipulating the said materials, notably the technique of somatic cell nuclear transfer used to create Dolly. This technique, which is many times more valuable than the substance of the sheep herself, becomes the combined property of the scientists behind her gestation and of the various organisations providing capital to fund the research in the first place.

Paul Rabinow (1999: 408) (taking up a quotation used by Gilles Deleuze) is intrigued by a cryptic remark of the poet Rimbaud that has come to take on a very material meaning in this age of genomics and genetic modification: that "the man of the future will be filled (*chargé*) with animals". This remark finds echoes in Donna Haraway's recent works, *The Companion Species Manifesto* and *When Species Meet* (Haraway 2003, 2008), which develop themes that emerge from her earlier discussions of cyborgs (Haraway 1991). In these works Haraway skilfully negotiates a path between abstract philosophical theory and everyday lived relations and interactions with animals. Her intention is to highlight the mutual dependence of forms of life, one with another, and to deploy animal-human relations to emphasise the physical, social and emotional entanglement of species. She aims thereby to challenge the "human exceptionalism" (Haraway 2008: 11-12) that views humans as ontologically unique, in not being situated within a web of interspecies dependencies, and thus privileges human beings over other animals in everyday assumptions, philosophy and policy making. In her opinion, such a view has in any case been destabilised irretrievably by recent advances in biotechnology that confirm the interspecies commonality of much genetic substance. Haraway illustrates her arguments through the relationship she has developed with her dog: not only the social interactions involved in living side by side with an animal, but also the exchanges of biological material that take place when we share our lives with companion species. As a result, she argues, we and animals literally "make each other up in the flesh" (Haraway 2008: 16). Her philosophical line of reasoning leads her to join Bruno Latour in challenging a series of "Great Divides": between nature and culture; human and animal; organic and technical; and kinship and ownership, a challenge that, like Latour's work, has radical political as well as philosophical implications.

Anthropology and its Concerns with Science

Having sketched out anthropology's concerns with animals, terminating with the ways in which studies of animals have started to intersect with those of science, it remains to give a brief resumé of anthropology's relationship and concerns with science itself. Science, as both a way of knowing the world and as a set of distinctive practices that helps create meaning about the world, has increasingly become the focus of anthropological attention. This is partly due to longstanding anthropological interest in the points of intersection between knowledge, belief and practice that science makes manifest. It is also partly due to the reflexive turn in anthropology since the 1980s that has prompted greater scrutiny of knowledge practices closer to "home" and has led to sustained problematising of inherent assumptions about epistemology and ontology held within scientific models of explanation (Edwards, Harvey and Wade 2007). But science of course does not remain at arm's length from the rest of society. It is, as Franklin reminds us, "a foundational belief system" in Western societies that is also "a source of cultural values" (1995:165), but one that is simultaneously embedded in the cultural systems from which it stems. Science is thus a site of critical importance for understanding how knowledge and meaning are established in the near to hand.

In addition to such long-standing concerns with knowledge, belief and practice, anthropology has also long been concerned with examining the ways in which power is exercised and reproduced via discursive practices and epistemological regimes. Science holds a particularly powerful place in Western cosmologies and ideologies, the roots of which are in the Enlightenment, and as Nader starkly asserts, "science anchors power" (1996: 12). Furthermore, a "belief in the omnicompetence of science" in the Western world has been building momentum throughout the 20th century (Nader 1996: 24). As such, science becomes a riveting domain in which to interrogate the production and reproduction of power and knowledge in Western society. Working from within, however, presents its own sets of challenges, particularly in navigating these power relationships in which the ethnographer of science is both immersed and subordinate and so consequently "studying up" (Franklin 2002:354). Additionally, from a Latourian point of view scientific endeavour has exacerbated the purification work that divides up natural and cultural worlds and which conceptually holds science apart from culture (Nader 1996; Edwards, Harvey and Wade 2007). Working against this deeply imbedded indigenous belief is something anthropologists studying science take on. That the anthropology of science should be willing to take such challenges

up, however, should not come as a surprise, given the ways in which the field has also built upon and drawn from feminist analysis of gender and kinship that threw into question the status of the biological and the social (see Franklin 1995: 168-170). This contribution, one that Franklin has termed a "gender to science shift" (1995:170), has provided fruitful theoretical ground for rethinking other cultural certainties, evidenced as she reminds us in seminal works by Strathern (1980, 1988, 1992) and Haraway (1989b, 1991, 1997).

Science has further been a productive site of ethnographic inquiry because far from being homogenous, it encompasses great diversity. The relationships between science and society are equally complex. Convincing examples of this come from Knorr Cetina (1999), on the knowledge practices of the epistemic cultures of experimental high energy physics and molecular biology, and from Traweek (1996), on power differentials amongst international science networks and within national science programmes. Anthropological approaches to science have thus also been multiple. Some anthropologists and sociologists have approached the study of science by working alongside scientists in the laboratory. The allied fields of Science and Technology Studies (STS) and Sociology of Scientific Knowledge (SSK) have both relied heavily on Actor Network Theory (initially developed by Callon 1986a and Latour 1987), a paradigm that shares many points of interest with anthropology, but which is balanced by other anthropological challenges such as "to develop translation and mediation tools for helping make visible the differences of interests, access, power, needs, desire, and philosophical perspective" (Fischer 2003:3) and attending to "the crossing-over between the culture of the lab and the culture of which this culture is a part" (Franklin 1995:174).

While the natural sciences are vast in scope, it is well established that their gaze, like all forms of knowledge, is a partially selective one: certain questions and paradigms come into focus at certain historical moments and simultaneously screen out other potential candidates (Kuhn 1970). Particular domains of concern explode into prominence and then may eventually recede as others come to supplant them. Biotechnology, genetics and genomics are current occupiers of this sort of boom in scientific attention, and Keller (1995) provides a riveting account of such shifts by focusing on transformations within biology in the twentieth century (Fischer 2003: 348-9) and as such offers a pertinent reminder of both the historicity of Western science and its malleable parameters.

As we have previously noted, science is entering into anthropological accounts of animals to an increasing extent and is thereby providing new directions for anthropological theory. However, what exactly does a focus

on animals add to the anthropology of science? In this volume, we offer a response to this question, crafted through ethnographic and historical studies. Our collective work crosses disciplinary boundaries and draws from anthropology, history, sociology, and art. At stake in our discussions are a wide range of animals, sciences, ethnographic regions, and historical time frames. Collaborators on this volume have also employed very different ways of "doing anthropology", which in turn reveal different aspects of the cultural processes at work in the relationship between animals and science. Taking the chapters together, a mosaic of meaning begins to emerge that reveals particular aspects of science as practice and knowledge when non-human rather than human animals are put at the centre of inquiry. Adopting a decentring perspective, or viewing science from the margins, engenders valuable insights into foundational cultural assumptions that would take animals to be handmaidens to science rather than considering them to be co-conversationalists in how scientific knowledge comes to be what it is in the first place.

Themes Addressed in the Volume

Knowledge Practices, Classification and Boundaries

One of the most striking points of intersection between animals and science in the chapters of this volume is in regards to competing epistemologies and forms of practice. Stephanie Bunn, working in Central Asia with Kyrgyz pastoralists, examines this rubric through Kyrgyz relations with and knowledge of animals. Through the lens of food, Bunn contrasts ways of knowing and forms of evidence premised on Western science with those of the Kyrgyz people she worked with, and poses the pertinent question: how can such considerations recalibrate the relationship between science and animals? She argues that extensive practical and empirical knowledge is held by Kyrgyz people about the properties of the food they produce and eat from their animals (such as medicinal properties), and that food holds qualities that heal, protect and are attuned to unfolding social circumstances. Rather than attribute this to "ritual belief", Bunn shows how it is part and parcel of a paradigm of nature in which relationships between supernatural powers, animals and the environment are integrated into, a specific "philosophy of nature" as she terms it. Bunn demonstrates how Kyrgyz knowledge of animal and human relations are not just practical or symbolic, but intersubjective and affective, lessons that she would like to see extended to Western science.

We return to the possibilities she puts forward for this extension below in the section "Nature and Culture".

Marcia Stephenson engages in a similar set of considerations. Like Bunn, she is dealing with the paradox of two different bodies of knowledge. Drawing from Sawday (1995), Stephenson explicitly names them as the *physical* animal body and the body of *knowledge produced* about animals. While Bunn links these two bodies of knowledge through food, Stephenson shows how they are tied together via dissection. Her account is grounded in 18th century European "picturesque anatomy" of camelids and colonial expansion in the Andes. She demonstrates the ways in which anatomy and dissection of these animals (novel curiosities to a European audience) are enmeshed with the acquisition of knowledge, economic gain and exploitative colonial encounters. While dissection was practised by Andeans and Europeans alike, the knowledge gained by the colonisers' cutting and mapping of the interior of the camelids' bodies simultaneously erased indigenous knowledge and appropriated the animals as an economic resource to be profitably exploited and made "useful", particularly for their fleece.

Maggie Bolton and Penny Dransart share an ethnographic interest with Stephenson in Andean camelid pastoralists, and again, both authors contribute to this theme of competing epistemologies and practice. In Bolton's case, this is based on contemporary fieldwork in Bolivia with llama herders who are under pressure by NGO veterinarians and agronomists to administer anti-parasitic drugs to their animals. The herders however are not motivated by the same (economic) rationales as the development NGO scientific professionals. This divergence reproduces social and class tensions as well as revealing a substantial gap between Andean and Western concepts, and the persistently colonizing perspectives of science as practised by development NGOs in this context. For her part, Dransart draws on a series of comparisons between camelid herders in the Andes (Isluga, Chile) and European (Welsh) camelid fanciers. Dransart then maps the divergences in herding practices in these two cultural and geographical locations including different responses to properties of herd animals (such as leadership), different possibilities in the characteristics of relations between humans and camelids, differences in categorisation and different understandings of handling and herding practices. Such differences in herding practices, as Dransart demonstrates, are grounded in divergent understandings of autonomy, notions of property and inter-agential relations between humans and herd animals. Radical divergences in received knowledge about classificatory schema of human and non-human animals in turn develop radically different priorities in everyday practice.

Attempts at classification on such contested terrain unsurprisingly can lead to dispute. This is evident in cross-cultural contexts as the examples above ably illustrate, but as the chapters by Whitehouse, Degnen and Nimmo show, classifying and ordering in relation to animals and science present real dilemmas when contained within Western settings, too. Throughout this volume, multiple forms of ordering and classifying are evident, made possible by techniques and practices discussed here already as widespread as eating, herding, tending, "development" and anatomical aesthetics, but also via conservationism, sport shooting, biotechnology, microbiology and bovine IVF.

Nature and Culture

Another theme that is broached repeatedly in this volume is that of the "Great Divides" of post-Enlightenment thought: between nature and culture or between human and animal. Over the years anthropologists have shifted from writing from within this tradition and assuming such divisions as universals of human thought (Lévi-Strauss 1992, and see also Ortner 1974), to pointing out the cultural specificity of both nature and culture, and their non-applicability to non-Western societies (Strathern and MacCormack (eds.) 1980). More recently several have been concerned with looking at ways in which post-Enlightenment assumptions underlie thinking both in the sciences and social sciences and the ways that they impact on people from different intellectual traditions in colonial and post-colonial encounters (e.g. Shepherd 2006; Verran 2002). In the volume, several contributors use the intersection of animals with science to throw light either on changing understandings of the nature/culture or human/non-human divide, or to provide powerful critiques of existing theorisation around the topic. It is therefore perhaps unsurprising that an interlocutor to a number of the chapters is science studies scholar, Bruno Latour, particularly through his unmasking of the "Modern Constitution", the sleight of hand through which the things of nature are kept apart from the politics and culture of human beings (Latour 1993). Latour also features through his efforts to undo the great divide and reconfigure both science and social science in the process (Latour 2005) and through his blueprint for remaking environmental politics (Latour 2004).

Before commenting on those chapters that engage directly with Latour's work, a further mention of Stephanie Bunn's contribution is appropriate for, although her work stems from an intellectual tradition outside science studies, Bunn's conclusions have a strong intersection with Latour's work. Through her consideration of Kyrgyz animal knowledge,

Bunn suggests that science should find a place for the sort of detailed local and other knowledges of non-Western people. However, the reconfiguration she suggests does not stop with science, but extends to anthropology. Anthropology, she argues, has made too sharp a distinction between culture and nature, or between what it considers symbolic or metaphoric–with which it is concerned–and practical, mundane knowledge derived from sensory and intersubjective experience–which it has frequently ignored. Such a distinction, she argues, limits our ability to engage with the intellectual landscape of others, which should be one of our goals. It is hard not to identify resonances here with Latour's project of "reassembling the social", his critique of the social sciences in general. The social sciences, he argues, assume "the social" to be a special domain governed by nebulous and ill-defined forces, like "political power". He would rather the social sciences were reconfigured more as the "tracing of associations" (Latour 2005: 5), the connections between things not social in themselves, to show how such associations give rise to effects like power. However, in his earlier work Latour appeared to consider anthropology, with its ability to deal calmly "with the seamless fabric of what I shall call 'nature-culture'", an example that other social sciences should follow (Latour 1993: 7). A consideration of the animal knowledge of a non-Western people appears to have brought Bunn to similar conclusions as Latour, but without his idealisation of anthropology, towards which her critical gaze is turned.

Moving on to the contributions that directly engage with Latour's work, it is the notion of the "Modern Constitution" that sociologist Richie Nimmo addresses when he takes as his subject the diseases that pass between animals and humans. The anxiety surrounding such diseases has become a familiar feature in these early years of the twenty-first century following outbreaks of avian and swine 'flu and the prominent coverage they have received in the media. However, Nimmo's study is based not on present-day epidemics, or epizootics,[3] but on past anxieties over animal-borne disease. Nimmo takes as his focus an outbreak of rinderpest or "cattle plague" in the British dairy industry of the nineteenth century together with subsequent efforts to render the bodies of animals safe for humans to consume and uses this outbreak of disease to argue that animal-human relations have been absolutely central to defining the boundaries of the human in late-modern thought. In making this assertion he critiques Latour's formulation of the "Modern Constitution" for relegating animals to the sidelines of the nature/culture divide and giving precedence to things–especially technological objects–over beasts.

Rather than "Modern Constitution", Nimmo prefers to use the term "humanism", in emphasising the species relations underpinning the human/non-human divide of late-modern ontology. His use of the term recalls not so much its use in some postcolonial writing–in which it refers to attempts to posit the unity of humankind and thereby subsume the non-Western other to a Western ideal of the human[4]–but something approximating Haraway's "human exceptionalism" (see above): an axiomatic assumption that human beings inhabit an ontologically unique domain. Both Nimmo and Haraway are interested in connections between species, animal and human, but while Haraway (2008) has looked at how humanism (or human exceptionalism) at this present time is being undermined by interspecies meetings and advances in biology, Nimmo looks to the past–to how it became entrenched in modern thought and its materialisation in a complex of everyday practices and institutions. Such everyday practices included in the nineteenth century the efforts required to render liquid milk a safe and clean product for humans to consume–the subject of Nimmo's historical research. As milk was rendered safe and pure, he argues, the boundary between humans and animals was simultaneously "purified" in the Latourian sense, with humans coming to occupy a unique domain incommensurable with the non-human world.

Making the bodies of animals safe for humans to consume is also central to the contribution by Maggie Bolton. As noted above, the focus of this study is an attempt by development professionals in Bolivia to persuade llama herders to administer veterinary medicines to their animals amidst the racial politics of the Andean region. Developers hope that improving animal health and hygiene will help transform llama meat into a food of choice for urban consumers and as a consequence that the commercial possibilities of llama herding will be enhanced, thereby improving the livelihoods of rural people.

Bolton examines how the application of science, as "universal knowledge", can attempt to reconfigure relations between humans and animals. At its core is the attempted transformation of an animal crucial to Andean sacrificial ritual, and the maintenance of relations between humans and supernatural beings, into a commodity: a transformation regarded with suspicion by herders. Bolton acknowledges the usefulness of actor-network theory (ANT), the approach developed by Bruno Latour, Michel Callon and others, as an approach to understand the entanglement of what are conventionally held to be science and politics, in unravelling the complexities of what at first sight looks to be a straight-forward application of animal medicine. The approach also illuminates how particular configurations of human and non-human actors give rise to what

we call power. However, she considers the approach to have its limitations, and its proponents to find it difficult to avoid the assumptions of post-Enlightenment thought that they wish to critique. Like the development professionals in the Andes, ANT theorists assume the various actants they posit to have "interests", which all too often seem to be those of "rational economic man" (see for example Callon 1986b). Herders however do not always behave as rational economic actors and at times prioritise the maintenance of relationships over furthering interests of their own.

Nature and culture in the cosmology of contemporary Europeans come under scrutiny in Ben Campbell's chapter. Genetic modification disrupts the biological discreteness of humans and other organisms by distributing parts of previous wholes in new combinations. Campbell uses the public debates into genetic modification that took place in the UK in 2003 to suggest that biotechnology has destabilised the modernist division between nature and culture, and between human and non-human. One specific aim of his chapter is to interrogate Descola's (2005) characterisation of the cosmology of contemporary European society as "modern naturalism" divided between an objective material world of the non-human, knowable through science, and a subjective realm of human meaning.

While opposition to genetically modified (GM) crops based on their (real or imagined) threat to the environment is sometimes phrased in terms that recall property relations (heritage, for example), Campbell suggests we understand it through a different idiom. For him, the new types of knowledge and practice represented by GM organisms have made visible the sort of relationships between humans and non-humans that we normally associate with non-Western cultures: in spite of Descola's modernist cosmology, modern people understand themselves to be related to and share citizenship with wildlife. While this conclusion brings to mind Latour's (2004) template for a public politics of associations between humans and non-humans, Campbell sees the relationships between humans and wildlife as of a more intimate nature. He builds upon Donna Haraway's (1997, 2008) arguments against human exceptionalism, and suggests that in a post-humanist, or post-exceptionalist, world we could usefully employ the notion of kinship to describe such animal-human relationships, and that we should rethink what we mean when we talk about a "natural relation".

Possession and Ownership

The theme of possession and how it relates science to animals surfaces in several chapters in the volume. We have already pointed out the etymological relation between "capital" and cattle, and "stock" and "livestock" that Franklin (2007) noted, and here we further note the common association of both the scientific revolution and the theorising of property within the same historical period. In seventeenth-century England, as the scientific revolution consolidated nature as a domain separate from the politics and society of humans (Shapin and Schaffer 1985), John Locke set out in his second treatise on government how human beings come to claim ownership over the things of nature, including animals, through the performance of labour upon them (Locke [1690] 1988).

Marcia Stephenson's contribution focuses on a historical period shortly after Locke's time: the eighteenth century and the height of the European Enlightenment. As Mary Louise Pratt (1992) has noted, this was a period when the systematisation of nature was a global project, and when knowledge was sought through the opening up of interiors, whether interiors of continents, or, as in the cases documented by Stephenson, the bodies of animals. The collection and dissection of camelid specimens related in Stephenson's chapter unfold against the background of a new phase of colonialism in which European powers competed to acquire sources of raw materials from their overseas territories. For Stephenson, the actions of natural historians and anatomists also form a metaphor for the dismemberment of Andean traditions and ways of living at the hands of Europeans.

Penelope Dransart's chapter on camelids also addresses themes of possession and property. In Locke's formulation, the things of the earth, including the "beasts it feeds" are given by God to mankind in common. They may be removed from that common state by the application of labour. Animals are part of the commons (or nature) and do not get to have property of their own. Dransart makes the point that notions of property in turn influence what sort of characteristics (or properties) are attributed to animals. Western possessive individualism does not only infect people in Western societies who own animals, but also, as she notes, the anthropological accounts of animal ownership written from within the Western tradition, that envisage animals as alienable property of humans. Such accounts do not generally see animals as exercising control over their bodies or the products of their labour, nor as having the property of being themselves acting subjects "empowered to care" (c.f. Ingold 1994).

On the basis of fieldwork in Isluga in northern Chile, Dransart is prompted to wonder about the social relations in which animals participate there and whether they might be able to reciprocate the care of their owners: whether Andean herders might indeed consider them to be the "possessors of possessions". She suggests that Strathern's (1984) comments about the position of women in Melanesian society, as wealth, but not objects as postulated by our own subject-object matrix might provide a useful framework for thinking about animals in the Andes where they are both "part of and detachable from" human society.

Power, Politics and Balance

That science is posited as knowledge which is omnicompetent gives its proponents a unique authority to impose scientific analyses and solutions on the lives of people (and animals) in different parts of the world. As Penny Harvey has noted, the power of such expert knowledge "lies also in the entrenchment of social asymmetries between those who can impose singular truths and those who are subjected to the social consequences of these ways of knowing" (Harvey 2007:164). It is not unexpected therefore that in some form or other issues of power and politics are present in most of the chapters in this volume. Indeed, science and asymmetries of power, either between humans and animals or between different groups of humans, have already been touched upon in our discussions of the contributions by Dransart, Stephenson, Nimmo, and Bolton, while Degnen and Campbell examine the social and political debates that surround scientific research, animals and innovation.

As Harvey (2007: 180) also notes, abstract (rationalised) scientific knowledge is not intrinsically more mobile than other knowledges, for it still requires convincing social dramas to achieve wide reaching effects. Cristina Grasseni in her chapter looks at some of the social dramas surrounding technification and scientific innovation in the dairy industry in the highland areas of Lombardy in northern Italy and the social consequences of the changes they have brought about. The situation in Val Brembana is far from straight forward, with scientific solutions not so much being imposed upon local farmers as the remote, and seemingly traditional, farms themselves becoming sites of technological innovation. Grasseni documents how the boundaries of what constitutes the laboratory have become porous, as novel techniques are implemented on mountain farms and, faced with increasing economic and political pressure to increase productivity, highland breeders actively seek relations with biotechnology research institutions. Here animals and science stand for

complex constellations of actors situated amidst considerations of technology, politics, economics and ecology, which Grasseni demonstrates through attention to the routines and relationships she observed and in which she participated as an ethnographer.

In drawing attention to the social ramifications of biotechnical innovations in farming, Grasseni notes that while the direction of scientific research is often highly controversial, and the subject of media attention and public scrutiny, questions about how and when to implement technoscientific innovation remain largely undebated in the public sphere. However, this does not mean that they have a negligible impact on the lives of people and animals. Although some of the farmers with whom Grasseni worked are eager to apply technoscientific innovation, the introduction of such measures has had a devastating impact on the farming community, with many smaller farmers having already been forced out of business.

While the exercise of political power *per se* is not so much the concern of Andrew Whitehouse, his contribution links to that of Grasseni through its exposition of a Latourian entanglement of science with politics and its discussion of the application of scientific measures in scenarios that affect livelihoods in rural areas. Whitehouse addresses the discourses and practices surrounding conservation strategies as ecologists, conservationists and gamekeepers debate what constitutes appropriate environmental relations on Scottish estates. Their particular concern is the management of populations of raptors and gamebirds and the interpretation of field studies into the effect of populations of birds of prey and of other factors on numbers of gamebirds present. Scientific data is mobilised and attributed different political significance by the different parties to the debate.

John Stuart Mill once remarked, in critiquing the ideas of his day on the need for balance in political constitution, that, "there seems to be something singularly captivating in the word balance, as if because anything is called balance, it must for that reason be necessarily good" (Mill 1988: 263). Whitehouse shows us how the idea of balance is mobilised by different actors in the raptor debates. Balance is considered something that is desirable and that humans should seek to foster in nature through their actions; science is mobilised by both conservationists and gamekeepers as a means of understanding how to generate a balance between populations of prey and predators that have been disrupted by what they deem to be the inappropriate actions of other humans. Balance becomes indexical of human behaviour, an indication of good land management. The debate is concerned not only about how best to achieve

a balance of wildlife populations but also with what means are appropriate to balance the interests of estate managers, conservationists, raptors and gamebirds.

Balance reappears in other contributions in relation to science: science is seen sometimes as a means through which a balance with nature–or even a better-than-natural balance–can be achieved and at others its application is seen as an imposition that acts to disrupt a balance that should occur naturally. This is clearly true in the case of debates surrounding genetic modification, particularly in their treatment by Campbell. Classical science is indeed itself deeply permeated with the idea of balance: the notion that systems whether biological or physical will remain in or return to a state of balance or equilibrium unless acted upon by some outside influence (as in Newton's first law of motion, for example). This idea–that natural systems with no interference from humans will remain in a state of balance–appears to have become entrenched in some popular understandings of science.[5] Testament to this perception of balance as a naturally occurring state of affairs is provided both by the uptake among certain sectors of the public of James Lovelock's Gaia hypothesis of global homeostasis (Lovelock 2000), and also by those, often of very different political persuasions, who stubbornly remain unconvinced that human actions are responsible for climate change.

Ideas of balance in non-Western cultures also surface in the volume. The importance of achieving a balance in nutrition, or well-being, is an important focus of Bunn's discussion of Kyrgyz animal knowledge, while Bolton writes of the importance to Andeans of achieving balanced relations with supernatural actors and of this balance being disrupted by the introduction of modern methods of animal management.[6] There is a contrast to be made between these ethnographic studies of indigenous people and the Western examples. However, rather than drawing a naïve distinction between the West and the rest, it might be better to distinguish on the basis of these contributions between groups of humans who envision themselves as existing within a web of dependencies alongside other entities–which might include animal species, the earth, or supernatural beings–between which a balance should be sought, and those who consider themselves to exist outwith such a system. The latter category encompasses both those who wish to leave nature to its own course and those who see natural systems as being in need of manipulation and control in order to balance the interests of different groups of humans (the gamekeepers in Whitehouse's account, for example). Such a distinction, of course, returns us to the arguments of both Latour (2004)