

Animal Encounters in The Unwild
or What Is It Like To Hold Down A Baby Monkey:
On Metaphysical Excess, and 'The Three Rs' as Paradoxes of Authority

Sam Schulte

University of Chicago
Committee on the Conceptual and Historical Studies of Science

ABSTRACT:

In the 2011 *Guide for the Care and Use of Laboratory Animals*, the National Research Council uses the conceptual apparatus of 'Replacement, Reduction, and Refinement' developed by W.M.S. Russell and R.L. Burch in 1959 as a tool to develop more humane research practice in the United States. As 'The Three Rs' become institutionalized as part of the regulatory apparatus of the National Institutes of Health, a question arises of how this triad operates to negotiate the epistemic and ontic space between human and nonhuman. I propose that each 'R' is an expression of a paradox that emerges from the practice of animal experimentation: the more researchers use an animal, the more human that animal becomes and the use of that animal less humane. Using Marshall Sahlins idea of kinship as a mutuality of being and Robert Proctor's notion of agnotology, I argue that the appeal of the 'Three Rs' comes from each concept's ability to simultaneously produce kinship and ignorance, thereby managing the affective relationship between researcher and experimental object.

Sailing to Genetics

“In the first place, you avoid seeing the unpleasant expression of the ape when being vivisected,” by using a pig or a goat rather than a primate for dissection, advises Galen to the prospective 2nd century neuroanatomist. Refuting the peripatetic argument that the heart and not the brain is the seat of human action, Galen’s prose takes on the form of a bloody vivisection, where “it frequently happens that the outflow of blood is such that the operator can be disheartened from renewing and finishing his dissection,” (Galen 1963, Gross 1998) by specifying the means by which a curious interlocutor can replicate the procedure themselves. He takes the reader inside the body of the pig; the text lists the knives, cuts, and manipulation of the gray matter that must be made to show that as the brain is taken apart piece by piece motor functions and perceptual functions cease to operate. In doing so Aristotle’s heart-strings are cut. In this context, the advice to not use a primate as the surgical object is curious. Appearing not as moral admonishment, this seemingly humane gesture by the physician to the gladiators of Pergamum is instead incorporated into practical knowledge of how to violently extract evidence from a body. The ape’s unpleasant expression is an obstacle not unlike the pig’s Dura mater, that is to say a technical problem to be overcome.

The corresponding image of the human is of a raw, flesh-bound and mortal creature. The vivisection, tasked as it is with uncovering what part of the body is the most crucial for perception and thought, explicitly argues for an analogical relationship between the pig brain and the human brain, so as I slice across an optic nerve and one of the pigs eyes fails to function my perception is the manipulated object. In this moment, the literally cerebral becomes the figuratively visceral, and the reader both the pig and the surgeon. If the reason to avoid

vivisection of apes is the unpleasantness of their expressions, then perhaps we can characterize this squeamishness as a kind of metaphysical excess located in the similarity of the ape's face to the Roman's own, such that opening up the skull of one creature is preferable to that of another. Rather than make a claim about the universality of a human affective, somatic, or cognitive response to primate expressiveness, I would like to try to approach the possibility that this metaphysical excess is a practical concern for the contemporary use of animals in research as well.

In contrast to the sinuous, sensuous, and altogether mortal porcine anatomy and physiology under Galen's knife, Paul Rabinow's *Artificiality and Enlightenment*, (Rabinow 1992) offers genetics as a point of transformation yet to come, where human authority over our own genes and those of the creatures around us would shift biopower from twin poles of body and population to a single point as nature and culture collapse into one another under the rubric of genetic determinism and sociobiological contingency. The dream of the post-human that Rabinow finds in genetics is the dream of immortality and escape from the body, and has resonance with the all-too-modern desire to be gathered into the artifice of eternity. The human genome project's researchers are no Grecian goldsmiths, but Rabinow sees in the prospective ability to manipulate genetic material a forthcoming change in the way people conceptualize themselves as genetic beings in a genetic world such that the end of the social and the end of nature as separate is close at hand. Once out of nature, the genetic human is an entity unlike the flesh-bound body, as withering cells turn to timeless code inside the walls of immortal Byzantium. Man is reborn inside the emperor's fire: perfect, deathless, ageless as a sequence of purines and pyrimidines.

And yet, despite waiting 20 years for these changes to happen, Rainbow's assessment of the possibilities of genetics remains five minutes into the future. While we await the promised revolution of life itself, it is possible to look at a more modest change in the idea of life instantiated in the most recent (NCR 2011) edition of the National Research Council's *Guide for the Use and Care of Laboratory Animals*, the document used by the National Institutes of Health to articulate what it considers to be humane treatment of animals used in research. In the most significant change to the *Guide* from its previous (NCR 1996) edition, the incorporation of Russell and Burch's concepts of Replacement, Reduction, and Refinement becomes a keystone of the document's internal logic, and therefore part of how the American scientific community asserts authority over human and animal bodies and populations. Here, the same metaphysical excess that troubled Galen is managed by an effort to unite humane treatment and discovery, thereby allowing the practice of research to not only overcome but also to incorporate that excess. The result is the emergence of a post-social (Knorr-Cetina 2001), rather than post-human, form of life where new knowledge, techniques, technology and practices make us not into undying monuments of intellect, but rather bind us to flesh, hormone, and tissue.

I propose that at the heart of the authority to use animals as tools for discovery is a paradox inherent in attempting to make that use humane. The more researchers use an animal, the more human that animal becomes. As the animal becomes more human, the less humane use becomes and so the less researchers may use that animal. The less researchers use the animal, the less human the animal becomes, and the more humane using that animal becomes. Because the authority to use animals rests on their humane use, i.e. the NIH will not approve a grant that does not fulfill the criteria at work in the *Guide*, understanding how each of the 'Three Rs' expresses

this paradox reveals how researchers manage the relationship between themselves and their objects of study. I am going to look at how each of the ‘Rs’ is articulated in *The Principles of Humane Experimental Technique* (Russel and Burch 1959) and what emerges from the *Principles* and becomes part of the *Guide*. I will argue that these documents and through them the scientists they guide are engaged in the production of mutuality of being and therefore kinship (Sahlins 2013) between human and nonhuman, and that at the same time each of the concepts of Replacement, Reduction, and Refinement are agantological processes (Proctor 2008) that create a distance and ignorance that makes further experimentation possible.

This becomes an inhabiting of the dual moment of kinship and ignorance, rather than an attempt to resolve the paradox by declaring animal research absolutely inhumane or by declaring humans absolutely separate from animals and their use therefore unburdened by ethical concerns. The consequence of this inhabiting is that emotion, rather than some form of hyperationalization or overcoming of subjective reasoning comes to center stage in this narrative of a post-social form of life. The authority to use animals, which has really been the authority to manage humans who use animals all along, thereby comes to rest on an emotional connection to the creatures under study developed through scientific practice. Phrased more succinctly, though perhaps more opaquely, in addressing this question of the relationship between the epistemic status of a scientific object (the animal) and ontic tension that surrounds it (the human-humane paradox) the ethical dimension is in this case enveloped by a response conditioned through research practices. If this is the case, in order to understand the changing boundaries between human and nonhuman, and the emergence of new forms of (post)sociality, the place to look is with the feelings of the people and creatures who live on that border.

The *Guide* and The *Principles*

The *Guide for the Care and Use of Laboratory Animals*, published first in 1963 and subsequently revised in 1972, 1978, 1985, 1996, and most recently in 2011 is a key component of the regulation of animal use in the United States. Currently, this is because the 1985 Health Research Extension act (99th Congress 1985) required that the NIH establish guidelines for

"(1) The proper care of animals to be used in biomedical and behavioral research.

"(2) The proper treatment of animals while being used in such research. Guidelines under this paragraph shall require-

"(A) the appropriate use of tranquilizers, analgesics, anesthetics, paralytics, and euthanasia for animals in such research;

and

"(B) Appropriate pre-surgical and post-surgical veterinary medical and nursing care for animals in such research.

Such guidelines shall not be construed to prescribe methods of research.

"(3) The organization and operation of animal care committees in accordance with subsection (b).

This is accomplished through the Office of Laboratory Animal Welfare (OLAW) of the Public Health Service (PHS), whose guidelines (NIH 2002) begin by stating “No activity involving animals may be conducted or supported by the PHS until the institution conducting the activity has provided a written Assurance acceptable to the PHS.” In order to be accepted by the OLAW and submitted to PHS, “the Assurance shall full describe the institution’s program for the care and use of animals in PHS-conducted or supported activities. The PHS requires institutions to use the *Guide for the Care and Use of Laboratory Animals* (NCR 2011), “as a basis for

developing an institutional program for activities involving animals.” At each level there is a regress of guidelines into guidelines: The law mandates that the NIH produce guidelines concerning animal use; the NIH produces guidelines for the PHS to follow, which then produces guidelines for the OLAW to follow, which then produces guidelines for the IACUCs (Institutional Animal Care and Use Committees) to follow, which must be based on the *Guide* itself.

The majority of the *Guide* itself is composed of dry, vague, almost tautological descriptions of how animal care should be provided.

“monitoring of environmental condition in animal holding spaces and other environmentally sensitive areas in the facility should be considered.” (143)

“areas such as pastures and islands may provide a suitable environment for maintaining or producing animals for some types of research”(55)

“ Animal bedding and nesting materials are controllable environmental factors that can influence experimental data and improve animal well-being in most terrestrial species”(68)

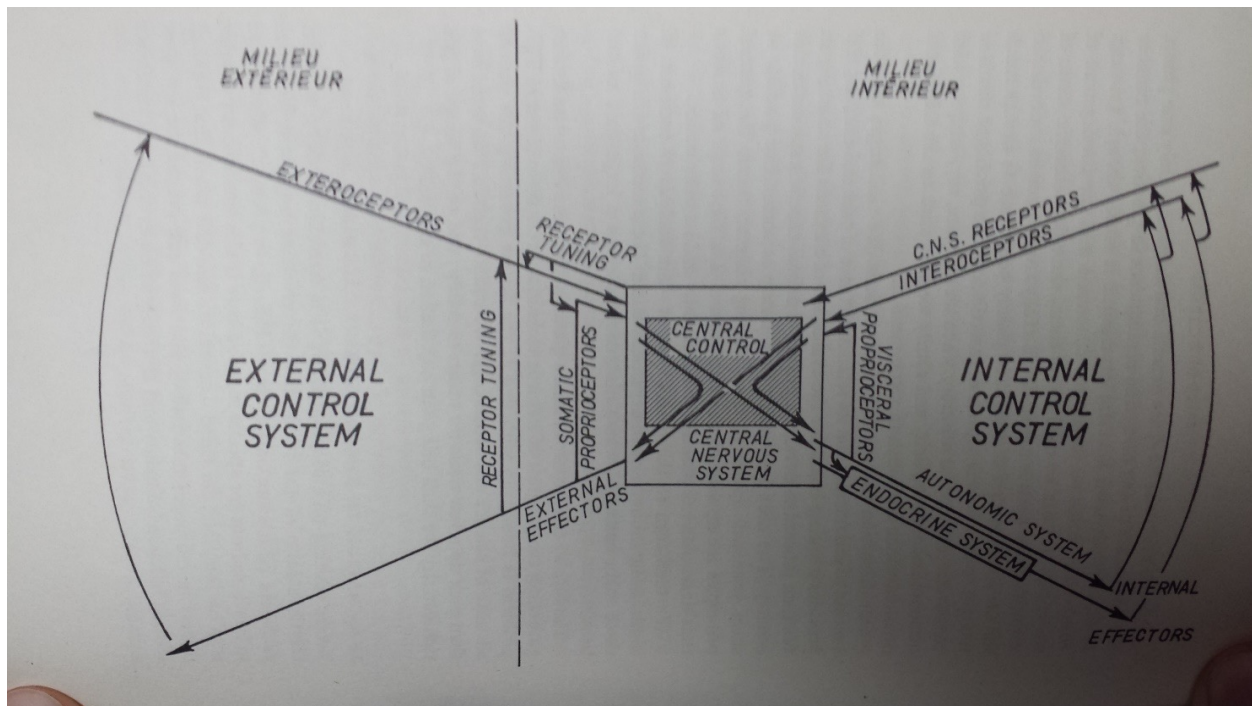
“space recommendations and housing density vary extensively with the species, age/size of the animals, life support system, and the type of research”(83)

These prescriptions are almost always given in terms of how a researcher or a facility *should* act, or how operations *should* be conducted, rather than *must* act or how operations *need* to be conducted. This emphasis on *should* rather than *must* makes it so that the judgment of what constitutes humane treatment, as in what is the size of a humane cage for a zebra finch, is up to the individual institution and researchers in question to determine.

The basis for making these judgments is not clear in the *Guide* itself and disappointingly what constitutes humane is never defined other than circuitously as “actions taken to ensure animals are treated according to high ethical and scientific standards”(6). Other than making broad gestures assuring the reader that “[the *Guide*] strongly affirms the principle that all who care, use, or produce animals for research, testing, or teaching must assume responsibility for their well-being” on the first page of the first chapter, trying to pin down the basis of these principles or even what these principles are is difficult. A cynical reader might be tempted to speculate that this is a purposeful effort to avoid having to make a commitment to any particular ethical formulation that would invite controversy, or worse, provide a basis for litigation. But fortunately, the authors go on to describe what they call a “practical method” for implementing their principles in the form of the Three Rs: Replacement, Reduction, and Refinement.

The Principles of Humane Experimental Technique (Russell and Burch 1959), the origin point of the Three Rs, is a theory of humane animal experimentation centered around the idea that humane treatment of animals is a necessary “prerequisite for successful animal experiment”(4). Crucially, it is **not** an ethical theory, but instead argues that Reduction, Replacement, and Refinement are solutions to technical problems encountered by the use of animals as objects of research. The second chapter emphasizes, in all capitals no less, that the terms humane, humanity, and the derivatives thereof “must NOT BE TAKEN TO IMPLY ETHICAL CRITICISM OR EVEN PSYCHOLOGICAL DESCRIPTION OF PERSONS PRACTISING ANY GIVEN PROCEDURE” but instead can be more usefully regarded as descriptors of how a particular experimental procedure is conducted with respect to the welfare of the animals involved.

Figure 1- Integration of the Vertebrate Organism



The above figure from the first chapter of *The Principles* is an image of what Russell and Burch consider to be a diagram of “integration in the vertebrate organism”. This is what they claim the vertebrate organism is, a set of at least three interlaced control systems that mediate a creature’s relationship to the environment and maintain control within the creature itself. Citing contemporary literature, they argue that the integration of the somatic nervous system (“the part of the nervous system that controls external outputs” (9), the autonomic nervous system (which sends signals to the body from the brain), and the endocrine system (the system of regulatory hormones in the body), into sets of overlapping feedback between different organs, the central nervous system, and the environment is an empirical refutation of the Cartesian mind/body dichotomy, which the authors consider “an entirely pathological fantasy.” (11) Though the authors recognize psychosomatic as “among the most inept and confusing [terms] ever

introduced into science” their approach emphasizing the importance of integration means that for the cybernetic, here defined as consisting of inputs and outputs into a system that is regulated by feedback, vertebrate they propose maintaining *mens sana in corpore sano* is a requirement for effective research. Both human and experimental vertebrate are for Russell and Burch psychosomatically sensitive beings.

The author’s consideration of humanity and inhumanity in animal experimentation with this image of the cybernetic vertebrate follows the classic argument that humane treatment of animals involves minimizing suffering found in Bentham (Bentham 1879) and would later be found in Peter Singer’s *Animal Liberation* (1995) that has place in British law at least since the animal rights act of 1876 (Public General Statutes 1876). However, Russell and Burch deliver limitation of animal suffering not as an axiomatic moral imperative, but as a definition of inhumanity such that what causes pain and distress in an organism is inhumane and that which prevents pain and distress is humane. The capacity for suffering that makes pain and distress a relevant category is argued to have an empirical basis in the feedback loops that the vertebrate organism consists of, with strong pain and extreme distress capable of distorting behavioral and physiological responses of the experimental subjects away from a normal response. This results in a **scientific imperative** to treat experimental subjects humanely since the idiosyncratic responses of creatures to different forms of suffering obscures the normal, healthy responses that scientists are looking for and need to understand in order to make claims about the human body by comparison to animal bodies. The authors argue that disruption of normal function, measured by any number of means, provides an objective basis to quantitatively determine the

(in)humanity of a given experimental protocol and develop techniques to limit this disruption to facilitate better scientific practice.

The cybernetic and suffering creature forms the basis for developing principles that aim to create more effective human experimentation through humane research practice. These principles turn out to be Reduction, Replacement and Refinement, which when integrated into the *Guide* as the key to the document's internal logic become central to how the American government manages animal welfare. Because these principles have their basis in a specific empirical claim about what constitutes the being of a vertebrate organism, the use of the three R's by the *Guide* carries with it this claim about the ontic status of human and nonhuman vertebrate animal life into its regulation of scientific practice in the United States. Thus it is the case that at least since 2011 in research performed with government funding in the United States, the practices that constrain what sort of knowledge can be acquired about animals has depended on other scientist's articulation of the boundary between human and animal though knowledge acquired by research performed on animals, rather than on an a priori constitution of this boundary.

Metaphysical Excess

While there are two thousand years between Galen and the modern primatologist, and the comparison between roman vivisection and American biopsychology in some respects unfair, the metaphysical excess of human-animal encounter remains as a practical concern. Working as a research assistant in a behavioral neuroendocrinology lab (Diary 2013), I was confronted by a strange mix of compassion, determination and fear when having to hold down year-old rhesus

macaques to have their blood drawn, and while not nearly as dramatic as vivisection, the cries and facial expressions of the young monkeys were certainly ‘unpleasant.’ The emotional content of this experience and how other people working at the same lab thought, felt, and dealt with it led me to want to understand the circumstances that brought about this experience. To that end, I talked to the other research assistants, the investigator I was working for, and others on different projects at the same site. Often, this conversation seemed to turn on a discussion of the ethical implications of work in the lab, and so the means by which those implications were managed I took to be an important part of how each individual felt about the work they engaged in.

Sitting on a beach as the tide was coming in, I had spent the afternoon swimming and talking to Anna and Clara, two other research assistants at working at the same site. Anna was working on a different project, and had previously worked as the lead on a project surveying gibbon populations as part of her master’s research, out in the wild as opposed to inside a lab. Clara on the other hand had previously worked at a large primate research facility in the United States, and had done research in the past on how enrichment, especially in terms of water features, could improve health outcomes in captive primates. For Anna, there was a sense in which the work in the lab was a ‘deal with the devil’ in order to gain further research experience before applying to a PhD program in primate conservation and ecology. Her view of the research at the lab itself was similar, and she saw it as a necessary, but regrettable evil.

For Clara, my positioning of the practice she and I were engaged in as problematic implied an ethical criticism she found insulting. For her, the work she was doing was deeply engaged in the care of animals much as it was in their use, and she quickly moved to say that all we were doing at that lab, and all the research at her previous lab were fully within regulatory

structures that ensured the welfare of the animals was attended to. She related the story of walking to work with protesters outside her facility who represented a kind of thoughtlessness about animals she could not abide, who despite knowing nothing about the animals and nothing about her work shouted insults and claimed to be the ones fighting on the animals' behalf. Unlike Anna, she had a deeply held conviction that use of animals under the institutional structures at hand was not a 'necessary evil' but a productive good, and to say otherwise was to be either misinformed or engaged in a kind of sophistry that was itself unethical.

The point here is relatively straightforward: engagement between animal and scientist generates a connection between researcher and scientific object. A conservation biologist working on gibbon populations has an emotional commitment to oppose deforestation; the veterinary researcher cares about the way cages are being arranged in a lab; the vivisectionist has to overcome the visceral discomfort involved in drilling through a screaming pig's cranium. What it is important to recognize though, and the case of the two different primate researchers varying responses indicate, is that it would be simplistic to describe the connection developed through animal use purely in terms of care or within a framework where connection was taken solely to mean a positive, sympathetic kind of bond. As demonstrated in the case of Haraway's (Haraway 1990) description of Carl Akeley relationship with the mountain gorilla in *Primate Visions*, where love and taxidermy follow patriarchy and anxiety into the natural history museum, this connection between human and non-human occurs within historically specific, culturally mediated context that shape the structure of that relationship.

The rules provided by the *Guide* and principles articulated through the Three Rs are a way of understanding how the relationship established in practice deals with the metaphysical

excess in the encounter between human and animal. As an example: when first going to work at this lab, every applicant has to take a training course that includes the Three Rs. Much like the written portion of the driving test, this course is short and easily completed. The relationship between the feeling rules (Hochschild 1983) in the lab and the rules articulated in the *Guide* have a similar relationship to laws and rules about good driving. I may not be able to cite exactly what part of state code says I must park six inches away from the curb or even where I learned to do so, but I obey this rule anyway even if my knowledge of why or how it operates are vague. By looking at the way the rules of care and use of animals are organized, and the what kind of context they establish, hopefully it will be possible to have some notion of how these rules, and the assumptions that lay behind them are also implicated in the emotional labor they seek to manage.

Producing Ignorance and Kinship

The experience of an idiosyncratic affective relation between researcher and laboratory animal is not unique, both in the sense that all kinds of culturally mediated affective relationships exist between humans and different kinds of animals (Haraway 2003, Haraway 2008), and in the sense that objects of all kinds can come to have deep layers of meaning in the lives of human beings (Latour 1999, Turkle et al. 2006, Sheller 2004, Callon 1999). But, unlike others who might be engaged in the intense use of animals like dog lovers, butchers, or circus performers, researchers working with animals are directly and intellectually engaged in scholarship that explicitly generates new questions challenging the ontic boundaries between human and nonhuman. There is an important sense in which Rabinow is right that genetics has the potential

to develop conceptual frameworks that can change society (Rabinow 1992) even if this dream has not yet come to fruition; the idea that biology emerged at the start of the 19th century in *The Order of Things*, (Foucault 1966) depends on new scientific concepts generating ontological forms. If the idea is to explore the affective turn (Clough 2007) in (post)social relation through the emotional framework established by contemporary regulatory apparatus then both the researchers and their research have to be engaged. The researcher must be something different than the classic anthropological informant in an ethnographic monograph.

In order to exploit the emic/etic tension, I want to think of the work performed by the *Guide* in terms of production. A simplistic objection might be raised that a pseudo-legal document like the *Guide* cannot produce anything at all and to say otherwise is to equivocate an analogy with an analogy-gone-too-far. Within this objection, production necessarily implies an exclusively ontic capacity, and so to say that the *Guide* produces a relationship is akin to saying that it brings a new being into the world, something that animals in a lab may do, but certainly not books. Two responses can be brought bear on this objection. The first is that the activity of the document is in part a consequence of trying to understand it in a functional perspective, and that understanding what something is in this way necessitates understanding what it does. For example: what is the function of a chair? Holding someone up from the ground. The chair produces holding in this case.

The second, and more consequential response, is that objects can be seen as epistemically productive. Scientific objects (Daston 2000) like microscopes, equipment in physics experiments (Gallison 1997), or Pasteur's microbes (Latour 1988) are part of the creation of new knowledge and new concepts that have important consequences for human social worlds. The diversity of

ways in which this can happen can be anything from the objects being material instantiations of knowledge claims (Gallison 1997) to weights placed on one end of the lever resting upon the laboratory's fulcrum (Latour 1999). Rabinow's (1992) future revolution of the idea of genetic life is the (projected) result of this kind of productivity. But it is difficult to argue that knowledge production is the outcome of the guiding going on in the *Guide*. Instead, the management of metaphysical excess might better be understood as accomplished by producing not only knowledge, but also ignorance and kinship.

"Doubt is our product," goes the line from infamous the tobacco industry memo, detailing a strategy of avoiding the public identification of cigarettes as carcinogenic, not by denying the link between cigarette smoking and lung cancer, but by working to create the public impression that there was not a scientific consensus on the issue (Proctor 1995, Oreskes 2010). Analytically, ignorance in the tobacco case is more than the absence of knowledge and instead is the outcome of an active choice to create doubt. Historian John Proctor (Proctor 2008) offers this as a case where *agnotology* is the appropriate notion to use. Agnotology, the study of ignorance in its own right, is useful as a concept in the tobacco case because it points to how ignorance can be the outcome of cultural and historical processes, with political and economic causes and consequences. Proctor (1995) demonstrates that the tobacco industry produced ignorance by funding all kinds of scientific and intellectual endeavors and while I do not want to suggest that anything so sinister is operating in the *Guide*, I want to consider how management of metaphysical excess might involve an agnotological aspect as a technical requirement. Ignorance is crucial in at least two ways: the horizon of discovery has to appear in order for new knowledge

to be created (for example, in a grant application arguing for a dearth of research on a given topic) and in order to create a distance between researchers and researched.

The idea of distance between researcher and reached calls for deploying a notion of kinship as a feeling of mutuality of being (Sahlins 2013). In *What Kinship is... and is not!* Marshal Sahlins argues that kinship across human cultures can be defined by a tendency to make what would otherwise be an Other, an integral part of the self. Doing so explicitly rejects the idea that kinship has anything to do with genetic relatedness, decent, or biology at all. A key feature of Sahlins' description is that kinship within this definition is a reduction of the metaphysical distance between kin, thereby creating a feeling that my brother and I are beings of the same flesh. The connection forged through animal experimentation can be understood within Sahlins' notion of kinship: like the claim that my cousin and I share something of our bodies with each other, studying monogamy in prairie voles implicitly links the behavior of the rodents to the experiences of human couples. When a geneticist disagrees with the idea of kinship as mutuality of being, by arguing that genetic relatedness is what forms a basis for differential treatment of conspecifics, she makes meaning out of human and nonhuman bodies. Whether or not kinship 'really is' mutuality of being does not matter so much as the fact that connecting the affective relation in animal research to kinship as culture allows this analysis to go beyond the banal statement that people have emotions that pertain to the work they do or the sociologically naïve argument that scientific progress wholly determines the possibilities for human self-understanding.

To ask by what authority scientists make use of animals is to ask by what means this use occurs. These means are in part the cages, scalpels, restraints and sacrificial chambers that haunt

the antivivisectionist's nightmares as well as the bedding, food, space and veterinary care that cannot in the balance be forgotten. Pushing further though, these means also include that the way that human lives and human action are bound to this authority. Just as there could be any number of ways a locking mechanism might be constructed for a cage, the way this authority binds humans can be imagined to take many forms. The operation of contemporary animal research within the regulatory apparatus of the NIH and the *Guide* mean that the binding of human response through the paradoxical simultaneous deployment of kinship and ignorance is tied to replacement, reduction, and refinement.

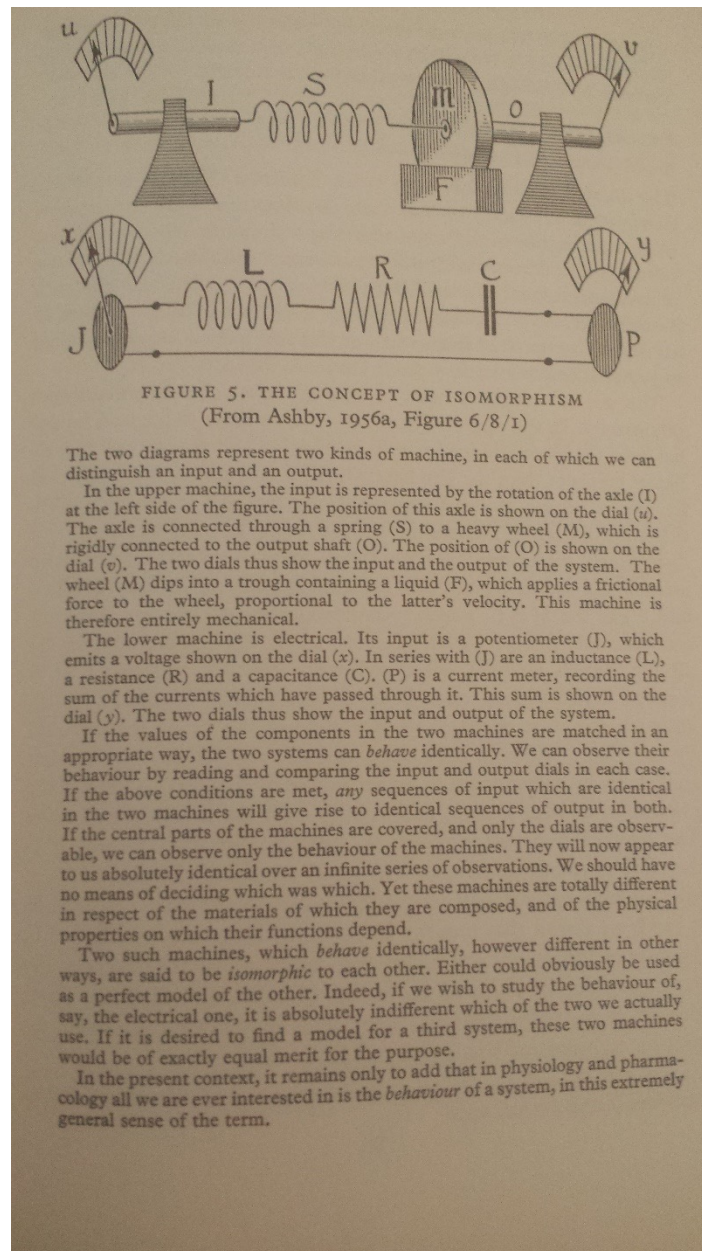
Replacement—Model as Model

“Replacement means the substitution for conscious living higher animals of insentient material,” (Russell and Burch 64) and after dispensing with the feelings of salt and acknowledging the limitation of concern to vertebrates as an arbitrary if reasonable heuristic, Russell and Burch begin by outlining a taxonomy of replacement. Distinguishing between relative and absolute replacement, that is, between “animals... still required through in actual experimentation ... exposed probably or certainly to no distress at all,” (70) and “animals ... not required at all in any stage,” the authors argue that many forms of replacement are already in place throughout laboratory practice. The development of tissue cultures for studying cancer, the use of decerebrated animals in medical exercises, and developments in the analysis by “physico-chemical methods” all seem to point to the “desirability on humane grounds”(74) of replacement. This commonsensical desirability though is “no adequate basis for the systematic and rational extension of replacement” (75) and so demands a general theory of how and why

replacement operates as part of experimental practice. With the integration of the vertebrate organism squarely in focus, the operation of animals in experiments as models provides the basis for extension of this theory.

Given the ecology of laboratory animals in the 1950's where medical bioassay as much as basic research is a matter of concern, the human system is taken by Russell and Burch to be the primary object researchers have in mind even if a frog or fruit fly is the creature under the microscope. But, as they point out, they only perfect model of the human animals is of the "Pygmalion" type, an exact reproduction, as "any other model ... must depart in some degree from the properties of the original (77)." This awareness of the model as model allows for a distinction to be made between fidelity, the "overall proportionate difference" and discrimination, "the extent to which one model reproduces a particular property of the original" (77). Some animals, like chimpanzees, are high fidelity models of the entire human system as a consequence of their phylogenetic position relative to humans, but offer poor discrimination as a corollary of that very fidelity. The power of replacement comes from being able to use 'lower' animals to better discriminate relevant properties of the original/human system and so to escape from the "hi-fi fallacy" (80) that medical experiments must be conducted on 'higher' vertebrates in order to be medically relevant. Instead of this fallacy, Russell and Burch offer isomorphism as a basis to establish a theory of replacement (see figure below), where given two systems with equivalent outcomes, the difference in components is a boon rather than a bane to understanding.

Figure 2—Isomorphism



Conceiving of animal models as isomorphic to the human system puts the paradox of humane experimentation to work. 'Higher' and 'lower' as terms of art can be read as placing a given creature closer to or farther from participation in human mutuality of being, but Russell and Burch complicate matters by making this feeling of kinship also depend upon understanding how the psychosomatic systems of these creatures operate. As such, it is not only the animals that

are the most apparently similar, those who interact most frequently, or occupy nearby phylogenetic branches that are the most metaphysically close, but also those whose physiological properties permit the discrimination of anthropically relevant causes and effects. The value of discrimination, and of animals as isomorphic models, in turn relies on ignorance of individual components of these systems with the aim of better understanding the actions of the whole integrated vertebrate. Replacement as a humane principle and technique of management therefore produces kinship with both the replaced and replacing scientific object and ignorance of the same simultaneously in order to improve understanding. By replacing one creature with another according to this regime one aspect of the relation between researcher and researched, taking at the very least the form of the commonsensical desirability of replacement, is managed and becomes the basis for good science.

Reduction—Sample as Sample

“Reduction means reduction in the number of animals used to obtain information of given amount and precision,” (64) and although this principle has a superficial similarity to a utilitarian’s concern for harming less flesh rather than more, experimental design and statistical inference together are the how and the why of reduction. Just as in replacement, the commonsensical desirability of reduction can be taken for granted, but the movement from heuristic to principle requires describing what is gained in performing a procedure on fewer animals. For Russell and Burch “the subject turns on what is perhaps the central fact of biology—that animals *vary*. (104)” The problem of variance presents a constant threat to the validity of any biology experiment, making the familiar refrain of ‘How large was your n ’ as ubiquitous as

intraspecific variation. This threat is a consequence of the difficulty of knowing exactly how variation between each creature within one experimental treatment will influence the inferences drawn from the outcome of a procedure, leaving the skeptic with the problem of induction (Popper 2014, Hume 2011) as a frustratingly perennial component of his or her arsenal.

As much as one might want to throw increasing large numbers of dead rodents at dead Scottish philosophers until experimental results seems credible, the authors point to reduction because using as few animals as possible forces the experimenter to consider the kinds of controls, statistical or otherwise, are needed to make the results of an experiment useful. In obtaining the dose-responsive curve of a drug, for example (110), even though the coefficient for slope of the curve (a mean) is the parameter researchers are interested in to determine potency, the variance is what determines the reliability of that value. The larger the number of mice drugged, the more likely the sample's variance is good predictor of the population's variance, but doing so will not necessarily reduce or increase the sample's variance. Improving the reliability of knowing the consequences of administering a drug at a certain dose is better served by a smaller sample where the variations in response can be controlled and thus understood. Reduction as a principle of animal experimentation calls for researchers to a reasonably straightforward 'look before you leap' approach to statistical analysis.

Proceeding from this elementary exercise in epistemology and statistics, the simultaneous production of kinship and ignorance in reduction as a principle of humane use can be explained. Conceiving of any data set as a sample from which inferences are drawn and the values that come from that set as a prediction of the population value means that ignorance is produced in choosing when to stop collecting data and not by never collecting it in the first place since within

this formulation, the population value is ineffable rather than ‘merely’ unknown. Even though this conception is not unique to Russell and Burch it means that reduction taken as a principle seems to ask the researcher to be as ignorant as possible in order to understand the causes and control the consequences of variation. At the same time, when variation is the “central fact of biology” (104) understanding the way variation in a particular species occurs according to patterns similar to that of human variation becomes a measure of how like or unlike human, and so how mutually participant in human being, a creature is. Therefore in using as few mice as possible to estimate the potency of a drug, the mice in question must go through a process that has made them simultaneously more and less human and stays firmly within the paradox of humane animal experimentation.

Refinement—Tool as Tool

“Refinement means any decrease in the incidence or severity of inhumane procedures applied to those animals which still have to be used,” (64) and by defining refinement in this way Russell and Burch explicitly link more humane research to better tools: sharper scalpels, more effective analgesics and anesthetics, and modernized husbandry. But the issue in making refinement a principle of humane use is defining what makes for a better tool. The difficulty in doing so, and so why refinement is needed along with replacement and reduction, is argued to arise from what “may seem to be a stubborn residuum of inevitably inhumane study – that of the main forms of distress itself,”(136). The authors’ attempt to overcome this stubbornness begins by setting out two broad, nonexclusive, categories of where refinement can occur, either in the superimposition of procedures applied or in the choice of procedures applied. Considering the

superimposition of procedures means recognizing that no technique or tool exists in a metaphorical vacuum and depends upon the effectiveness of other tools in order to be useful itself. A new method that allows for bilateral adrenalectomy in rabbits in one operation that reduces post-operative mortality (136) would be impossible without antiseptic techniques and effective anesthetic, killing the rabbit before the surgeon can toss her to the neuroendocrinologist for behavioral study. Choice of procedure (and species) means recognizing that the options for addressing a given biological question are neither infinite nor determined; there may be a more effective way of investigating the general biopsychology of fear in vertebrates than the procrustean method of rats in an electric maze.

Russell and Burch's appeal for refinement offers the allegory of an expert machinist in the place of Theseus for defeating chthonic research methods on the path to Athens. Being able to quickly fix a complex machine with a single technical knock of his hammer, he delivers the following invoice (140) when asked to justify being paid 50 pounds for so little apparent work.

Figure 3- Invoice

THE PROGRESS OF HUMANE TECHNIQUE			
queried the amount. In reply, the expert broke down his account into a detailed statement, as follows:			
To administering light tap with hammer	£	s.	d.
To knowing where to tap	49	19	11 $\frac{1}{2}$
	£50	0	0
Great experimentalists have always excelled in knowing where to tap, though unlike this expert they have often left their knowledge at home when engaged in tapping funds.			

What makes for a better tool is one that does not force a scientific object to conform to its requirements and instead is responsive to the qualities relevant to research; the best, most refined tool is the one that makes difficult work look like no work at all. As long as new tools continue

to emerge, the seemingly irreconcilable inhumanity of research into distress itself is direct consequence of the researcher's retreat to familiar tools and failure to find alternative methods. Refinement is a call to do exactly the opposite and that when "violence" is excluded as a refuge "there is perhaps no limit in animal experimentation to the progress of refinement." (153)

This expression of a feeling of hope and a feeling of faith that come from the possibility of better tools is the closest that Russell and Burch come to sentimentality in an otherwise cynical text that offers little sympathy to "the more virulent antivivisectionists" of the "revolutionary" (159) psychological disposition. Here, the operation of the humane experimentation paradox and the place of refinement within the paradox rather than attempting to escape it manages the emotional content of the encounter between researcher and researched, transforming a sense of despair at an inevitable totalizing necessity of using animal suffering to alleviate human suffering into a hopeful feeling that understanding more about animal lives is exactly what allows for the salvation of both human and nonhuman bodies. When the NIH demands that methods be refined, the creation of ignorance by admitting the inadequacy of the current state of a given field is needed to develop a space for researchers to consider novel techniques and tools. Human and nonhuman kinship is likewise produced by this demand as a mutuality of being is an inevitable consequences of novel articulation of the ways that these techniques and tools can connect living bodies to one another. From the moment composing a grant application has begun, refinement thus uses kinship and ignorance to attempt a conduction of prospective students of nature to a place of humility so that when in the midst of the encounter between human and nonhuman worlds the emotional content of the resulting agonism is positive. The possibility of better tools leads researchers to feeling better about the work they do.

Paradox of Authority

In the moment when I hold down the yearling Rhesus to have its blood drawn during a prescribed part of the research protocol, the paradox of humane experimentation appears not as an abstract consideration relegated to less important paragraphs of a grant application, but instead as the practice of holding the monkey itself. The procedure would not be many degrees removed from restraining an unwilling pet (or younger brother) to take needed medicine, yet the imperatives of research and safety considerations involved in dealing with this creature combine to define a specifically instantiated affective relation: fear. It is a double fear, felt by me as the monkey struggles against my attempt to pull it out of the cage and felt by the monkey as it is forced by my hands to lay still. And this affective relation, this fear, is managed by the authority constructed to enable scientific use of the animal, thus allowing me to overcome my fears as the authority of the NIH holds me just as surely as my hands hold the yearling. This haptic encounter is the materiality of the paradox literally at hand; here we find a paradox not of logic or word play but of authority and practice.

Authority in the context of humane animal experimentation paradox therefore can best be thought of as an embodied conduction/conductance (Davidson 2011) of the behavior of the researcher and the researched. In this way, proper conduct is achieved with the researcher deals humanely with the researched and counter-conduct on the part of the researcher (violating approved protocols, adding new experimental procedures without IACUC approval etc) comes into conflict with the authority to use animals in experiments. At the level of the yearling's conduction, authority comes in the form of restraining hands keeping screaming jaws away from the fingers holding the data-hunting syringe. At the level of the researchers behavior it is the

requirement to adhere to the *Guide* and wade through IACUC mandated documentation. For both cases, what is being conducted is not only actions, laboratory budgets, and sharp teeth, but also the metaphysical excess of the encounter. Calling humane animal experimentation a paradox of authority is to say the *Guide* is a conductance of anthropomorphic animal by zoomorphic animal when both humanity and discovery are matters of concern.

As a more-than-one-less-than-two relation between human and nonhuman, the authority to use animals for research as advocated by Russell and Burch and accomplished by the *Guide* reveals a productively unstable and post-social foundation. Understanding authority as the means of conduction, the Three Rs make this authority dependent on the metaphysical excess of interspecies agonism encountered in animal research and a dynamic constitution of the boundary between human and nonhuman that changes in some small way each time a new discovery is made or new technique developed. Further, the shifting boundary is not only a feature of this authority but a requirement as replacement, reduction, and refinement are humane in that they allow for greater future replacement, future reduction, and future refinement. On the basis of the fluidity of these boundaries and the centrality of affect, a post-social form of life operates in the *Guide*, where a set of social relations has been established between human, nonhuman, and object that goes beyond the notion of a purely human sociality. By recognizing the way human authority over animal bodies is dependent on what those bodies are like and how they ‘feel’, the *Guide*’s 2011 edition establishes a modest change in the idea of life itself.

Though the Three Rs approach the fine distinction between banality and elegance, their seemingly simple and aphoristic advocacy of foresight in research design belies a deep, unrelenting feeling of concern engendered by the affective consequences of human and

nonhuman encounters. Arguing that humane research is good science and regulating use of animals accordingly makes worrying about and learning about animals inseparable, but requires an understanding of models as models(replacement), samples as samples(reduction) and tools as tools(refinement) in order to simultaneously create and violate the epistemic and ontic boundaries between human and nonhuman. The humane experimentation paradox is that performing humane research makes that very research inhumane and performing inhumane research is what makes humane research possible; the capacity to inhabit this paradox and so to engage the above boundaries comes about because of each Rs' production of kinship and ignorance. Therefore, the appeal of the Three Rs comes from this productivity as the key to linking humanity and discovery, thereby conducting researchers' behavior to perpetually seek new research objectives as emotional objectives

Works Cited:

Rabinow Paul, "Artificiality and Enlightenment: From Sociobiology to Biosociality." (1992) In Jonathan Crary and Sanford Kwinter, eds., *Zone 6: Incorporations* Canada: Bradbury and Boorne Ltd., distributed by MIT Press pp. 234-252.

National Research Council *Guide for the Care and Use of Laboratory Animals* (2011) National Academies Press, Washington D.C.

National Research Council *Guide for the Care and Use of Laboratory Animals* (1996) National Academies Press, Washington D.C.

Knorr Cetina, K. 1997. "Sociality with Objects. Social Relations in Postsocial Knowledge Societies." *Theory, Culture and Society* 14(4): 1-30.

Knorr Cetina, K. 2001. "Postsocial Relations: Theorizing Sociality in a Postsocial Environment." In Ritzer and Smart, *Handbook of Social Theory*, London: SAGE.

Russell, W.M.S. and Burch, R.L., (1959). *The Principles of Humane Experimental Technique*, Methuen, London
Sahlins, Marshal *What Kinship is --- and Is not* (2013) University of Chicago Press, Chicago

Proctor, Robert and Schiebinger Londa ed *Agnotology: The Making and Unmaking of Ignorance* (2008) Stanford University Press, Redwood City, California

Proctor, Robert N. *Cancer Wars: How Politics Shapes What We Know and Don't Know about Cancer* (1995). . New York: BasicBooks.

Clough, Patricia Ticieneto *The Affective Turn: Theorizing the Social* (2007) Duke University Press, Durham North Carolina

Hochschild, Arlie Russell. 1983. *The Managed Heart: Commercialization of Human Feeling*. Berkeley: University of California Press.

Gross, Charles G. "Galen and the squealing pig." (1998): *The Neuroscientist* 4, no. 3 (216-221)

Galen. Duckworth WLH, Trans. On anatomical procedures, the later books (1963). Cambridge (Mass) Cambridge University Press 1963

Schulte, Samuel. Personal Diary from Oct 2012 May 2013

Haraway, Donna "Teddy Bear Patriarchy: Taxidermy in the Garden of Eden" In *Primate Visions: Gender, Race, and Nature in the World of Modern Societies*, New York: Routledge, 1990. pp. 26-58

Canguilhem, Georges "Experimentation in Animal Biology," and "Cell Theory," in *Knowledge of Life*, New York: Fordham Press, 2008/1952 , pp. 25-56

Haraway, Donna Jeanne. *The companion species manifesto: Dogs, people, and significant otherness*. Vol. 1. Chicago: Prickly Paradigm Press, 2003.

Haraway, Donna Jeanne. *When species meet*. No. 224. U of Minnesota Press, 2008.

Turkle , S., Taggart, W., Kidd, C.D. and Dasté, O. 2006. "Relational artifacts with children and elders: the complexities of cybercompanionship" *Connection Science*, 18:4, 347-361

Sheller, Mimi. 2004. "Automotive Emotions: Feeling the Car." *Theory, Culture and Society*. 21: 221-242

Latour, Bruno. *Pandora's hope: essays on the reality of science studies*. Harvard University Press, 1999.

Callon, Michel. "Some elements of a sociology of translation." *The science studies reader* (1999): 67.

Michel Foucault, "Classifying: What the Historians Say," "Natural History," "The Organic Structure of Beings," and " in The Order of Things, (New York: Vintage, 1996: 1966) pp 125-132; pp. 226-232; pp. 263-279

Health Research Extension Act of 1985, 99. Public Law 99-158 sec 495 Retrieved From <http://history.nih.gov/research/downloads/PL99-158.pdf> Oct 10 2014

"Office of Laboratory Animal Care Guidelines." National Institute of Health, Office of Laboratory Animal Care. August 1, 2002. Accessed October 10, 2014. <http://grants.nih.gov/grants/olaw/references/phspol.htm>.

Daston, Lorraine. "Biography of scientific objects." *Chicago: Chicago University*(2000).

Galison, Peter. *Image and logic: A material culture of microphysics*. University of Chicago Press, 1997.

Latour, Bruno. "Give me a laboratory and I will raise the world." *The science studies reader* (1999): 258-275.

Bruno Latour, "Strong Microbes and Weak Hygenists," and "You will be Pasteurs of Microbes," in *Pasteurization of France*, trans Alan Sheridan and John Law, Cambridge: Harvard University Press, 1988, pp 13-110

Oreskes, Naomi, and Erik M. Conway. "Merchants of doubt." (2010). Stanford University Press

Bentham, Jeremy. *An introduction to the principles of morals and legislation*. Clarendon Press, 1879.

Singer, Peter. *Animal liberation*. Random House, 1995.

"An Act to Amend the Law Relating to Cruelty to Animals," Public General Statutes passed in the Thirty-Ninth & Fortieth Years of the Reign of Her Majesty Queen Victoria, 1876 (London, 1876) 459-464

Davidson, Arnold I. "In praise of counter-conduct." *History of the human sciences* 24, no. 4 (2011): 25-41.

De la Cadena, Marisol. "Indigenous cosmopolitics in the Andes: Conceptual reflections beyond "Politics"." *Cultural Anthropology* 25, no. 2 (2010): 334-370.

Mol, Annemarie. "Ontological politics. A word and some questions." *The Sociological Review* 47, no. S1 (1999): 74-89.

Bacon, Francis. *Francis Bacon: the new organon*. Cambridge University Press, 2000.

Kant, Immanuel. *Groundwork for the Metaphysics of Morals*. Yale University Press, 2002.

Heidegger, Martin. *Being and time: A translation of Sein und Zeit*. SUNY Press, 1996.

Sarkar, S. (1992), "Models of reduction and categories of reductionism", *Synthese* 91:167–194.

Van Valen, Leigh M., and Virginia C. Maiorana. "HeLa, a new microbial species." *Evolutionary Theory* 10 (1991): 71-74.

Hume, David. *An enquiry concerning human understanding*. Broadview Press, 2011.

Thorazine. (2013). In Physicians' desk reference (68th ed.E-book page). Montvale, NJ: PDR Network