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AUTHORS

Davies, Gail

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Caring for the multiple and the multitude: assembling animal welfare and enabling ethical critique

Gail Davies

Abstract: This paper constitutes a speculative bioethical intervention into the challenge of developing cultures of care and assembling enriched environments for genetically-altered mice in laboratory environments. The principles of the 3Rs–to reduce, replace and refine the use of laboratory animals–established in the late 1950s, are still the institutional and international starting point for humane animal experimentation. However, the proliferating diversity and numbers of genetically-altered animals used in biomedical research is a challenge to the application of these universal principles. The different capacities of the many mice brought into being through scientific practices constitute biomedical experimentation as a multiple, challenging the identification of universal refinements. In this paper, I argue they constitute a multitude: their indefinite number and irreducible multiplicity is both a threat to these principles and an opening to the possibility of new bioethical formulations. Drawing on ethnographic research with scientists and policymakers involved in animal welfare and biomedical research, this paper explores emerging strategies for reassembling animal welfare in the face of the multitude and the multiple. Using insights from Žižek, Haraway and Hinchliffe it seeks to demonstrate the value of a speculative ethics, which, instead of the seeking new universal principles to protect animals from harm, starts from the inevitable and particular entanglements of animal and human suffering, as a way of connecting affective capacities across space and time. This is illustrated through the experimental conjunctures of barbering mice. In conclusion, I suggest such speculative bioethical formulations may contribute to renarrating modes of ethical engagement when sociotechnical assemblages are complex, objects and ontological forms are multiple and mutable, data is simultaneously abundant and inadequate, and formal ethical review procedures are incapable of either containing controversy or enabling critique.

The multiplicities of laboratory animal science

I want to start this paper with a list:

> Potato: A washed and dried baking potato (either Maris Piper or Marfona), approximately 275 g and 10 cm long
>
> Teabag: An empty, herbal flavoured teabag (cranberry, raspberry and elderflower flavour, Twinings, UK)
>
> Mirror: A highly polished, steel plate mirror (8 cm × 7 cm)
>
> Grass: A 20 cm × 10 cm sod of grass (Lawn turf, local garden centre)
>
> Hammock: A 17 cm × 19 cm piece of Hessian cloth (The Fabric Shop Ltd, UK) suspended at each corner by paperclips
>
> Hamster food: ('Harry Hamster' Premium Complete Food, Supreme Pet Foods Limited, UK), approximately 39g
>
> Birdsong: A CD of various songbird songs downloaded from the internet, played back through a personal CD player and two miniature earphones
>
> Shadows: A 15 cm diameter white cardboard disc with leaf shaped holes covered in yellow, blue, pink and white tissue paper, rotating at one revolution/minute

This strange catalogue of artefacts goes on for over two pages of the appendix of an academic paper (Nicol et al, 2008)[1]. There are more than twenty objects and other entities listed, gathered into three broad categories: i) edible/large/replaced, ii) shelter/hard/outside, iii) soft/replaced/chewable. It is a compelling and demanding read. In this quixotic mix, the objects have an apparently tenuous connection to each other, but are enumerated with remarkable precision and specificity. The list is reminiscent of the impossible taxonomy of Borges, which opens the preface to *The Order of Things* (Foucault, 1970). There is the same incongruous juxtaposition found in the categorisation attributed to a certain Chinese encyclopaedia,

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[1] This paper draws on research completed as part of a set of projects around 'Biogeography and Transgenic Life', funded by an ESRC research fellowship, grant number RES-063-27-0093. It is based on ethnographic research and in-depth interviews exploring the changing production, circulation and regulation of genetically-altered mouse models in biomedical research, in Europe, the USA and Singapore from 2007-2010. The research involved around 90 interviews with a diversity of research scientists, laboratory veterinarians, animal welfare scientists and charities, funders and regulators, as well as participation in research meetings, site visits and international conferences. All participants and locations in the research were offered anonymity. This ethnographic research was supplemented by review of the published literature in scientific journals and on public websites. Names are used, when relevant, for the material drawn from these sources.

> “in which it is written that ‘animals are divided into: (a) belonging to the Emperor, (b) embalmed, (c) tame, (d) sucking pigs, (e) sirens, (f) fabulous, (g) stray dogs, (h) included in the present classification, (i) frenzied, (j) innumerable, (k) drawn with a very fine camelhair brush, (l) et cetera, (m) having just broken the water pitcher, (n) that from a long way off look like flies’. In the wonderment of this taxonomy, the thing we apprehend in one great leap, the thing that, by means of the fable, is demonstrated as the exotic charm of another system of thought, is the limitation of our own, the stark impossibility of thinking that” (Foucault, 1970, page xv).

In this opening taxonomy of objects, there is the same challenge for us to discern the common world in which these objects can cohere. On this occasion, the list does not communicate the “exotic charm” of another system of thought; rather it emanates from our own. So there is the compelling provocation of historicity and of geography. How can we apprehend the ways in which this list “bears the stamps of our age and our geography” (Foucault, 1970, page xv)? “Where else could they be juxtaposed except in the non-place of language?” (Foucault, 1970, page xvii).

Towards the end of this inventory, there is the control. “Control: No potential enrichments added to the cage. A gloved hand was placed in the cage for approximately 30 seconds on replenishment days to simulate the replenishment of a potential enrichment”. The place of the cage, and the arrangement of these objects in the enclosures and logics of laboratory science, provides the clues to their coexistence. This gathering of unlikely objects takes place in the racked cages of experimental animals. The list is taken from an empirical experiment in which potential cage enrichments are allocated to groups of laboratory mice (Nicol et al, 2008). It is an elegant, intriguing and enriching study. The objects are placed in small laboratory cages, each housing a group of four female mice from two different in-bred mice strains. The mice are observed interacting with a different object, each week, for a period of 12 weeks. The extent to which the introduced materials alter behaviour is measured through recording the time the animals spend digging, sniffing, hiding, drinking, feeding, rearing, bar chewing, bar biting, fighting, manipulating the objects and interacting with each other. Some of these are assigned to the category of positive behaviours. These express the known range of natural mouse activities, and are taken to indicate animals with normal neurological development and acceptable welfare. Other behaviours are identified in the literature as stereotypic, including bar biting, hanging, back flips and barbering, when the mice remove hair from themselves and each other. These are taken as signs of fearfulness, anxiety and behavioural responses which have become repetitive and non-purposeful, potentially indicating animals with compromised welfare and neurological status (Mason and Rushen, 2006). The aim of the study is to locate the most effective cage enrichments for improving the behavioural and physiological indicators of laboratory mouse welfare. On this occasion, the laboratory animal enclosure is "the tabula", the setting which "enables thought to operate upon the entities of our world, to put them in order, to divide them into classes, to group them according to names that designate their similarities and their differences–the table upon which, since the beginning of time, language has intersected space" (Foucault, 1970, page xvii).

As in *The Order of Things*, this list attunes us to the scope and limitations of our schemas for attributing meaning to the world through allocating categories, drawing relations and designating differences. Foucault's focus is the emergence of the human sciences alongside the classificatory practices of natural history. The animals represented in this paper are not the range of wild species; they are domesticated laboratory animals. Histories of the domestication of mice to the demands of experimental systems in early genetics, cancer research and toxicology testing largely focus upon practices of standardisation and structures of government funding, which led to the development of a series of genetically-identical inbred strains in mice from the early 1900s upto the 1950s (see Rader, 2004). More recently, animal diets, cages and husbandry have been subject to a further round of standardisation, as genetically-altered mice are increasingly used as models for understanding mammalian gene function and researchers try to maintain healthy animals and control these environmental variables (Crabbe et al, 1999). Most mice are now kept in identical racks of individually ventilated cages, in small social groups, fed specially developed mouse chow. Yet, the interest in assessing genetically-altered animal phenotypes means there is renewed attention to the apparatus used for measuring behavioural capacities, as well as an increased scrutiny of the influence of all environmental experiences on animal development. As mice figure as models for a widening range of human genetic, metabolic and affective disorders in biomedical research (Rosenthal and Brown, 2007), the extent to which their behaviours might be altered by this conventional animal housing has become a challenging and contested issue (see also Davies, 2010). This list of potential enrichments is thus not only about how we see the natural world (although its experimental arrangement is part of this story), it also encompasses our grasping towards ways of understanding how mice might experience their own environment, in order to create better worlds for them to inhabit, in the process of understanding our own bodies, brains and biology.

The conclusions of this empirical study add the further complexity of multiplicity to these recursive relations between species. As Serres suggests, “the multiple as such, unhewn and little unified, is not an epistemological monster, but on the contrary the ordinary lot of situations, including that of the ordinary scholar, regular knowledge, everyday work, in short our common object” (1995, page 5). No enrichment results in unequivocal welfare gains for the two different mouse strains. The first animals, ICR(CD-1) mice, are an out-bred strain[2]. They are the workhorses of commercial drug efficacy and safety testing, used in large numbers in the systems of regulatory science. They are medium-sized animals with albino coats and pink eyes. The lack of pigment in their eyes means they often go blind under laboratory lights, and most adults have visual impairment. They are thought to exhibit low levels of anxiety, perhaps as a consequence of this, but do spend large periods of time bar chewing and bar climbing, seemingly escape orientated stereotypic behaviours (Nevison et al, 1999). Despite visual impediment, the mice in this experiment spent significant periods manipulating enrichments, chewing and climbing on the soft objects introduced. The second animal, the C57 Black 6, is the animal most often encountered in experimental biomedical research. It is a small black mouse, favoured for genetic experiments as it is in-bred, but also robust and relatively easy to breed[3]. Yet it is known to be somewhat aggressive and prone to other stereotypic behaviours, particularly barbering (Sarna et al, 2000; Kalueff and Tuohimaa, 2004). The mice in this experiment continue to barber. They are also known to be neo-phobic (Cabib et al, 2002) and may have been stressed by these constantly changing unknown objects. The paper concludes that “strain differences might need to be taken into account” (Nicol et al, 2008, page 350) when considering cage enrichments.

These experimental systems are intrinsically, but ordinarily, multiple, confounding the aspiration to establish universal cage enrichment. The animals are from two different strains, whose different bodily forms and capacities have been brought into being through the

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[2] For more information on this animal strain see http://www.criver.com/en-us/prodserv/bytype/resmodover/resmod/pages/cd-1mouse.aspx. Last accessed 11 July 2011.
[3] For more information on this animal strain see http://www.criver.com/EN-US/PRODSERV/BYTYPE/RESMODOVER/RESMOD/Pages/C57BL6Mouse.aspx. Last accessed 11 July 2011.

demands of two distinct experimental and testing systems[4]. They exhibit divergent behaviours, which are amplified through encounter with the variety of potential enrichments. Even in a single experiment, this multiplicity means that drawing firm conclusions about enrichment is freighted[5]. Yet, at the same time, such experimental systems are being rapidly scaled up. There are over 450 known inbred mouse strains, which have been developed through selective inbreeding in laboratories which are geographically dispersed or use different mouse models to examine specific human diseases (Beck et al, 2000). In addition, there are now numerous ways of producing genetic modifications to study the impact of genes on these animals' development, using transgenic techniques to introduce genes from other species, producing knock-out mice with existing genes inactivated, or producing random mutations through chemical mutagenesis. These also have potential implications for behaviour which are relevant to welfare[6]. The resulting mice circulate globally, with major animal laboratory suppliers archiving and distributing animal stocks to researchers situated in the centres of biomedical research in Europe, the USA and elsewhere.

The scale and ambition of this work using genetically-altered mice is perhaps best illustrated by the knock-out mouse project (The Comprehensive Knockout Mouse Project Consortium, 2004). This is seeking to produce and characterise (or phenotype) animals bearing a mutation on every gene of the C57 Black 6 mouse strain in order to say more about the function of mammalian genes. As one commentator suggests: "the knock-out [mouse] effort is arguably the largest international biological research endeavor since the Human Genome Project" (Grimm, 2006, page 1862). There are around 24,000 genes to knock out; though the number of genes changes as definitions of genes shift. The project is at an early stage, with a smaller number of animals produced, but each mutation has the potential to alter corporeal and affective capacities, elucidating patterns of human development and disease, as well as producing animals with different welfare requirements. And, it is not the only initiative. There are parallel projects using mouse models to understand gene function and develop

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[4] For an account of the role of experimental and testing systems in molecular biology see Rheinberger, 1997. For further reflections of the concept of the multiple in biology, see Mol, 2002.

[5] The difference between inbred strains is also emphasised in interviews with laboratory animal welfare researchers: "the genetic diversity between a C57 Black 6 strain and a C38G and a CBA [...] are huge in terms of their drives to do different behaviours" (interview, welfare researcher, 2008).

[6] Again, this point is made in interviews with animal welfare researchers: "There are questions raised about whether the systems themselves are changed in some way, for example the coping systems can be changed […] you could have a genetic change which meant that the receptor was changed, the neural pathway was changed, the possibilities for response were changed in the sense of physiological reaction mechanisms […] You are asking some different things because it's a modified animal (laboratory animal welfare researcher, interview, 2008).

disease models through ENU (N-ethyl-N-nitrosourea) mutagenesis and a collaborative cross exploring the potential of interbreeding inbred mouse strains.

The mice are not only multiple, but a multitude. The recognition of a multitude indicates both the mass of individual animals now involved in these endeavours, and their irreducibility to a single 'population', something which constitutes a challenge to the existing and expanding logics of both biomedical experimentation and ethical principles (Serres, 1995; Hardt and Negri, 2004). These international collaborations are progressing through the same difficult negotiation of standards across disparate institutions required by the human genome project (Balmer, 1996; Gondo, 2008), but many of them are struggling to cope with this "deluge of mice" (Abbott, 2004). This emerging experimental system is inherently excessive (Davies, 2011): in its production of multiple and multiply differentiated animal bodies, in the impact of environment (as well as gene effects) on animal corporeality and affective behaviours, and within the post-war development of scientific standards for governing animal welfare. It is challenging ethical commitments to reduce, replace and refine the use of animals in research, which has underpinned the regulatory agencies, scientific standards and social contract reconciling the use of animals in scientific research with commitments to animal welfare since the late 1950s (Kirk, 2008; 2009). The number of genetically-altered mice used in biomedical research continues to rise, reversing post-war declines in laboratory animals used (Home Office, 2009). There is no obvious replacement for the use of animals in this specific instantiation of functional genomics, even whilst the value of many of these mutant animals as models for human disease are still to be secured. Furthermore, the welfare and environmental enrichment needs of these mutant animals are often poorly characterised. It is simply not possible to do the experiments required to produce evidence for each genetically-altered animal, despite concerns that "the barren environment that has been designed to minimize uncontrolled environmental effects on the animals might ironically be a primary source of pathologic effects" (Olsson et al, 2003, page 246). Without scientific knowledge of the harm of stereotypic behaviours, and their alleviation by particular enrichments, evidence-based legislation and scientific practices are resistant to change. The incongruous list that opens this paper reflects the growing necessity, but also the increasing impossibility of a unitary science for laboratory animal welfare. As Serres suggests, "we are as little sure of the one as of the multitude" (Serres, 1995, page 3).

It is in this context that this paper explores the emerging experimental material and spatial strategies for reassembling animal welfare in the face of the multiple and the multitude. Drawing on interview and ethnographic research with scientists and policymakers involved in animal welfare and biomedical research, I suggest the twin processes of scaling and differentiating are opening up the existing ethico-political settlements around animal welfare, revealing international and disciplinary tensions. The challenges that emerge are both epistemic and ethical. Since the 1950s, laboratory animal welfare science has sought to achieve a consensus around the links between animal welfare and good experimental data, encapsulated in Russell and Burch's 1959 book on *The Principles of Humane Experimental Technique*, which introduced the terminology and epistemic terrain on which to evaluate the 3Rs–reducing, refining and replacing the use of animals in research. This meant that, in this context, welfare arguments were won, and lost, on largely scientific grounds. This manoeuvre historically shifted policy arguments about animal experimentation away from animal rights to animal welfare, giving welfare arguments a scientific legitimacy. Yet, there is now an inevitable and increasing epistemic gap–an impossible demand for evidence around new animal forms and new animal spaces that cannot be fulfilled.

The ethical and epistemic issues emerging from this multiplicity raise spatial questions too. As Hinchliffe suggests, "to do something is to assemble many wheres" (2010, p35). The care of animals is increasingly globalised, and has to be amenable to both the potential for genetic mutation and the capacity for endless repetition. The expectation of universalising animal care through legislation underpinned in all events and in all places by scientific knowledge is challenged. This is something acknowledged in the search for alternative ethical sites and vocabularies within the social sciences (Greenhough and Roe, 2011; Whatmore, 1997) and critical bioethics (Hedgecoe, 2004), but it is also troubling animal welfare researchers, who are experimenting with ways of responding to these spatial challenges. There is a broader point too about social scientific critiques of science and technology, which are not deconstructive–in terms of attributing narrow motives, but additive–in terms of gathering generative capacities (Latour, 2004), within contexts which are multiple, uncertain and eventful (Thrift, 2011). In what follows, I narrate some of these emerging strategies from the biomedical sciences, and the questions they raise for social scientists, not only around the role of standardisation in scientific and ethical practices, but also in the speculative bioethical formations that emerge from considering inconsistency, exceptions and the irreducible multiplicity of the multitude.

Universalising Care

Two notable strategies for furthering the welfare of genetically-altered laboratory animals have emerged within the wider animal care community. Both offer different ways into the epistemic, ontological and spatial complexities of laboratory animal welfare. One can be identified as a conspicuously ethical intervention, the second is perhaps more sociological. First, there is a growing bioethical literature on species integrity, which seeks to return formal bioethical registers to the consideration of genetically-altered animal welfare. The concept of species integrity has emerged since the 1990s, borrowed from biomedical ethics, as a translation of the bioethical principle of human autonomy. Arguments around individual animal integrity, used to contest practices like tail-docking and de-clawing, are extended to encompass the integrity of species, and more latterly species genomes (De Vries, 2006). Within a largely European bioethics literature, the limits of genetic modification, and most particularly the biomedical mixing of human and animal tissues, are negotiated through the extent to which they might trouble species identity and integrity. Crudely put, this asks whether there is a point at which genetic modification becomes unacceptable, not due to the accumulation of scientific evidence for harm to welfare, but when the integrity of the mouse, the 'mouse-ness' of the mouse as it were, is put at risk. The second strategy is perhaps a more utilitarian response to the challenge of accumulating evidence to enhance welfare. In the UK, the development of the mouse passport, by a working group of academics and animal welfare charities (Wells et al, 2006), seeks to link all extant knowledge of the individual animal's welfare needs to the animal itself, such that a document of the welfare issues associated with each genetically-altered strain travels with the animal, in transit and on-line, and can subsequently be added to whenever relevant issues emerge. The invention here is to redistribute discussion of animal welfare both from bioethical arguments about animal integrity and also from the peer-reviewed literatures of animal welfare science. Instead, the knowledges and documents of animal welfare are dispersed to the animal caretakers and animal technicians who work with and care for animals on a daily basis, such that their ability to respond to these animals diverse needs are enhanced. Both are innovative, interesting and important initiatives. However, both appear to be only partially successful strategies for progressing widely distributed gains in animal welfare.

The first is actively resisted by scientists, and others, in conversation and in print. Arguments about species identity are trying to bring into ethical purview issues that have apparently already been settled within scientific frameworks. Suggesting that new ethical questions are raised by genetic modification, which exceed the frame of laboratory animal science, means that questions about species integrity get embroiled in interminable arguments about the scientific validity of different definitions and characterisations of species, as well as debates over the extent to which genetic modification itself constitutes a novel development beyond selective breeding (Robert and Baylis, 2003; Rollin, 2003; Siegel, 2003). Any practical assessment of species integrity proceeds according to a list of individual attributes, including behaviour, appearance, disease risks and independence, which are themselves dependent on the evaluation of animal welfare experts (De Vries, 2006). In practice, as well as in principle, the ethical potential of this term is dissipated by pre-existing commitments to scientific epistemologies. The second is also resisted, albeit more by inactivity than explicit dissent. There is less of an epistemic challenge here, but there is an economic and organisational one. For many biomedical researchers I spoke to, and in different geographical contexts, this was seen as an unnecessary elaboration of the existing protocols already in place to protect experimental animals from harm, including veterinary oversight, animal caretaker training and ethical review. Animal research already incurs high overheads, and they were not clear of the additional value of producing documents for each animal strain, especially as the scientific case for the welfare implications of many genetic modifications were still to be made. Both appear to fall into a trap that comes from seeking universal strategies to secure animal welfare, which bring them into direct conflict with the existing ethical, epistemic and economic framings of biomedical research. And, I would suggest, in this context they will struggle to achieve what they aim to do.

At this point, biomedical researchers will understandably argue that they, as individuals and collectively, give the highest consideration to animal welfare. In legislative frameworks animals are recognised as sentient creatures, whose welfare should be protected, even as they are the subject of experimentation. Ethical review is an essential component of the regulation of all animal experimentation in Europe and the USA, and increasing elsewhere. The potential benefits of biomedical research for human health are always balanced against the potential harm to experimental animals, and where possible, this should be avoided or mitigated. However, there are often exceptions to principles designed to protect animals from pain, suffering and lasting harm. Environmental enrichments will be used for caged rodents, unless they are contra-indicated by current experimental design. Pain relieving drugs will be administered, unless they might interfere with experimental outcomes. Best practice in cage designs will be adopted, unless they will make research too costly. In context, the exceptions can become the rule. Many laboratory suppliers, especially outside the EU, do not use cage enrichments, such as nesting material or cardboard tubes, for rodents. The scale and margins of their operation mean even the fractional cost of such materials are large and additional costs are incurred as racks of mice become less visible to the quick health check. Enrichments remain uneconomic unless scientific arguments about the impact of these on the experimental value of research animals are unequivocal. Laboratory procedures thus continue to be carried out on animals that exhibit stereotypic behaviours, and may be neurologically disordered as well as stressed. This has a probable welfare implication for animals, and as well as a potential impact on research outcomes. Yet, arguments about the possible impact of affective states on research using laboratory animals still fail to cohere in these contexts.

Through conversations with biomedical researchers, and drawing comparison with historical research on animal laboratories, I would suggest that the extended scientific community has repeatedly been able to forget, or strategically ignore, the ways in which the affective states and environmental situations of animals may contribute to experimental outcomes. From early work on physiology and the impact of stress on measurements of spleen size (Eichberg, 2009), through experimental psychology and the influence of empathetic animal handling on behavioural testing (Despret, 2004), within the links made between animal ethology and pharmacology (Kirk, 2009), and up to functional genomics and the impact of complex environmental factors on genetically-altered animal phenotypes (Crabbe et al, 1999), this link seems to have to be remade in each historical period and each disciplinary context. This ability to forget is so prevalent that it has to be important. Memory practices are a vital component to science (Bowker, 2005). Indeed, the notion of the historical control, the ability to compare current experimental animal data with past practice, is routinely invoked as a reason for not changing practices or husbandry procedures that are known to have adverse effects on animal welfare. Yet, processes of forgetting are important to the creation of institutions and epistemic communities too (Douglas 1986). In biomedical research, the memory of research animals and environments as corporeally and affectively more active than research tools appears remarkably precarious. So how can you account for these resurgent practices of not-knowing?

I would suggest that running alongside the well-documented practices of standardisation in the historical development of laboratory animal research (Rader, 2004; Kirk, 2008), and the efforts to make animals cohere as research tools (Robins, 2008), there is a counter current of inconsistency or incoherence, which is perhaps less fully examined, but is an equally important element in the ability of science to act in the world (Mol, 2002; Law, 2004). This inconsistency is inevitable in a science as multidisciplinary as laboratory animal welfare. In this case, using scientific evidence as a guiding principle for ethical experimentation imbues science with the qualities of a Machiavellian leader. There are always competing experiments from which to select evidence, alternative frameworks from which to interpret data, and exceptions as yet to be explored. Action is effected by choosing which framework to use and in which context, and does not necessarily follow from the data itself. This can be exemplified by comparing two different contexts in which novel objects are used to test anxious states in laboratory animals. In the introduction, and in the context of welfare science, such tests generate data judged to be an ambiguous guide to the need for action to improve welfare. Yet, a similar test on a newly modified model organism need only exhibit behaviour with a marginal deviation from the norm to have potential as a valued research model in the study of human anxiety disorders (see Davies, 2010). What is universalised, and committed to the distributed memory of science, are the infrastructures and experimental protocols that enable the articulations of animals, testing apparatus and drug interventions to move beyond experimental to clinical contexts. Those able to travel, through articulating with the existing value structures of biomedical research, achieve a facticity, which arguments about species integrity and the invention of the mouse passport struggle to match. The fluctuating affective states of animals remain visible only in the particular moment of experimentation.

Here, I want to draw on Žižek, his potent mix of dialectical and psychoanalytic thinking, and his compelling, if admittedly loaded, analysis of the persistence of complicity with state torture in the West despite near universal condemnation. As Žižek explains, in this context the universal is always supplemented with exceptions. “The standard trick of prohibiting something in principle (torture, for instance), but then slipping in enough qualifications (“except in specified extreme circumstances …”) [ensures] it can be done whenever one really wants to do it” (Žižek, 2010 page 20). Žižek draws attention to a paradox typical in his analysis, suggesting it is more powerful to treat every case as an exception, to seek to universalise the exception, rather than seeking protection through universal principles. His example is allowing torture, or the death penalty, in principle, but ensuring that in practice the conditions under which such a principle can be exercised are never realised. As he suggests, “the prohibition is much stronger when one allows torture in principle - in this case, the principled ‘yes’ is never allowed to realise itself; while in the other case, the principled ‘no’ is exceptionally allowed to realised itself” (page 20), “whenever one really wants to do it”. Why, and in what ways this might be relevant to the extension of care to genetically-altered research animals requires some careful argumentation and some important caveats.

Legislation permitting animal experimentation in the UK, and elsewhere, is in fact already permissive. Given regulation of the people, places and procedures involved in research using animals they allow practices to be carried out that would ordinarily be considered cruelty. Yet recognition of this, and the inevitable ethical entanglements implied by it, have been shifted, or perhaps forgotten, by the increasingly universalised commitment to the 3Rs. These require formal review of experimental protocols with exploration of opportunities to replace, reduce, and refine the use of animals in research prior to experimental permissions. The 3Rs are important; their increasingly adoption is to be welcomed. But, there are practical effects in the way they have been institutionalised, which suggests that once the people, places and procedures have been signed off, the ethical considerations have ended and the science can proceed. There is a formal commitment to reducing the pain, suffering or lasting harm to animals embedded in the 3Rs, which has changed the ethical status of animals in the abstract, but can allow suffering as the practical exception for the range of epistemic and institutional reasons outlined above. It is difficult to argue this principle has achieved the anticipated and uninterrupted progress, as the number of experimental animals and procedures continues to increase.

Furthermore, the application of the 3Rs is incorporated into the frameworks of a cost-benefit analysis. In this, the suffering of both humans and animals are made visible, to be considered within the same ethico-political framework, which is its obvious appeal. Yet, at the same time that human and animal suffering are brought into the frame, they are formally separated. A formal inequality is instituted through cost-benefit equations which trade-off; the potential for animal suffering or harm is weighted again the promissory, even if never realised, gains in human health, as if this was a zero-sum game. There is furthermore a growing inequality in the pursuit and weighting of evidence. The marketisation of science means that there is a constant expansionary pressure in the extent to which human suffering is seen to be tractable to medical intervention, and a recurrent forgetting of the extent to which animal suffering might be relevant to both animals themselves and the outcomes of biomedical experimentation. Few research proposals are ever turned down on the basis of such cost-benefit analysis; the potential gains in understanding human health are assumed to speak for themselves. At the same time, animal welfare researchers are placed in the impossible position of seeking unequivocal data to support the adoption of even minor cage adaptations, which might result in better welfare outcomes, knowing that for this evidence to be weighted again the known costs and promissory gains of animal experimentation for human health–already a difficult task–it has to be verified across multiple strains and experimental contexts–a further iteration for which there is sparse funding.

That this principled desire to reduce harm and suffering fails is perhaps not surprising. The settlement around the 3Rs has instituted forms of governance, which leaves no outside from which to question its commitments to reducing harm, for both humans and animals, whilst also allowing the exceptions to continue. Further efforts to seek universal principles for protecting laboratory animal welfare, whether through reintroducing bioethical principles, which define the point at which animal integrity is breached, or of universalising the monitoring of animal welfare through the mouse passport look likely to suffer similar issues; proceeding through the legislation of universal principles, but exemplified by their practical exception. These innovations leave untouched the formal structures and governance of science that institute this ethical and empirical asymmetry. Interpolated into any zero-sum game, animal welfare can never win, whilst its uncertain science is weighed against the potential biomedical and financial gains in understanding human suffering. This universal principle fails to cohere in the face of ontological multiplicity, epistemic asymmetry and the growing complexity of the particular experimental systems through which human and animal bodies are intricately articulated.

The continuing effort to find ways to universalise the principles embedded in the 3Rs may turn out to be the best ethical strategy for furthering the welfare of experimental animals, but, if only as an exercise in the value of speculative bioethics, it is worth exploring what happens if we start from the other way around. Instead of trying to elaborate further principles designed to protect experimental animals in the abstract, I want to ask what it might mean to try to universalise the exception, to accept that in principle all animal experimentation will have consequences for animal lives in ways that potentially cause pain, suffering and lasting harm; this is both accepted and permitted. The critical corollary is that the consequences of any such suffering can never be ignored by animal care takers, scientists, regulators or investors. The consequence in the particular is that science can never proceed as if the ontological, epistemic and ethical issues have been settled prior to the point of experimentation. There is no such easy redemption[7]. The particularities of each experimental articulation of animals and apparatus are freighted with the impossibility of disarticulating the consequences for animals and the implications for potential understandings of human health. The shift from furthering universal principles, to exploring the aporias and potential for action embedded in the exception, takes us into a slightly different theoretical and empirical terrain.

Caring for the particular

Theoretically, this moves us away from the formal arena of bioethics and towards the ethical questions emerging in the work of Haraway, and others, as they seek to explore the political and ethical implications of "grappling with, rather than generalizing from, the ordinary" (Haraway, 2008, page 3). Haraway's work is particularly relevant here, in her amplification of the response-ability which might follow recognition of the entangled subjectivities and "opening to shared pain and mortality" of humans and animals (Haraway, 2008, page 83). This is embodied in her conceptualisation of shared, but non-mimetic, suffering; an important, but controversial intervention into the ethical terrain of animal experimentation (Weisberg, 2009). Haraway first articulates this through a fictional extract whereby a researcher experimenting on guinea pigs to improve methods of tsetse fly control in 1980s Zimbabwe, allows his arm to be bitten by the flies, "sharing pain to learn what animal suffering is" (Haraway, 2008, page 70), and reflecting on the extent to which "people and animals in labs are both subjects and objects to each other in ongoing intra-action" (page 71). Recognising shared suffering is not simply to suggest symmetry between humans and animals, to raise the status of one versus the other in subsequent cost-benefit equations[8]. It is

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[7] Animal experimentation is of course imbued with religious imagery, most obviously in the term animal sacrifice, used to refer to the culling of animals at the end of experiments. See for example, Birke et al (2007).

[8] Nor does it function in the same way as the recuperative stories of laboratory animal pets (Birke et al, 2007), whereby researchers single out of an individual charismatic or vulnerable animal as a pet, thus demonstrating the humanity and humility of the laboratory researchers in relation to the wider set of animals in their care. The increased engineering of the mouse house makes this less feasible in any case.

more complicated than this, for both animals and humans are inserted into complex knots of relations, which recognise the impossibility of living without suffering. As Haraway puts it, "there is no way of living that is not also a way of someone, not just something, else dying differentially" (Haraway, 2008, page 80). Instead, this is a call to address the extent to which suffering is both ordinary *and* forgotten. The moral provocation is towards "culturing a radical ability to remember and feel what is going on" (Haraway, 2008, page 75).

Haraway offers a compelling opening up of the ethical and epistemic settlements around laboratory animal experimentation. As she writes, such "abstractions, which require our best calculations, mathematics, reasons, are built in order to be able to break down so that richer and more responsive invention, speculation, proposing–worlding–can go on" (Haraway, 2008, page 93). These forms are already taking shape, particularly around what it might mean to "feel what is going on". Haraway focuses primarily on the moments of shared suffering taking place between experimenter and experimental subject. She argues this has the potential to destabilise the identities of each, returning the experimental subject to "a someone" as well as "a something", thus stalling the processes by which it is possible to forget an animal is not merely a research tool. This is exemplified in Greenhough and Roe's recent paper on the potential to amplify a somatic sensibility in both clinical trials and animal experimentation, supporting the development of the care-ful practices of nurses and animal care takers in each context (Greenhough and Roe, 2011; see also Greenhough and Roe, 2010). Yet, questions still remain around the extent to which such an opening up can culture the "radical ability to remember" outside of these contexts of care and thus address the multiple and spatial questions challenging laboratory animal welfare.

A shared suffering based on co-presence may be limited in this particular experimental context, which takes place within spaces that are often isolated and increasingly invisible. The potential for shared suffering fits uneasily within large commercial mouse houses, containing upto 60,000 animals, in which animal care is increasingly as routinised as the standardised animal housing. This is the point of the mouse passport; to increase the potential for day-to-day care of animals through cultivating the informal expertise and somatic sensibilities of caretakers and technicians. But the challenge remains in its limited uptake, that "to do something is to assemble many wheres" (Hinchliffe, 2010, page 35). Laboratory animal research needs not only to culture the ability to feel what is going on, through amplifying somatic sensibilities, but to culture "a radical ability to remember" over time and across space, connecting the organisation of animal breeding with those of experimentation and ultimately clinical application, without reducing the multiplicity of these different spaces. There is still an issue of how such space-times might be knitted together, which I want to explore, not through generalising the particular, but through universalising the exception. This argues that all animal experimentation develops entanglements between human and animal capacities, with potential consequences for both animal and human wellbeing, which can never be ignored by science. I want illustrate this by returning to the opening question of animal stereotypies, and the alternative forms of ethico-political action emerging around the particular conjuncture of the barbering mouse.

Joseph Garner, a British academic currently working at Purdue University, is perhaps an unusual scientist in the animal welfare community. Instead of seeking to further the welfare of laboratory animals through disentangling the conditions that constitute the best care for these animals in the abstract, his research starts from the inevitable and particular point of mixing between animal and human capacities. His early research was on barbering mice (Garner and Mason, 2002). This behaviour vexes animal welfare scientists, but has been largely ignored by biomedical researchers interested in research on human biology. Garner's response has not been to address these communities separately, but to enmesh them more thoroughly through collaborative research with each. He now works in the fields of both animal welfare and human psychology. The barbering mice are not merely an experimental externality, an ethical issue of welfare concern or an ignored product of scientific protocols; they become a 'matter of concern' in themselves (Latour, 2004), critically through considering their relation to the wider range of human behaviours. In his work, the barbering mice are allowed to become a model for human trichotillomania (Garner et al, 2004; Stein et al, 2007). Or, perhaps more precisely, he allows affected humans to become a model for mouse barbering.

Some people are also known to pull hair repeatedly and obsessively. The causes of this are also complex and multifactoral. The consequences are deeply traumatic for affected individuals and, given the young age at which hair pulling tends to start, for their families too. Garner works with the animal welfare societies and trichotillomania support and research groups. The particular experimental aporias of barbering mice travel deeply into the worlds of both animal welfare and human psychiatric research, motivated by the desire to reduce suffering in both. In addition, once established as a model for human trichotillomania, the barbering mice are less comfortably ignored by other biomedical researchers. It is one thing to proceed as if barbering was an accidental but inconsequential experimental outcome, and another to seek to model common disorders, such as diabetes or heart disease, known to have affective components, using a mouse which is also already, and in the same kind of journal, a model for human trichotillomania. The particularities of this conjuncture of animal, apparatus and affective states have radical potential for rethinking relations between humans and animals throughout this experimental system.

There are alternative forms of care implied here, which are less dependent on proximity and personal sensibility to suffering, operating instead through a challenge to the 'care for the data' that biomedical researchers already demonstrate through attention to experimental practices and design (Fortun and Fortun, 2005). Attention to affective capacities is reinserted into the entanglements of animals and apparatus, through which human disease and drug intervention is already understood. This critique is affected, not simply by standing in judgement of animal research, but in multiplying the "signs of existence" (Foucault, 1997, page 322)[9] for both the human and animal subjects within experimental systems. That a single animal under certain conditions may become a disease model for say trichotillomania and diabetes, autism and immunology, obsessive compulsive behaviour and heart disease, destabilises an animal's identity as either technical object or epistemic thing (Rheinberger 1997), challenging the coherence of the speculative facts of biomedical research. It demands different ways of thinking about difference and equivalence in each experimental context. These are not the aggregated differences between humans and animals, which underpin the extrapolation of data from experimental animals, whilst relegating biomedical research and laboratory animal science, epistemology and ethics to different realms, each purified to their "own exalted peaks" (Foucault 1970, page xv), with separate literatures and experimental practices. Rather, what is demanded are ways of dealing with the intricately layered differences of animal and human biographies, environmental and microbial entanglements, social interactions and genetic compositions, such that what is being modelled and under what conditions is more closely examined and understood. This has the potential to benefit both animal care and understandings of human disease.

[9] The full quote was used to advertise a recent conference at Durham University on affirmative critique: "I can't help but dream of a kind of criticism that would try not to judge but to bring an oeuvre, a book, a sentence, an idea to life; it would light fires, watch the grass grow, listen to the wind, and catch the sea foam in the breeze and scatter it. It would multiply not judgements but signs of existence" (Foucault 1997, page 322). See http://www.dur.ac.uk/ias/events/thematic/dehumanisation/sustaininghumanness/. Last accessed 11 July 2011.

There are already signs of how this proposition might travel, drawing attention to the potential multiplicity of experimental spaces in mouse genetics and laboratory animal research, and the diversity of ways that these might be articulated, not only through standardisation. There is a growing debate about the extent to which standardisation may increase internal "reproducibility at the expense of external validity" (Würbel, 2000, page 263). The desire to minimise variability within experimental settings risks generating experimental artefacts, which are both idiosyncratic to that situation and, given standardisation, highly reproducible, but lacking in applicability to other places, populations and species (Richter et al, 2009; 2010). Varied environments may enhance an animal's ability to control their own behaviour and environment, but, rather than seeing these as confounding the search for genetic factors, such resources might help determine more subtle and informative experimental effects. The experimental systems of functional genomics have to face the impossibility of standardising human biology and ecology outside of the laboratory; a consideration which is returning environment, space and situation as a variable in this arena of laboratory animal research. The 'envirotype' is beginning to take its place along the genotype and the phenotype (Beckers et al, 2009).

There are also arguments for the return, not only of geography, but also of biography in the articulation of research animals and humans patients. Arguments about the lack of pain relief, and other ameliorative treatments, used on research animals initially suggested animals did not feel pain or experience suffering. It was latter claimed that analgesic drugs or other interventions would disrupt experimental results. Now, some suggest this experimental control also endangers external validity. Arguments are emerging about the importance of treating the pain and stabilising the clinical states of research animals to bring them closer to the trajectories taken by disease in clinical patients, so aiding the translation of research findings from bench to bedside (AALAS meeting, 2009). These intersections of geography and history add complexity to animal research, but this is a complexity already evident in the human bodies and populations it is hoped the animals will model. The laboratory animal community are thus looking to the clinical sciences to learn from their means of managing complexity in the experimental design and software of clinical trials. As a recent press release puts it: "mice and men should have more in common in clinical trials".[10]

[10] See http://news.uns.purdue.edu/x/2009a/090330GarnerMice.html, last accessed 11th July, 2011

This paper started with a list of different experimental enrichments for laboratory animals. In the context of the post-war settlement, but unequal separation, between laboratory animal science and biomedical research, I argued this incongruous list represented an articulation between these realms through the impossible search for a universal enrichment to alleviate the stereotypies of laboratory animals. This research is still important, as are ethical arguments about species identity and the practical suggestions around the mouse passport. But, given the expansionary potential of biomedical research and the increasing multiplicity and multitude of research animals, I have argued such universal efforts, premised on the separation of humans and animals; science and ethics; laboratory animal science and biomedical research may be limited. I have argued, instead, that a focus on rendering difference differently in biomedical research could be a productive starting point, and one that helps make space and support for other initiatives too. This difference is not only the difference between humans and animals; in fact, the paper is about the incoherence of the category of either human or animal as isolated entities. The arguments here starts from the ways in which humans and animals are already complexly enmeshed within experimental systems, giving some shape to what an ethics of animal evidence might look like (Lezaun, 2010).

These speculative ethics are more anthropocentric than those which seek animal welfare gains through asserting the independence and separate status of animals; our grasping towards more complex understandings of animal lives loops into understanding the complexity of our own embodied experiences. It is also arguably more pessimistic; for it argues we are already deeply implicated in the suffering of countless other humans and animals. To seek principles that minimise this may be understandable, but risks the recurrent practices of forgetting and the re-emergence of the exception. Instead, accepting the particularity and multiplicity of experimental systems means paying careful attention to the complex processes involved in adding places together, in both science and ethics, and in each case. It is also perhaps more provisional, for past scientific practices demonstrate the search for understanding is often accompanied by the tendency to subsume multiplicity under unity (Serres 1995). Yet despite these cautions, what potentially follows is a more affirmative bioethical critique, one that is reflective of a “multispecies and a multi-expertise way of doing/thinking worlds and ways of life” (Haraway, 2004, p308) and one that critically returns a radical ability to remember the importance of care for the multitude and the multiple, for both humans and animals.

These small animals thus raise big questions for social scientists involved in understanding the life sciences when ontological forms are multiple and mutable, data is simultaneously abundant and inadequate, and formal ethical review procedures are incapable of either containing controversy or enabling critique. In this paper, I have argued such interventions might start from the practical aporias involved in such constitutions, amplifying those voices already making alternative connections, and exploring how they address the task of assembling complex sociotechnical systems and space differently. As Thrift suggests, “practical vocabularies for understanding and constituting this ontology are running ahead of any theoretical vocabulary” (2011, page 23). In conclusion, I want to suggest it is not only in the laboratory animal sciences that the indefinite number of the multitude is a challenge to bioethical practice and theoretical conceptualisation. The contemporary expansion of the biosciences is dependent on a series of speculative logics, which are remaking the social through affective labour, in which marketing comes first and production follows (Hardt and Negri, 2004; see also Anderson 2007). Such speculative bioethical formulations may thus be of wider value, offering resources for social scientists, and others, who seek to connect the spaces of response-ability within this epistemic, economic and affective terrain. Between the conceptual orders of science and ethics, there is both multiplicity and the potential of the multitude: “a diffuse set of singularities that produce a common life” (Hardt and Negri, 2004, page 349). The barbering mice affect a mobile and fleshy ethical intervention, travelling internationally, knitting together animals, ethics, affect and experimental protocols, whilst unsettling the facticity of extravagant biotechnological speculations, in ways that formal universalised bioethics cannot. The call to be attentive to particularity and multiplicity militates against an easy definition of what this argument might look like in other arenas. But, this is an invitation to bioethical speculation and experimentation; or, to put it colloquially to ‘see how they run’.

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