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Companion Species and Model Systems: Researcher and Animal Relationships in the Work of Alice Sheldon/James Tiptree, Jr.

Introduction. Alice Sheldon obtained her doctorate in experimental psychology from George Washington University in 1967. She studied visual perception, specifically responses to novel and familiar stimuli by hooded rats in familiar and unfamiliar surroundings. In 1968, she began publishing science fiction under the pseudonym James Tiptree, Jr., and, less famously, Raccoona Sheldon.[1] In her art and the correspondence that sprang from it she advanced ideas developed in the course of her laboratory research that can provide fresh perspectives for feminist ethics around the use of animal models. In this essay, I address the idea, prevalent among her feminist contemporaries and some more recent scholars, that Sheldon's views about biology and her critique of sexism contradicted each another. Sheldon thought that understanding the evolution of sex differences could end oppressions. Her feminist contemporaries critiqued this kind of research as inherently sexist. In contrast, Sheldon believed that it was reductionism that impoverished the research, inevitably producing results that would support, rather than challenge, oppression and maladies. In order to use evolutionary research on sex differences to oppose oppression, Sheldon envisioned doing a different kind of science. She ceased research because she could not enact this vision, and turned to science fiction in part to further explore her ideas.

The promise and problem of model systems: Reductionism. Model organisms are housed, treated, bred, and otherwise standardized to minimize variation among the animals tested; at the extreme, they are genetically engineered animals produced for very specific work. Their use is common practice in many fields of medical and biological research, including psychology and other behavioral fields, for several reasons. First, reducing variation allows scientists to perform research without concern about confounding results.[2] Second, ethics rules written for models permit experimental treatments that may be considered unacceptable with regard to other species. Third, model systems reproduce quickly and are easily maintained in large numbers. This provides quick results and enables researchers to follow lines of inquiry through multiple generations, to modify experiments, and to compare outcomes over a relatively short time frame. The use of models is based on the assumption that

identified mechanisms are generalizable across species, as long as they share significant traits with the model. A few organisms provide most data in large part because techniques for managing them in the laboratory are well developed; using other species would require changing techniques, which is costly. (See Lewis et al. for further discussion of model selection and of difficulties in using new models.)

One of the tenets of models-based research is that the study of species considered "simple" under controlled circumstances produces new knowledge. Scientists employ model organisms to simplify complex systems, as, for example, by working with a rat, which they believe has fewer interacting parts than humans, to determine how humans might react to certain stimuli. The tight control of factors in the lab makes it possible to consider processes of focus in isolation. Sheldon believed the assumption that such research produces information about mechanisms applicable either to a target species (such as humans) or to a range of animals is problematic for a number of reasons. She critiqued the overreliance on data from species that were selected because they made good models for employing reductionist methods, as well as the assumption that conclusions gained from the study of these species, in tightly controlled laboratories, can be generalized beyond those environments. Similar objections are being raised by scientists today (see, for example, Zuk et al.).

The point of minimizing or controlling variation, except in areas specific to the research question, is to allow for repetition, and to isolate the impacts of the experimental intervention in a common circumstance (i.e., an organism of a genetic type). But variation is an important biological concept. Types and levels of variation include variation among members of a species and variation in how individuals display certain traits due to their external circumstances. The latter may include the peer animals they find themselves among, the risks they perceive, their options for mating, and their available resources. Phenotypic variation — that is, the manifestation of genes in an organism's innate traits — is understood as manner in which an organism's environment mediates the expression of its genetic structure, including behavioral expression.

Birke, Arluke, and Michael argue that the reduction of variation in experimental regimes is problematic for two reasons: 1) because species that are more variable are not used, researchers learn about only certain types of species, and 2) laboratory species differ from their wild counterparts, because they are bred to reduce "natural" variability, an important component of wild populations (39-42). Extrapolations of findings from models to target species tend to ignore these issues. As Birke and her

colleagues argue, since nature is variable, scientists experimenting with model-species cannot claim to study it. Experiments on homogenized animals cannot be generalized to variable humans or animals that are not bred for standardization (47-51).

Fehr, however, makes a distinction between reliance on reductive methodologies and the search for mechanisms, defined as "causal processes" (138).[3] She does not argue for the abandonment of reductionism, which she describes as "the view that things in the universe are arranged hierarchically, and that causation only occurs at the lower levels of this hierarchy" (137). Rather, she calls for the inclusion of non-reductive methods that scientists have neglected, and for the recognition that causation can occur at multiple levels of organization and interactions among them (e.g., variation in hormone levels as a result of an organism's environmental context). Fehr employs feminist analyses of the assumptions behind reductionism to argue that the search for mechanism is only problematic if it is always reductive. Rather than always seeking explanations by breaking things down into small pieces, Fehr argues that researchers should consider how different interactions among the component parts might affect the phenomena under investigation. This shift in attention to "higher level and interlevel mechanisms makes it possible to conduct research that pays attention to context and complicated causal situations" (154).

Fehr argues that researchers should use a plurality of methods for the task. She challenges the privileging of reductive mechanisms, wherein "wholes are explained in terms of their parts" (137), maintaining that non-reductive scientific methods can be used to find mechanisms operating at higher organizational levels. She posits also that this privileging of reduction results in the neglect of those areas of study that are not easily reduced to component parts, of the impacts of context on mechanism. As Fehr puts it, "[b]y focusing only on tiny parts, relationships between the phenomenon and a greater whole are lost. Possible higher level causal influences that may affect the phenomenon disappear and become inaccessible to investigation" (142). Reductive approaches lead to the belief that the "tiny parts" will always produce the mechanism in question, regardless of context (143). I argue that Sheldon also called for non-reductive mechanisms, for similar reasons.

Sheldon's discomfort with reductionist philosophies led to her eventual disillusionment with science, and to write science fiction in order to theorize non-reductive methodologies. Her vision of science as a potentially feminist tool to end oppression placed her at odds with many of her feminist contemporaries, and led later critics to describe it as self-contradictory. Understanding Sheldon's critique of the reductionism

that was embedded in the theoretical and methodological debates surrounding the study of behavior at the time of her active research is the missing piece for resolving this apparent contradiction. Behaviorism focuses strictly on observable units of behavior, and its proponents believe that actions undertaken by animals can be understood without a need to refer to what is going on inside the animal, and specifically without accounting for constructs such as mind. Behaviorism focuses on learning, and sets aside processes such as emotion and cognition. Although it has fallen out of favor recently, behaviorism dominated the psychological research of Sheldon's time.

Sheldon described the completion of her graduate work as "the most thrilling moment I have ever had in my whole life" (Phillips 206). Yet she would recall, "I kept having ideas that didn't jibe with the official academic outlook at my department" (Tiptree, Meet Me 311). Sheldon believed in holistic models, which treated animals as complex, and which, therefore, could be applied to significant, complex questions of behavior. The protagonist of her 1976 story, "The Psychologist Who Wouldn't Do Awful Things to Rats," Tilman "Tilly" Lipsitz is, as Sheldon had been, an engaged, idealistic PhD of experimental psychology. He is passionate about learning about his model organism, the rat, and the idea that he can use this knowledge to better human conditions. He is disillusioned because no one else seems to share his vision.

In his analysis of scenes of cruelty in "The Psychologist Who Empathized with Rats," Elms argues that Lipsitz's "observations and emotions regarding his colleagues and his research animals express those of Alice Sheldon" (89). I believe that Sheldon's critique goes beyond expressing discomfort with, as Elms describes, "the treatment of small or relatively weak animals" (90). Lipsitz exemplifies Sheldon's utopian vision for the possibilities of science. The passion with which Lipsitz considers his opportunities to learn matches Sheldon's own. Both Sheldon and her character accept the use of animals as research models in laboratories, but they seek ethical use of animals, which is linked to their pursuit of non-reductive methodologies. This pursuit puts Lipsitz at odds with the dominant paradigms and researchers in their fields, much as it did Sheldon. In "The Psychologist," Sheldon hints at an alternative way of interacting with model systems, one that emphasizes the relationship between researchers and study animals, and uses their interactions to develop new methods and research questions. Pessimistically, she presents the most extreme, dismal possible outcomes in the story — utopia never materializes. By showing why this vision fails, she explores what generates conditions for cruel treatment of animals.

The context of Sheldon's research career: theories, methods, and models. Sheldon obtained her psychology bachelor's degree from in 1959, and her experimental psychology PhD from George Washington University in 1967. During this period, her field was deciding how to select model systems, what they should be used to illustrate, what assumptions should be made about their application, and how best to understand their applicability to a broader range of species. Researchers discussed publicly several issues on which Sheldon reflected in both her fiction and nonfiction.[4] Since Sheldon's sole 1969 research publication appeared in the *Journal of Comparative and Physiological Psychology*, and did not address physiology, I will focus on how comparative psychologists saw these issues, since the other two groups concerned with these issues — physiological psychologists and behavioral psychologists — had less bearing on Sheldon's interests.

Comparative psychology emphasized research using model species from which findings could be broadly generalized to identify general principles, especially those related to humans and focused on learning. Ethology, by contrast, aimed to identify principles of animal behavior, especially as applied to animals in the wild, although they too relied on model organisms.[5] Ethology and comparative psychology share a common origin in the work of Darwin and other 18th- and 19th-century natural historians. Anthropomorphism, the use of human subjective experience to define animal reactions, was grounded in Darwin's arguments for continuity between animals and humans. Researchers' assumptions about the relationship between human and non-human animal behavior changed as different theoretical paradigms became prevalent (reviewed in Watanabe).

Eileen Crist argues that naturalists in Darwin's time allowed for animal intentionality, and in their writings constructed life-worlds with meaning for their animal subjects. In the quest to make their field a mature, respected science, ethologists abandoned this meaningful view of animal minds, and instead adopted a "technical-causal language" that inadvertently promoted a mechanomorphic view of animals as "mindless" (Crist 203–04). Crist posits that the claim that anthropomorphism is biased rests on the assumption that animals are not like humans, an assumption that has had consequences for models of animal behavior.

Crist focuses on field studies, and thus does not specifically critique comparative psychology. Her work does provide, however, an overview of the driving forces, specifically higher valuation of reductive methods, that impacted that field as well.[6] Most (primarily North American) comparative psychologists differed from the majority

of (primarily European) ethologists in that the former focused on laboratory studies and the role of learning in behavior, while the latter focused on field studies and instinct. During the post-World War II period, the influence and institutional standing of comparative psychology waned, while that of ethology grew, culminating in the 1973 Nobel Prize awarded to Nikolaas Tinbergen, Konrad Lorenz, and Karl von Frisch.

One reason for this may have been that some comparative psychologists adopted an ethological critique of their field. Comparative psychologist Frank Beach's 1949 presidential address to the Experimental Psychological Division of the American Psychological Association exemplifies this trend. Beach pointed out that, although mammals account for only a tiny percentage of the world's animals, they account for the overwhelming majority of the species studied. He questioned the emphasis on learning, arguing that comparative psychologists had not adequately defined learning, and therefore were categorizing any number of complex behaviors that might significantly differ as simply "unlearned." In short, he asked, "[A]re we building a general science of behavior or merely a science of rat learning?" (Beach 121). The then-dominant white rat, he pointed out, had been adopted for use in behavioral studies because it was already being used in laboratory research, not because it was especially suited to the types of questions about behavior that were being asked.[7] Such critiques reflected the influence of ideas prevalent in ethology, and indicate a permeable boundary between the two fields. Examining the overlaps and flow of information between the two fields, Dewsbury shows that the distinct "origin myths" (Dewsbury, "Comparative Psychology" 208) of the two approaches reflect the psychologists' explicit goal of challenging their fellow comparatists to broaden their approaches in the hopes of improving their field's reputation for offering excitement to researchers and catching up to ethology in the matter of institutional support.

Sheldon's training began during this period, and her views reflect Beach's urgings to adopt a more ethological perspective. She felt that, as Lipsitz muses about his research in "The Psychologist," rats might be an effective model for understanding general principles about aesthetic senses that would transcend species and could also be applied to humans (Tiptree, "The Psychologist" 675–79). Lipsitz "wants to explore the capacity of animals to anticipate, to gain some knowledge of the wave-front of expectations that they must build up, even in the tiniest heads. He thinks it might even be useful, might illuminate the labors of the human infant learning its world" (679; italics in original). But Sheldon also had a love for field research. In addition to her formal research on visual perception, Sheldon observed and experimented with wild animals near her home. Phillips posits that she "would have been perfectly at home as a

female Darwin: one of the great Victorian naturalists, with a capacity both for observation and for original interpretations of behavior" (199). Thus, in addition to valuing rats as models, she was interested in their behavior, and that of other animals she encountered, as beings (204–05).

Sheldon also appreciated her laboratory rats as a species. She acknowledged their wild origins and how this might impact their behavior, especially in terms of how they would prefer to live, yet she recognized that they differed from wild species, so that results from laboratory research could not be used to explain fully what wild animals might do. She uses Lipsitz to reflect on how the evolutionary history of lab rats interacts with their behavior when he places their cages in a dark alcove to simulate the "friendly dark warm burrows" of "nocturnal rodents," because he "sensed their misery, suspended in bright metal and Plexiglas cubes in the glare" ("The Psychologist" 674), attributing what Elms terms "human feelings" to the rats (89). Yet Lipsitz notes the impact of human interference, as "they're so genetically selected for tameness they can't survive in the feral state" (674). As Elms has noted, Sheldon's selection of research projects for her rats largely paralleled Lipsitz's (89).

The emphasis on reductionism reached an extreme in the dominance of behaviorism as a theoretical framework in psychology between World Wars I and II. Behaviors could be reduced to mechanisms applicable across species. Thus, it was possible to base theories of human behavior on experiments with animals, and animals became a model by which to understand human behavior. Under the assumption that animals were less complex than humans but obeyed the same general principles, they could be used to identify mechanisms in the lab. Behaviorism relied especially on the laboratory rat to elucidate these broad principles.

Lyman-Henley and Henley provide a cogent discussion of the key differences among behaviorism, comparative psychology, and ethology that are especially relevant to Sheldon's positioning of herself and her animals in her research. They distinguish three approaches in terms of their reasons for studying animals. Psychology's goal is to arrive at "general principles that are intended to lead ultimately to an understanding of (human) behavior — using its (animal) subjects as a means to that end," and ethology's emphasis on "the naturalistic behavior of the animals under study in their own right — regardless of species" (Lyman-Henley and Henley 19). They note the impact of behaviorism on the development of modern psychology, but argue that its emphasis on "the phenomena of learning and behavior, and animals per se … for reasons of scientific expediency and never for the study of their unique natures" distinguishes it from the

broader study of comparative psychology (17; emphasis in original). Behaviorism, moreover, focused solely on the units of behavior that can be observed, quantified, measured, and set aside as unobservable mental processes, including cognition, emotion, and so on. By contrast, comparative psychologists were less willing to abandon studying such things as intelligence and consciousness. Overall, "for the comparative psychologist the focus was then not so much on the phenomenon (as with behaviorism) exclusively, but on the phenomenon examined comparatively" (18). Sheldon described behaviorism's theoretical models as those in which "the animal doesn't do anything nonobservable like thinking or even perceiving" (Tiptree, *Meet Me* 358). In her own research, she tried to address this complexity. While prevailing theory presumed that novel stimuli attracted animals. Sheldon proposed an alternative model: "if you want to see real animals in the real world, you don't go out and present them with maximum novelty. You go where they are and try to look like a bush" (358–59). In her dissertation and her 1969 research publication, Sheldon theorized that an animal's attraction to novelty would depend on context, and her investigation found that an animal's attraction to novel stimuli was a function of the familiarity of the environment — in a familiar environment rats sought out novel stimuli; in a new environment, they avoided it.

Although some of Sheldon's influences were considered behaviorists, they recognized the impact and importance of mental processes outside the observed units emphasized by most behaviorists.[8] Edward Tolman taught Sheldon's first psychology class; he was a professor Dewsbury categorizes as a cognitive psychologist, in that he focused on "the mind's functions such as perception, attention, memory, imagery, and decision-making [and] focused on phenomena that appear to require the postulation of 'higher processes' than basic learning and memory" (Dewsbury, "Some Historical Trends" 8). In an early paper, Sheldon aligned herself with Tolman as a believer in complexity (Elms 82). She also corresponded with and copyedited a book for Rudolph Arnheim, who linked psychology and art (discussed by Elms and Phillips). Although they critiqued behaviorism's reductionism, they did not, however, oppose the use of model systems or research itself. Sheldon, in particular, saw ethics, the treatment of animals, theory, and model systems as linked. She used work such as "The Psychologist" to explore how a reductionist approach led to both cruelty and impoverished research.

Pragmatic solutions: Ethico-onto-epistemology and companion species. In *Meeting the Universe Halfway* and other works, Karen Barad argues for the "entanglement" of knowing, being, and ethics in what she terms the "ethico-onto-epistemology" of "agential realism," positions she considers inseparable. Like critical-science-studies

theorists such as Donna Haraway, Barad aims to grant agency to non-humans. She echoes the common argument in science studies that critiques of science based in social construction envision nature as a passive, immutable object to which cultural forces assign meaning and significance. Barad notes that social construction, ironically, shares certain assumptions with realism (the belief that science "objectively" reflects nature as it is) that privilege human activity. Realists and social constructionists differ as to "whether scientific knowledge represents things in the world as they really are (i.e., 'Nature') or 'objects' that are the product of social activities (i.e., 'Culture'), but both groups subscribe to representationalism" ("Posthumanist Performativity" 806). Representationalism assumes that there exists a static, separate nature "out there" that is represented or described by humans using words and other data.

Barad and Haraway see representationalism as a reflexive way of envisioning the science/culture interaction. For example, a realist metaphor might describe science as a mirror reflecting the nature out there, and a social constructionist metaphor would use the image of a lens, in which human social activities and processes might magnify or distort the image of nature. Barad and Haraway call for the replacement of reflexivity and associated reflective metaphors because they are based on reproduction or modification of something that putatively exists independently of the tool used to view it.

In *Meeting the Universe Halfway* Barad proposes an alternative: the notion of a diffraction grating through which light passes with no reflection. This passage divides the light into components, such as waves. However, this division is not a preexisting static condition (like the image-production process in reflection). Rather, the interaction between the structure of the grating itself (specifically the number of slits) and the light creates the pattern. Thus, the diffraction grating emphasizes the "entanglements" that Barad wishes to identify, instead of reinscribing the division between the knowing subject and the natural object under scrutiny upon which reflexive/reflective imagery relies.

Barad grounds her argument in a reading of physicist Niels Bohr's notion of complementarity. Determining position requires an experimental apparatus with fixed parts. Measuring momentum requires an apparatus with movable, instead of fixed, parts. It is impossible to measure momentum and position simultaneously (Barad, *op. cit.* 814). Theoretical concepts like position and momentum are not ideas; instead, they are specific physical arrangements: "'[P]osition' only has meaning when a rigid apparatus with fixed parts is used (e.g., a ruler is nailed to a fixed table in the

laboratory), thereby establishing a fixed frame of reference for specifying 'position.... [A]ny measurement of 'position' using this apparatus cannot be attributed to some abstract independently existing 'object' but rather is a property of the phenomenon — the inseparability of 'observed object' and 'agencies of observation.'" Position and momentum cannot exist without the pieces of equipment used to measure them; thus, they are integrated with the apparatus rather than independently existing. In other words, there is a causal relationship between experimental apparatuses and phenomena being studied, which she calls "agential intra-action." Barad argues that "*practices of knowing are specific material engagements that participate in (re)configuring the world*" and, thus, "objectivity cannot be about producing undistorted representations from afar; rather, objectivity is about being accountable to the specific materializations of which we are a part" (*Meeting the Universe* 88–91; emphasis in original). Unlike mirrors or reflective tools, the structure of the apparatus used in diffraction participates in the produced pattern. Diffraction gratings are specifically designed to produce particular patterns, and the patterns and gratings do not exist independently; rather, they are entwined.

As one demonstration of ethico-onto-epistemology and agential realism, Barad concludes her book with a chapter discussing nanotechnology. This chapter opens with a description of early nanotechnology experiments in which scientists were able to manipulate individual atoms to form the IBM logo. She argues that changing views of the atom — from nature's smallest, indivisible unit, to heuristic models rather than actual objects, to particles that can be physically manipulated and subdivided — do not mean that "the earlier images were wrong and we know better now, or that atoms are but social constructs that change as our ideas change" (Barad, *Meeting* 354). Scientists investigating the cause of streaks that obscured images the scanning tunneling microscope (STM) produced realized it could move atoms. They realized that by changing the properties of the STM, they could switch between imaging and moving modes. Thus, "imaging and manipulating are complementary" and "exclusive modes of operation" (358). The atom can either be part of the image surface (image mode) or part of the apparatus tip (manipulation mode). Similarly, the human and the non-human intra-act in complex "entanglements," which produce various knowledge objects. The fact that the atom is both the "object" under scrutiny and part of the "agencies of observation," depending on the configuration, shows the entanglement of ontology (being) and epistemology (knowing), in that these are fluid, rather than being fixed preexisting objects. Separating them creates a false dualism.

Similarly, the laboratory rat can be seen as part of the apparatus of the experiment and as the data or pattern produced by the experimental intervention. Sheldon recognized that laboratory rats existed as entities in their own right, as well as part of her experimental apparatus. However, she recognized that laboratory rats are not wild rats (Sheldon emphasized this by claiming her results only applied to the laboratory species); they would not even exist were it not for human intervention.

Birke, Bryld, and Lykke argue that scientists and science-studies critics, including some who consider themselves feminist, erroneously see animals as static, with completely biologically determined behaviors. Birke, Bryld, and Lykke argue that even the most standardized laboratory species can exhibit flexible behaviors, determined by context, genetics, hormones, and other biological processes. This flexibility impacts the outcome of experiments. In the sense that researchers continually adjust and adapt laboratory techniques and research to account for this inevitable variation, model organisms can determine the direction of research. For example, laboratory rats are often bred for docility, and handling techniques have to account for minimizing stress, which might affect results. Holmberg adds that some researchers are better at handling animals than others; thus, the human-animal interaction itself is a source of difficult-to-control variation: "[E]ven in the most highly standardized technique there must be room for individual interpretation and practice to make it work across different laboratories," leaving some room for variation in the intra-actions between laboratory humans and animals ("A Feeling" 332). The biology and sociology of model species shapes the development of researchers' tools, and research is a product of the interaction between researcher and animal, occurring in the context of other societal forces. Ultimately, Birke, Bryld, and Lykke advocate for scientists to recognize "nonhuman otherness as a doing or becoming, produced and reproduced in specific contexts of human/nonhuman interaction" (169), rather than to assume that the models are expressing constant forms of behavior.

This argument exemplifies agential realism and highlights the intra-actions and entanglements among theory, method, apparatus, researcher, and the other aspects of doing behavioral research with living — human and non-human — participants, both model and researcher. It demonstrates how models have agency and influence the outcomes of experiments. Sheldon similarly recognized the individuality of standardized laboratory animals; this is especially apparent in the whimsical drawings she included in her publications. From the rat's eye view, the drawings showed what the rats would rather do than perform the experiment (described and reprinted in Elms; some of these drawings, credited to Raccoona Sheldon, appear in "The Psychologist.")

Instead of finding the rats' agency an impediment to her research, Sheldon responded with humor and interest. She anthropomorphized the rats as a means of clarifying her perspective on her research question for her reader. Another drawing, intended to invite the reader to empathize with the rats' situation when making her point about novelty, shows two anthropomorphized rat families at home. In each one, a rat in a comfy chair smokes a pipe. A young rat plays with a toy on the floor of each room. Each rat house has a different painting on the wall. The next panel shows the rats entering an art museum and the final panel contrasts the visit — both paintings are on the wall, and each rat family goes to the painting from their home — illustrating her hypothesis that animals will seek out familiar stimuli in a novel environment (discussed further in Elms 86).

Sheldon's drawings provide a visual example of how she saw the entanglements among ontology, ethics, and epistemology through the configuration of the experimental apparatus. The apparatus most associated with behaviorism is the Skinner box, in which an animal is constrained and given a choice between two tasks (generally pushing a lever) and associated rewards (food) or punishment (electric shocks).[9] This becomes a representation of the animal as a black box, because the triggers produce behaviors based on pain or pleasure responses, and no appeal to any mental process (cognition, emotion, etc.) is needed. The apparatus itself, by its design, excludes these mental functions from among the phenomena under investigation. In contrast, Sheldon's apparatus—designed to make an animal's environment either distinctly novel or familiar and to examine responsiveness to familiar and unfamiliar stimuli in each context—and especially her imaging of the animals in her drawings emphasize comfort, aesthetics, humor, and other high-level processes.

Further, Sheldon uses Lipsitz to show how the interaction between the rats and the apparatus in ways the experimenter did not expect can lead to new research directions. In a conversation with his advisor, Lipsitz shares the same drawings (here credited to Racoona Sheldon) that Alice Sheldon included in her dissertation to show what the rats would rather do instead of following her experimental protocol. Lipsitz argues to his skeptical advisor that differences between hamsters and rats in their behavior in an open field can be explored using an apparatus in the lab to examine thigmotaxis, that is, how "the animal responds to edges and the shape of the environment" ("The Psychologist" 676). This clearly indicates that Sheldon had not given up on using animals to explore aspects of aesthetics in terms of perception of and reaction to environmental features. The whimsical drawings in "Figure 18. Examples of thigmotaxic response" show rats engaged in "shadow-crouching," "crack-following,"

and "rear-end-anchored locomotion" (677). Lipsitz places this concept in the history, rather than in current practice, of research on animal behavior, saying "[t]hey used to call it thigmotaxis" (676). This indicates that Sheldon encountered the concept because of her interest in the behavior of non-human animals, specifically their behavior in the wild, as the concept was no longer of interest to the field at her time. In the time-pressed environment of the laboratory, animals that exhibit behaviors not directly relevant to the research question at hand (in the case of this experiment, the rats were expected to go down one of two branches of a Y-maze—either toward a familiar or a novel object) are generally discarded from the dataset as outliers. Sheldon's, and Lipsitz's, ability to watch, to record, and to see their subjects' interaction with the apparatus as theoretically meaningful allows the concept to re-emerge as a research question of interest, exemplifying agential realism.

Since the laboratory rat is a living apparatus, Sheldon was particularly concerned about ethics, which she felt was at the forefront of the entanglement. Sheldon's ethical imperative is on display in her desire to provide familiarity and comfort, where possible, within the construction of the research apparatus, including experimental design. She aimed both to comfort her subjects, where possible, and to study something that reflected her observations of wild animals. She recognized that animals in nature would be made uncomfortable by their constraint in the lab; thus, her desire to provide comfortable surroundings reflects not just an ethical imperative to treat animals well, but also a foundational belief about what good research requires. It illustrates that she saw the ethical and methododological questions as integrated in the formation of the entire theoretical structure. Centralization and standardization of animal care regulations had only just begun in the United States at the time when Sheldon entered the lab; individual researchers had long determined animal care.[10] According to Phillips (205), Sheldon's graduate advisor stressed, after the publication of "The Psychologist," that his lab did not allow the atrocities described therein. Even so, her scientific work likely made her aware of cruelty in other places.

Like Sheldon, Donna Haraway calls for ethical treatment of animals, yet disagrees with those who seek to end the use of animals in experiments. Haraway argues that suffering and killing are inevitable components of relationships among human and non-human companion species, "a species in obligatory, constitutive, historical, protean relationship with human beings" (*Companion Species* 11-12). She qualifies that relationship as "not especially nice; it is full of waste, cruelty, indifference, ignorance, and loss, as well as of joy, invention, labor, intelligence, and play" (12). She rejects ranking systems that set ethical criteria for acceptable suffering and killing because these calculations rely on

"hierarchical and dualistic ranking schemes" that position some animals (and some humans) as "Other." She describes these criteria as in conflict with feminist challenges to oppression, because ranking systems allow some animals and people to become "killable" and "dead things" (*When Species Meet* 72–73). Making some types of suffering, or the suffering of some, acceptable in all cases opens the pathway to more suffering. Haraway accepts the inevitability of suffering, but rejects the acceptability of any; instead, all suffering must be minimized. Her approach requires thinking about each case of animal experimentation, rather than adopting an all-or-nothing approach based on characteristics of a group. Empathy from those inflicting the suffering does not mean that causing suffering is less wicked; instead, it "may" be forgivable (75). Researchers should provide, as much as possible, positive living environments and conditions that meet a subject species' needs and preferences, even if it complicates handling techniques or makes the reduction of variation impossible (88–93).

Haraway's argument that suffering and killing is inevitable, but always unacceptable, that no classes of creatures are inherently killable, though some may be killed, and that infliction of suffering must be weighed carefully and minimized, provides a feminist ethical framework for thinking through the complexities Lipsitz faces. Tora Holmberg revises and extends Haraway's position with the concept of mortal love, theorizing people's relationships with animals they must harm or kill. Both authors present positive relationships between experimental animals and the scientists and technicians who experiment upon them. They argue that these relationships provide feminist conditions for animal experimentation. Holmberg applies a feminist ethics of care to the relationships between technicians and laboratory animals — specifically to the contradiction between caring while inflicting suffering, or even killing. She finds that "caring and killing seem to be more closely linked" for most of her respondents, in contrast to the few who cope with their task by objectifying animals ("Mortal Love" 157). Lipsitz lives up to Holmberg's three principles for euthanasia or "killing well": 1) attending to the animal's comfort and peace during its life and death, 2) practicing and refining equipment, methods, and apparatuses, and 3) ensuring that only those who can minimize distress to both animal and experimenter kill (*ibid*.).

Lipsitz works to better his own animals' conditions, as well as those of animals mistreated by his colleagues. He provides shredded newspapers to cover the bare wire in pregnant rats' cages, even though the sterile cages allow for faster care and uniformity, showing compassion that his co-workers do not. Lipsitz's colleague Jones, for example, places probes inside the heads of dogs. When the animals bloody their heads by scratching against the wire, Jones puts plastic collars around their heads so

that they can't reach the wire instead of trying to alleviate their discomfort. In another instance, Lipsitz rescues a colony of rats that was scheduled for euthanasia.

In many ways, Lipsitz crosses a division of laboratory labor described by Birke, Arluke, and Michael, with research scientists delegating unpleasant tasks — such as culling or killing to control the number of animals — to technicians. In response, technicians blame "scientists' lack of adequate planning" (Birke, Arluke, and Michael 101) for the need to cull. Like Lipsitz, the technicians perceive themselves as a "buffer" (103) between the animals and other researchers. In one case, Lipsitz euthanizes a dog a colleague has vivisected and left alive over the weekend. He knows the colleague intentionally prolonged the dog's suffering as part his experiment and may therefore be angry with him. But Lipsitz considers his responsibility to end the animal's suffering as a higher priority than his collegial responsibilities to support, or at least to ignore, his colleague's research methods. But he does not confront his colleague directly, and he wonders whether the colleague knows who killed the dog. This indicates that, like the technicians Birke, Arluke, and Michael interviewed, he sees himself as lacking the power to change the parameters of the research. He does what he can within his relatively powerless sphere. He does try to explain the need for more humane experimentation to his supervisor, but fails. Frustrated, Lipsitz proposes to his supervisor that he study why psychologists are so attracted to cruelty in their research questions. His supervisor accuses him of having "emotional problems" and a membership in the Society for the Prevention of Cruelty to Animals, and threatens to dismiss him ("The Psychologist" 678).

Lipsitz's supervisor accuses him of not being a professional scientist. He uses the definition of professionalization Birke, Arluke, and Michael supply: "learning to distance oneself from the animal as animal and learning to approach it more as a laboratory tool" (11). These authors document strategies that professionals use to justify inflicting pain and death on animals, including emotional hardening to create distance from feelings and justification of both pain and death through a valorization of the pursuit of knowledge for the sake of knowledge. In contrast, Lipsitz's ideal model of science is fully integrated with his commitment to treating his animals kindly. He harbors an "unfashionable yearning to learn by appreciation, to tease out the secrets with only his eyes and mind" instead of "with acids or shock" ("The Psychologist" 674). Although he accepts the need to euthanize his animals on some occasions, he seeks to do this humanely, and even to go beyond the basics of providing a pain-free death.

After his supervisor delivers an ultimatum that he develop a different, more profitable project or lose his position, Lipsitz fortifies himself with absinthe and goes to kill his rats. During the kill scene, Lipsitz feeds his rats carrots and then tries to kill them humanely, placing each rat in a separate jar with "an ether pad under a grill to keep their feet from being burned" by the chemicals (682). Lipsitz's experience of the deaths is filled with interactivity, compassion, and respect. It costs him dearly; if he objectified his animals, instead of seeing them as individuals, he would not suffer from their deaths.

Lipsitz refuses to use the term "sacrifice," which his colleagues favor. He reflects: "'The subjects were sacrificed.' They insist on saying that. He has been given a lecture when he called it killing. Sacrificed, like to a god. Lord of the Flies, maybe" (680). Birke, Arluke, and Michael note "sacrifice" among the euphemisms that appear regularly in written reports of research results. They describe the term as helping the writer cope by linking the death of the animal to the experiment's larger purpose (Birke, Arluke, and Michael 100). Lipsitz, however, questions the value of his colleagues' experiments, and that feeds his objection to animal suffering. He doesn't believe that the kinds of research questions that his colleagues ask warrant the type and number of deaths they cause. He recognizes that the euphemism obscures the researchers' moral responsibility for killing and allows them to avoid an empathetic response. The construction his colleagues prefer uses the passive voice, thereby avoiding ascribing the killing to anyone's agency. Moreover, the term "sacrifice" implies that the deaths served a greater purpose, while Lipsitz reflects, "[b]ut what the hell are they all working on? Reinforcement schedules, cerebral deficits, split brain, God knows only that it seems to produce a lot of dead animals" ("The Psychologist" 680). His colleagues are hardened to animal suffering and do not suffer themselves when they inflict pain.

The story is most critical of research that is disengaged from social problems and oriented toward addressing abstract questions, regardless of the pain it inflicts. His supervisor chastises Lipsitz for "frittering away [his] time and funds" (676) because he does not think that Lipsitz's desire to understand rat behavior will produce a significant payoff. Additionally, Lipsitz's goal of conducting societally significant research to better the lives of children is not in line with those of his colleagues, who deride research questions that focus on applied problems. Lipsitz cannot align his efforts with his peers' goals, leading to guilty reflection about "what he should be doing, he with those thousands of government dollars invested in his doctorate, his grant" (680–81). His sense of duty and responsibility toward those who have funded his work drives his

misery. This contrasts with his colleagues, who prioritize theory-driven work to answer broad questions; in general, more applied research is less prestigious.

Yet, even Lipsitz's colleagues sometimes see value for their research in his skill in handling rats. While they view his abilities "somewhat scornfully," they ask him to handle their animals because his skill makes the task easier (674). Lipsitz attempts to train his colleagues to empathize with their animals. He uses the example of a bite to try to get them to understand the rats' point of view: '"It can't let go,' he tells them. 'You're biting yourself on the rat. It's the same with cats' claws. Push, they'll let go. Wouldn't you if somebody pushed his hand in your mouth?'" (675). This is based on his observation that rat teeth and claws are curved like a fish hook—pulling against the hook will only embed it more deeply in the flesh and result in more damage. Lipsitz even uses his example from the rats' point of view to empathize with his supervisor. Although he resists the supervisor's instruction to kill his rats and move to another research project, Lipsitz wonders "Am I biting myself on him?" He "involuntarily" empathizes with '"the chairman's unknown problems" (ibid.).

Lipsitz's empathy is one of his defining traits and is, in fact, what makes his integration into the laboratory so difficult. Sheldon links the sterility of the laboratory space with a sterility of attitude, in which compassion and empathy toward animals represents a contaminating factor. This is apparent in the description of "productive" research labs: "All over the country, the world, the spotless knives are slicing, the trained minds devising casual torments in labs so bright and fair you could eat off their floors" (682–3). This contamination must be removed from the minds of scientists, just like physical contaminants are removed from the labs. In contrast, Lipsitz's experimental space is not clean. He links his space's untidiness with the murder that he is about to commit by killing his rats to achieve efficiency. Lipsitz faces the moral implications of his actions squarely, likening the pain inflicted on laboratory animals and the inflictors' lack of empathy for this suffering to the German concentration camps:

> This is a temple of pain, he thinks. A small shabby dirty one. Maybe its dirt and squalor are better so, more honest. A charnel house shouldn't look pretty, like a clean kitchen.… Auschwitz, Belsen were neat. With flowers. Only the reek of pain going up to the sky, the empty sky. But people don't think animals' pain matters. They didn't think my people's pain mattered either, in the death camps a generation back. It's all the same, endless agonies going up unheard from helpless things. (682–83)

Lipsitz's Jewish heritage informs his attitudes toward his animals. He recognizes the argument that all oppressions are linked — the crimes of the Holocaust arise from the same root of inhumanity that leads to cruel science.

Lipsitz's musings link adherence to reductionism and the exclusion of more complex and complicated methods to the pervasive cruelty that Sheldon and Lipsitz saw and resisted. Lipsitz's fellow researchers set up experiments to maximize efficient data collection without considering the impacts on the animals' pain, or how that pain, discomfort, and fear might affect their research. The assumption that the animals' pain would not affect the result exemplifies reductionist thinking, in that they see the animal as a piece of apparatus without the internal processes that would allow it to react to and shape the results of the experiment. They see Lipsitz as an outsider because he challenges the dominant reductionist view; although Lipsitz believes his supervisor deserves empathy, Lipsitz's perspective is so foreign to him that the supervisor accuses Lipsitz of mental instability. This indicates how Sheldon perceived the rigidity of the philosophies that drove behavioral research in psychology.

The supervisor's view of the rats and his doubts about Lipsitz's proposal show the impact of a reductionist behaviorist framework. Specifically, the supervisor approaches the rats as simple creatures without the complex internal lives and emotional experiences that would allow them to serve as a model for higher-level human behaviors. This represents seeing animals and humans, with the possible exclusion of primates in this example, as separate. It also shows behaviorist reductionism, in that the supervisor is not acknowledging that rats may experience what are generally seen by researchers as more complex or higher-order processes (e.g., cognition, emotion) that Sheldon and her mentors (like Arnheim and Tolman) were interested in studying.

Sheldon addressed the variability that Birke, Arluke, and Michael argue most model organism research avoids. She argued that laboratory rats were bred for "cage life" and "not biting psychologists" and were thus "incapable of free life" (Tiptree, *Meet Me* 358–59). This can be extrapolated to a need to recognize the limitations of a specific species. Specifically, experiments on a species should only be generalized to those species that share significant traits. This contrasts with the overreliance on one species and over-universalization of findings generated from that one species that Beach criticized.

Sheldon used Lipsitz to propose a non-reductive approach to searching for behavioral mechanisms. Lipsitz rescues unwanted rats from other experiments and establishes a colony of them in a basement space, ignored by others in the lab. He balances

recognition of the uniqueness, complexity, and context-dependence of this community and any results that he might get from research on them, with recognition that their particular traits allow him to explore complex behavioral mechanisms. Lipsitz also recognizes the difference between laboratory animals and wild animals, even when they are closely related. Specifically, he considers his lab colony as a community unto itself with its own peculiar behavior distinct from feral rats, and valuable for understanding the behavior of lab rats as a unique species.

Lipsitz also credits his model species for complexity in their behavior, and wants to understand the higher-level processes involved in their behaviors, such as the aesthetic sense the following passage shows. In addition to making his rats comfortable, Lipsitz's provision of nesting material leads him to new research questions. He is amazed when the rats transform their cages into "solid cubic volumes of artfully crumpled and plastered paper strips" ("The Psychologist" 674). He wonders why no one has studied the nest-building capabilities of rats as they have studied similar abilities among birds. Lipsitz appreciates the significance of the rats' behavior and also how it depends on an environmental context. This event exemplifies Birke, Bryld, and Lykke's key point that model organisms and humans co-constitute the laboratory and that rats shape scientific research. In their view, Lipsitz's and the rats' actions together opened this possible new research avenue; their view is significant because it centers the activity of the model system in the generation of research questions. As Haraway and Sheldon demonstrate in terms of a feminist research ethic, the acknowledgement of these intra-actions leads to increased comfort and additional knowledge. Thus, instead of relying on reductionism to produce generality, Lipsitz argues for context dependence as a better way to understand complexity. This is a non-reductive approach because he is venturing outside of a narrowly defined research question to think about connections across species, both to understand something about those species and also about the mechanism underlying their nest-building abilities.

Lipsitz also recognizes that he can learn much from the rats that can then be applied to solving human problems. His knowledge of rats as rats lets him see, more than other researchers, the rats' potential as model organisms for more complex questions; the others just assume the rats are too simple for this work (678-79). Specifically, his supervisor's view is that the rats lack the capabilities and thought processes to answer questions of human development, and that Lipsitz would need to use primates instead. Overall, Lipsitz's supervisor does not think that Lipsitz's desire to understand rat behavior will produce a significant payoff for his research group. Lipsitz sees the complexity of rat behavior because he provides an environment full of materials that

the rats can manipulate, and he spends time observing the creatures. He realizes they are capable of higher-level processes than his supervisor assumes. This calls attention to the fact that standard laboratory protocols that minimize variation and standardize researcher/model species interactions limit knowledge. In fact, model organisms and scientists co-constitute research directions germane to both species when researchers allow their relationship to the model to be complex and variable.

As a researcher, Sheldon wanted to explore how animal behaviors could vary based on social or environmental context, and to address the considerable variation within animal species used as models, especially between the laboratory and the wild. She believed that this kind of work could provide solutions to what she saw as an evolutionarily derived human tendency toward oppression and environmental destruction. She also saw humans as animals, and was interested in examining the evolutionary origins of human behaviors.

Sheldon held strong beliefs about the biological origins of some sex differences and of human tendencies that she saw leading to environmental destruction and oppression. Sheldon feared that evolutionary linkages between human—primarily male—aggression and sex drives threatened human survival. She deemed evolutionary concepts "the best tool we have in thinking about sex differences" (Phillips 292). As Phillips argues, Sheldon saw scientific research as a possible solution to the gendered dilemmas she explored in her fiction. Many of the other feminist science fiction writers of her time period did not share her belief that applying evolutionary principles would further feminist goals; they saw this approach as problematic because it appeared to argue that sexism was "natural" for humans. Other feminist writers of her time criticized Sheldon for her arguments about the need to attend to evolutionary factors in addressing oppressions; they feared that evolutionary explanations would be used to justify sex differences as biological in origin and, therefore, natural.[11]

Some literary critics read Sheldon's stories as pessimistic reflections on human gender roles. Heldreth, for example, writes that "Tiptree seems to see no hope for feminist equality, no release from the bondage of violent sex, and no hope for the human race" (28). More recently, Unger has found the stories "disturbing" because "they appeared to accept a biologically determinist explanation" for the "hostile relationship between the sexes," and they "did not offer any social or psychological mechanisms for change" (114).

I, like some other critics, perceive more ambiguity in Sheldon's depiction of evolution, biology, and nature. Genova argues that Sheldon "rejects the biological determinism that her critics attribute to her…but without abandoning an independent and critical role for nature" (7). Genova posits that Sheldon , like Haraway, saw herself "as rescuing nature from the clutches of deterministic science" (7): "[n]ature was not fixed, but more mutable than even culture or society" (12). Sheldon's writing appears to advance the notion "that there is no hope but that we will be victims of our own biology,"

> [a]nd then just as one accepts this message, she exonerates nature and blames such willful displays of culture as greed, avarice, ignorance. Has nature failed the human species for Tiptree or culture? The answer is neither. Her final irony is that only humans fail themselves by thinking cheap and small about both nature and culture (17).

Genova argues that the conclusion of this is that attempts to locate answers in nature or culture are "misconceived" (17). Galef posits that '[t]he clash between biological constraints and social imperatives, or between biological imperatives and social constraints, is what creates a large part of the complexity in Tiptree's fiction" (203). And according to Williams, Sheldon's writing disrupts Darwinian competitive narratives and replaces them with evolution by cooperative mechanisms.

I believe that Sheldon recognized that impoverished research conditions lead to impoverished data. While she wanted to use biology to understand and combat oppression, she was intending to use her utopian vision, not the science as she saw it practiced. Sheldon recognized the problems of the overly reductionist models of her time, and she used science fiction to think through how altering those models to add non-reductive methodologies might lead to a science that meets feminist aims. I argue that those who react negatively to her position do not recognize this critical distinction; Sheldon wanted to change science, and this new science undergirded her feminist possibilities.

Sheldon's work mirrors ecofeminist and other feminist theorists' arguments that addressing injustice and oppression includes the treatment of non-human inhabitants of the earth. Francoise d'Eubbone is credited with coining the term ecofeminism and combining the principles of ecology and feminism in her 1974 piece "*Le féminisme ou la mort*." In general, ecofeminism rejects the dualism between human and nature and posits that all oppressions are connected. Sheldon anticipated many of these positions, reminiscing in an introduction to one of her stories that prior to the ecology movement

of the sixties, "I did my screaming to myself; it sounded pretty silly saying, I love Earth. Earth? Rocks, weeds, dirt? Oh, come on. A friend lectured me: People have to relate to people, you can't relate to a planet" (*Meet Me* 234). She includes calling attention to the destruction of that planet along with "what man is doing to man — and woman" as her motivation in writing (385–86).

What Sheldon saw as a human, not just a male, tendency toward environmental destruction frightened her. However, she did not see the human species as evil. Rather, returning to her beliefs that studying evolution was the key to understanding many destructive human impulses, she posited that "natural" human impulses led to the destructive behaviors because "the Human beings who are doing all this are not malicious or aberrant. They are doing what we have always done" (236). For example, Sheldon recognized that much environmental destruction arises from the fulfillment of basic human needs so that "[e]ven the trawlers who are fishing with nets five miles long — killing everything in huge swatches off the Florida seas — are doing the Human food-getting thing." However, she feared that instead of changing environmentally destructive behaviors, the human species would simply adapt to survival on a ruined Earth, "shoulder-to-buttock, gasping our own poisons and scrabbling for algae soup as the conveyor belt creaks by" (237).

Sheldon's confidence in evolutionary explanations created discomfort for many of her contemporaries as well as for some more recent critics, because placing human behavior into an evolutionary context lacking internal significance and meaning along with animal models can lead to the objectification of humans. When Sheldon called for the use of science to end oppression, I posit that she envisioned a science that would include non-reductive methodologies informed by feminist practice. Many feminist critics, both scientists and non-scientists, critique androcentricism and sexism in sociobiological and evolutionary psychological theorizing about sex roles when these are applied to human behavior. Sheldon argued that strictly reductionist approaches were also inadequate to explain animal behavior — a perspective that feminist animal and science studies writings have mirrored since her time. To reach my overall goal of resolving the contradiction that some of her feminist contemporaries saw, and that some more recent scholars still see between her views about biology and her critique of sexism, I will conclude by integrating her perspective within this new framework and discuss the dire consequences that Sheldon anticipated if the research of her time continued on its trajectory.

Like Sheldon, Lynda Birke, a biologist and feminist theorist, found science unfulfilling because "the love of nature that, in part, drove me to want to study biology seemed to be at odds with the scientific methods in which I was trained," and the emphasis on reductionism denied her "awe at the marvelous creatures that exist in the world, in all their complexity and individuality" (*Feminism* 7). However, Birke also described feminist theories as inadequate because "feminism unwittingly relies on evolutionary discontinuity." When "the flexibility implied by social constructionism extends only to human behavior ... the behavior of nonhuman animals remains largely in the realm of biology, outside the remit of most feminist inquiry" ("Intimate Familiarities" 430). Anthropologist Barbara Noske agrees that the reluctance of those concerned with social justice to engage with the study of animals has left the development of behavioral models solely up to those who employ reductionism (114). A better strategy to combat sexism is to develop richer understandings of non-humans. Sheldon sought this position.

One response to biological determinism has been that humans are too complex for biologically based explanations of behavior, even though these models are appropriate for non-human animals. Birke argues that by accepting this dichotomy, neither feminism nor science fully accounts for the richness of animal lives. Birke underscores the current significance of what Sheldon wanted to do in the lab and the continued need for attention to this area because "[i]t is, moreover, that question of accountability to others, including non-human others, that provides a significant challenge to feminist scholarship" ("Unnamed Others" 152). Birke calls for cross-pollination among those who study non-humans, those who look at human/non-human relations, and those who focus on humans. She argues "[i]t is vital that this mutuality is properly recognized in our politics. To that end, it is equally important that feminist theorists engage explicitly with scholarship on animal behavior, particularly emerging debates about cognition and sentience" (153). Sheldon attended to these same issues in her own research, and vested a longing to address them in Lipsitz.

Paying attention can also lead to research linking environment and biology, or nature and nurture, another long-standing feminist priority.[12] Birke, Bryld, and Lykke argue that scientists attribute "gender differences" in non-human animals to intrinsic differences, such as genes or hormones, rather than to social interaction, even though most scientists recognize human gender as a "socio-cultural process" (169). Birke's "Structuring Relationships" critiques the notion that hormones and other biological processes alone determine animal gender. Using "The Psychologist" to frame her case, she argues that keeping animals in constrained and limited conditions leads to limited

and distorted behaviors, which provide constrained and limited information about their gender or the case of human gender. She calls for attention to how the practices of minimizing variation lead to behavioral constraints on the models. These are all positions that we see illustrated in Lipsitz's belief in the potential of his rat colony to offer insight into higher-level processes and his willingness to study the rats in and of themselves and to follow their behaviors for direction into new and exciting areas of research.

Elms argues for the influence of Sheldon's experimental psychology work on much of Tiptree's fiction, yet stops short of looking for direct connections between her research and her concerns for feminist issues especially around critiques of sex roles, arguing that "[i]t would be difficult to find any immediate origins of Sheldon's concerns with these broad issues of human psychological functioning in her laboratory rat research" (Elms 92). The root of Sheldon's critique of both areas lies in her resistance to reductionism; it originates in her thinking about these issues as ethologists, comparative psychologists, and others discussed them, especially in their critique of behaviorism.

Consideration of Sheldon's work provides strategies for developing non-reductionist methods by looking at both human and non-human behaviors as contextual and ever-changing. Sheldon's work heralded the importance of the following points for a feminist scientific practice: recognizing and attending to variation; emphasizing context and interactivity instead of reductionism; and centering the significance of the human/animal relationship, even when it leads to suffering and death. Overall, Alice Sheldon provided one of the earliest glimpses of what it might mean to become a feminist scientist working on animal models, with all of the moral ambiguities, pain, and contradictions the role entails. Sheldon argues that the researcher/model organism relationship is a key part of science, and attention to this relationship enhances both feminism and science. By showing the dire consequences of cruelty and callousness and contrasting them with Lipsitz's behavior prior to his transformation, she argues that learning about other creatures with care, regard, and respect, answering Birke's call to feminists to take into account the fact that animals "have points of view" and "to start listening," will promote social justice and environmentalism ("Unnamed Others" 155). The kind of listening that Sheldon proposed involved attending closely to species in the laboratory as entities deserving of study in their own right, not just because of what they might reveal about human nature. Sadly, this utopian vision does not materialize. Instead, Sheldon's dystopian ending to the story in which Lipsitz becomes just as cruel as any other researcher emphasizes her belief that strictly reductionist approaches will only lead to oppression, cruelty, and misery.

After he starts killing the rats as his supervisor has directed, Lipsitz hallucinates. The images that he sees examine the contradiction that dirt and ugliness sometimes create stronger conditions for relevant and ethical science than cleanliness and sterility, a metaphor for the messiness of non-reductive approaches as compared to strict reductionism. He hears something and investigates by looking under a cage, where he sees a living composite of rat parts. Lipsitz calls this a "Rat Pie" and wonders if it was "created and summoned by torment" from "a reservoir of pain" filled by the suffering inflicted by humans ("The Psychologist" 683). In the next moment, the creature, or perhaps his view of it, becomes more familiar, "not threatening at all" when it makes a "tooth-click" that reveals that it compasses parts of a rat of which Lipsitz is particularly fond. Lipsitz then calls it a "Rat King," a being that has been mythologized since medieval times and that "occurred at times of great attack on the rats." Lipsitz feels that he summoned it by killing the colony of rats. He feels despair and rejection of "the whole human world." In that instant, the creature changes again, and Lipsitz meets the eyes of a different kind of Rat King — a wise, gentle, and beautiful being. Sheldon's descriptions of these changes are grotesque and beautiful, dark and hopeful. She juxtaposes horror and beauty, cruelty and kindness because it was the horrific Rat Pie's "conjoined forces which strove and suffered to give birth to this other — the King himself" (684).

The King begins leading "[a]ll of them, blinded rabbits, mutilated hamsters, damaged cats and rats and brain-holed rhesus quietly knuckling along, even the paralyzed dogs out of the laboratory" (684). Lipsitz follows, "thinking, I am an animal, too!" He looks back and sees even more animals, and some damaged humans as well. Lipsitz believes that "all the abused ones, the gentle ones" and "[t]he ones who can't cut it" are leaving the world (685). Following, he wonders why these gentle creatures have been seen as a "threat" by those with power, and why the powerful have "hated us so." He realizes how having to bear the cruelty present in the world has damaged him. The procession includes a girl who looks like Sheila — one of Lipsitz's colleagues to whom he is attracted. In contrast to the hardened Sheila, this girl is innocent. The girl and Lipsitz locate the origins of the world's cruelty in the philosopher Descartes's separations between body and mind, human and animal, and in his belief that "[t]heir pain doesn't count" (686). But Lipsitz realizes that a flaw in Descartes's reasoning is that humans are also animals and discounting animal pain means discounting human pain, similar to Haraway's arguments about the linked nature of all suffering.

In the midst of the procession, Lipsitz wonders, "Who will remain? If there is anything to care for, to be comforted, who will care?" (685). Lipsitz feels responsible for what will be left behind, especially the cruelties that will arise when goodness is gone. Due to this hesitation, he is eventually left behind. When he awakens, he feels as if he has forgotten something important, and for an instant it seems he might remember himself. But Lipsitz is now truly transformed into what he is expected to become — a productive, callous scientist. He proceeds with a brutal killing of the rats and the planning of even crueler experiments on horses. He loses his ability to empathize and acknowledge pain, and he becomes as willing to inflict it as his colleagues.

The kill scenes pre- and post-transformation exemplify Lipsitz's change from empathic scientist to cold-hearted careerist. In contrast to the mortal love and shared suffering present in the initial kill scene, the transformed Lipsitz finds the "filthy rats" disgusting. He looks at the individual kill jars and thinks "whatever had possessed him, trying to kill them individually like that. Hours it would take" (687). Lipsitz dumps the rats into a garbage can and pours the ether on top. He sits on the can while the rats die shrieking, except for an escaped baby, which he stomps to death. Lipsitz doesn't just kill the rats; he obliterates the animal/human relationship that he had previously treasured.

Post-transformation Lipsitz also disregards humanity, exemplified by his changed attitude toward his students. In the first part of the story, Lipsitz struggles with effective teaching, much as Sheldon did during her career (described in Phillips 206). At the end, he muses that "teaching is for suckers" ("The Psychologist" 688). Lipsitz's new attitudes also link animal abuse and misogyny. While killing the rats, Lipsitz fantasizes about Sheila, the research colleague who has not returned his sexual interest in her, and muses that "[t]here is no error more powerful than the belief that some cunt can't be had. Someday he feels sure that he will find that particular pussy-patch wide open to him" (687). Lipsitz's previous attitude toward Shelia was wistful lust. The parts of Lipsitz that made him Sheldon's ideal scientist left with the procession of all of the good things. What remains behind is a Lipsitz aligned with the cold, cruel efficiency characterizing Sheldon's perception of the scientific status quo.

Sheldon's story is ultimately despairing because she does not explore the possibility of a feminist vision in the laboratory. The good, gentle parts of Lipsitz couldn't survive in the lab or create such a vision. The destination of the procession is never shown to the reader and the girl in the procession who talks to Lipsitz says it "isn't real" (687). The reader's focus remains on the lab and the now despicable Lipsitz. We see the depravity that results when goodness is gone. When the relationship with animals and the

acknowledgement of animal agency is completely removed from science, we get the kinds of "science" the Nazis performed (depraved, inhumane), which Lipsitz's earlier reflections had referenced.

An examination of Sheldon's non-fiction reflections on her fiction and her research career provides needed direction for recent feminist interest in theorizing to include the non-human. At the time she was writing, consideration of ecological issues was just beginning within feminist theorizing; further, her views on the significance of understanding evolution to address women's oppression were troubling to her contemporaries. As well as being one of the first (and indeed perhaps the first) to articulate why treatment of the non-human is a feminist issue, Sheldon's works provide guidance for the further development of feminist science and animal studies in areas of recent concern. Sheldon calls for researchers to attend to nuance and context by acknowledging an ongoing relationship with the creatures they study, instead of simply seeing them as representations of mechanism, theory, or processes in the human species. Although she directed much of this toward people studying animals, which did not extend to the feminist theoretical community of the time, more recent tensions between feminist scientists in animal behavior and evolutionary biology and other feminist critics indicate that theories that link human and non-human are of broad concern and question how the human/animal boundary has been constructed within feminist theorizing. Sheldon provides a significant contribution in this area.

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Notes

1. Phillips explores Sheldon's multiple identities under these pseudonyms. Tiptree's correspondents and readers thought she was a male writer, and the broader science fiction communities of her time treated her that way. In this piece, I use the name Sheldon in relation to the work or correspondence being described.

2. The rats Sheldon studied were selected and bred to minimize variation in traits, but they were not directly manipulated to the degree that contemporary biomedical models are.

3. Fehr is part of a long line of feminist philosophy and science studies scholars interested in this question. The wide range of material in this area makes a full review impossible, but for a classic piece see Longino.

4. The range of debate about model species in the late 1950s and 1960s is beyond the scope of this article. For further information about the details and fine distinctions in the history of behavioral research, I refer the reader to works such as Burkhardt; Lyman-Henley and Henley; Thomas; and Dewsbury, "A Brief History of the Study of Animal Behavior in North America."

5. Richard Burkhardt examines their debates on the proper role of lab, field, and semi-wild conditions, focusing specifically on Lorenz and Tinbergen (501-02).

6. Crist does note that since comparative psychology was established prior to ethology, ethologists' emphasis on technical language and skepticism about the idea of an animal mind (e.g., emotions, thought, and so on) probably arose because ethologists were responding to a framework already established by comparative psychologists for how to do objective science.

7. Other scholars have pointed to more nuances in the initial selection of the rat model than Beach acknowledged, with those who originally proposed rats as models sharing some of his concerns. For a detailed discussion of the impacts of standardization on selection of animal models see, for example, Logan. For a thorough discussion of Beach's work, see Pettit. Sheldon herself studied hooded rats, not the white rat, probably because their superior eyesight was critical to her studies on perception (Elms 86).

8. Sheldon was initially interested in upper-level processes, an appreciation of aesthetics that she wanted to explore in humans (see Elms for further discussion).

9. For further discussion of the impacts of the experimental apparatus on the history of the study of animal behavior, as well as its relationship to researchers' underlying assumptions about animal minds, see Thomas. For a detailed description of Sheldon's own apparatus, see Elms 85–88.

10. The first edition of *The Guide for the Care and Use of Laboratory Animals* (currently revised by the National Institutes of Health [NIH]) appeared in 1963. The 1966 Laboratory Animal Welfare Act, now the Animal Welfare Act (AWA, Public Law 89-544), was the first US Federal Law regulating the treatment of animals in laboratories, and it excluded rats and mice. The 1971 NIH Policy, "Care and Treatment of Laboratory Animals," addressed rats and mice. These regulations responded in large part to public outrage about Harry Harlow's experiments raising monkeys in sensory deprivation chambers (for detailed descriptions, see Haraway's *Primate Visions*). Animal care guidelines for psychological research are much more stringent now than when Sheldon was in the lab. Since the seventies, institutional committees have clarified animal care guidelines and obtained the right to approve procedures to monitor animal care in federally funded laboratories and individual researchers' protocols before they begin their work, monitor compliance, and require trainings for personnel. The 2002 OPRR/ARENA Institutional Animal Care and Use Committee Guidebook (IACUC) Guidebook, Office of Laboratory Animal Welfare, NIH, sets forth these guidelines and supervisory mechanisms. Currently, research published in the American Psychological Association's journals must adhere to its 2012 Guidelines for ethical conduct in the care and use of non-human animals in research.

11. In fact, Tiptree was asked by fellow panelists to withdraw from a science fiction fanzine's panel of letter exchanges on feminism for expressing these beliefs. See Phillips for a thorough exploration of Sheldon's critique of sexism and her presentation of sex differences, especially pp. 292–93 and 333–38. Phillips (Chapters 31 and 34) provides a nuanced discussion of Sheldon's views on gender, sex, evolution, and biology as well as their reception in the feminist science fiction community of the time that shaped them.

12. The works of Patricia Adair Gowaty and Marlene Zuk exemplify feminist animal behavior researchers who integrate evolutionary insights with feminist theory. See for example, "Evolutionary Psychology and Darwinian Feminism," co-written with Anne Fausto-Sterling, an expert in gender and developmental biology, who had previously criticized gender biases in evolutionary biology.

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