Systems of Care:
A Participatory Approach Toward
Intervention In Wild Animal Wellbeing

Thesis

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Oscar Courchaine

Department of Anthrozoology

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Dr. Joshua Russell, Advisor

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Chapter 1: Introduction

What role should humans have in wild animals' lives? Some believe the ultimate goal should be removing as much human activity and influence as possible from wild animals' lives and environments, allowing ecosystems to regulate themselves (Palmer, 2022). Others see a role for some continued human activity in natural spaces and processes, recognizing the long history of Indigenous environmental practices, including selective brush clearing and controlled fires, that make environments more hospitable for the humans and nonhuman animals that live there (Goode et al., 2022). And some, including myself, see the possibility for humans to drastically increase many species' quality of life by directly mitigating the harms they face (Johannsen, 2021) and promoting their flourishing by satisfying their natural capabilities (Nussbaum, 2023). This would require a high level of effort and resources, but it may be the least that we owe to other beings that, while capable of joy and suffering, lack the agency and opportunity to direct their lives and control their environments to the extent humans do. This thesis will explore the ethical and practical aspects of intervening in wild animals' wellbeing, advocating for a care-based, participatory approach that respects individuals' and species' autonomy, highlights precaution, and leverages advancing technologies to promote flourishing while mitigating suffering.

First, this task will require discussions of moral status and ethics, where I will claim sentience as the best qualifier for determining which species' interests should be considered within an ethics of care. I then expand on the ethics of care, integrating Martha Nussbaum's Capabilities Approach to discern the various ways in which all sentient beings seek to flourish. I will also address concerns over human intervention in wild animals' lives, describing ongoing negative and positive interventions and how they affect wild animals. Here, I propose a distinction between intervention–non-relational activities that ultimately support human goals–and participation, or relational activities where nonhuman animals' needs and desires are considered equal to our own. Further, I address the problem of paternalism that emerges when humans play such a large role in shaping the lives of so many animals, differentiating between distinct forms of paternalism to determine how best to consider it in this context. Ultimately, I argue that many of humanity's best endeavors have been to mitigate our own suffering from natural causes. If nonhuman animals can suffer in the same ways, then they would likely also desire some alleviation of their suffering, so long as respect is held for their agency, autonomy, and sense of dignity.

Next, I tackle the largest question in wild animal ethics: How much knowledge of the ecosystem and nonhuman animals' lives is needed to avoid catastrophic outcomes? Theorists who write about wild animal ethics all raise this question, as it is the only defense against the accusation that participation in nature will result in worse outcomes than if nature were left untouched. While it is true that many attempts at intervention have historically resulted in worse outcomes, theorists are correct in saying that closing the ecological knowledge gap will make large-scale participation without negative consequences possible. Still, none have proposed how we could close that gap, especially without negatively impacting the very species we would ultimately want to help. Many tools in use by conservationists can have these negative effects, especially if scaled up to provide the required level of information. For example, GPS tracking collars and tags can injure the animals they are attached to, not to mention the trauma of capture and sedation to attach it. But newer technologies, like environmental DNA and acoustic monitoring, can provide a greater amount of information with far less impact on the animals under study. I discuss these technologies, their tradeoffs, and what kinds of data would be needed to prove to the most cautious skeptic that some intervention may be possible without resulting in unforeseen negative consequences.

Having discussed the use of monitoring systems that maximize knowledge and avoid harm, I then look at what kinds of intervention may be best. Gene drives are commonly touted as an efficient and effective way to make all kinds of interventions possible, but their use is controversial (Boersma et al., 2023). Further, their examination reveals some serious drawbacks regarding the necessary timescales for implementation, invasive research required for development, and irreversibility after the fact. Reversibility and the precautionary principle should be the core tenets of any proposed intervention in nature, and I use them to structure my proposals for compassionate intervention. There are many natural sources of harm to be mitigated, and some can be relatively easily, but not without causing harm to others. If 10% of baby rabbits die due to a curable disease, curing that disease may result in mothers having too many rabbits to care for and they may suffer and die regardless. Similarly, if 10% of baby foxes die from a similar disease, curing it may increase predation pressure for species hunted by foxes, resulting in far more suffering and death than had the fox died naturally. I argue that intervention should not be a one-shot solution to individual issues; rather, it should be a participatory system of care that addresses the two hard problems of compassionate intervention: reproduction and predation.

I ultimately argue for, in the long term, humans to take a much greater role in environmental stewardship, focusing on ways to promote wellbeing for wild animals in ways

respecting their agency, autonomy, and sense of dignity. In Chapter 2, I look at the ethical arguments for and against intervention in wild animals' lives, providing my own model for how we can think about this relation. In Chapter 3, I address the key question in wild animal ethics: how much knowledge of nonhuman animals' lives and the environment is necessary before humans can safely engage in positive intervention or participation? In Chapter 4, I explore the possibilities for positive interventions beyond gene drives, which I argue are too ethically costly when other options are available to ensure all animals' capabilities can be expressed. Overall, I hope to paint a picture of humans' relationship with wild animals in the best possible future.

Chapter 2: Wild Animal Ethics

Section 1: Who Matters?

Sentience

In the introduction, I introduced the core concepts of compassion and justice in the context of wild animals. But compassion and justice for whom? Most of the philosophical discussion in this thesis centers around Western beliefs and societal norms as that is what I have experience with, but these norms often do not lend consideration to nonhuman animals beyond their use in human endeavors. However, other societies have long held that there can be relationships of meaning between humans and other animals. The Ojibwe nation in the Great Lakes region has long taught that wolves are to be seen more as family members than beings for whom no concern should be held (Gilbert et al., 2022). A wolf may be killed by humans if they are causing significant hardship either for humans or other animals in the area, but arbitrary or trophy killings would violate the sanctity of that relationship. Furthermore, African Ubuntu philosophy is rooted in the idea, "I am because we are", with emphasis placed on recognizing every being's inherent value and agency (Paulson, 2020). Though, some scholars fear that this philosophy is losing its usefulness in increasingly capitalist and urbanized African societies (Chibvongodze, 2016). Presently, in Western societies, compassion for nonhuman animals mostly takes the form of caring for companion animals in our homes and communities. This is in contrast to farmed and captive animals, who receive care only to the extent of maximizing their profitability. Some compassion likely also extends to some captive animals in zoos, but these animals are treated primarily based on the value they can provide to the zoo's

mission, with genetically redundant animals sometimes being discarded before their natural end-of-life (Wiener-Bronner, 2014).

Still, when compassion is felt for nonhuman animals, it often stems from an innate understanding that they, like us, experience positive and negative physio-emotional states, or "valenced experiences" (Lee, 2022). Put simply, they *care* about what happens to them. I claim that this capacity, commonly referred to as **sentience**, is the best available determinant for which entities' interests should be taken into moral consideration (Browning & Birch, 2022). Historically, in Western philosophical traditions, there have been numerous determinants for logically separating the human and nonhuman animal worlds that fall under the umbrella of **anthropocentrism** or the view that humans should be the center of moral concern (Lynn, 1998). Aristotle claimed that animals had life and perception, but that humans had an additional factor: **rationality** (Calarco, 2015). For centuries, subsequent philosophers maintained rationality as a uniquely human characteristic. Almost 1300 years later, the French philosopher Rene Descartes promoted the idea that animals are merely automata with no thinking mind between sensation and action (Thomas, 2020). This claim was backed up by his continuing practice of live vivisection, where he would demonstrate that since animals did not ask for the torture to cease, they must not feel anything. Here, nonhuman animals are reduced to mere objects, a view still largely held in present-day legal systems. It is not until the next century that Jeremy Bentham proposes: "The question is not, can they reason? Nor, can they talk? But, can they suffer?" (Bentham, 1789, p. 144). For Bentham, animals need only show distress to prove that they have an internal point-of-view, and this is the only factor that should determine whether an animal should have legal protections. Though the term itself emerged later, this was the first time sentientism was described and promoted as the singular capacity from which moral standing should be derived.

Since that time, there has been further thought on whether and how to expand the moral circle. **Biocentrism** attempts to place moral focus on all forms of life wherever it may be (Attfield, 2016). Humans and other animals are included in this, as are non-sentient beings like plants, fungi, and microorganisms. **Ecocentrism** expands the circle even further, including non-living entities like rivers, forests, and rocks (Lynn, 1998). Both these ethics emerged as Western philosophers were trying to de-center humans from moral consideration in response to the ongoing environmental destruction becoming more and more apparent during the 20th and 21st centuries. While they depart from anthropocentric models, I claim they unnecessarily expand the moral circle as a way of bypassing questions about humans' treatment of other animals. In legal systems, if the precedent that "all animals matter" were to be established, there

would be grounds for ending all animal agriculture operations, as well as greatly disrupting research in the life sciences and limiting future habitat destruction caused by human expansion. Making the argument that a particular environment or environmental feature should be protected for its own sake is far more effective than first establishing a precedent that animals could have moral standing. Even beyond contexts of law, proponents of eco and biocentrism are able to protect their own cognitive dissonances around how humans use other animals and the extent of suffering in the wild, so long as biology or ecology as a whole flourish. To reach authentic **relationality** (Joy, 2020) with other animals, I argue a **sentiocentric** worldview is necessary, as it acknowledges all animals' shared evolutionary history and the similarity of challenges faced in our ways of life (MacClellan, 2012). Unlike a river, rock, or ecosystem, animals can care about what happens in their life, seeking out positive experiences and avoiding negative ones where possible. For animals that live lives similar to us, like deer, it is easy to imagine what sort of valenced experiences they might have, like the joy of bonding with a newborn foal (Bekoff, 2000), and the despair if that fawn dies of illness, starvation, or predation (Brooks Pribac, 2013). These experiences of flourishing and suffering can be more difficult to imagine for animals further from us evolutionarily, like bees, but research has shown that bees, flies, and cockroaches can experience pain, and research continues to emerge for this evidence in other invertebrate species (Gibbons et al., 2022). Some animals, like sponges, are currently left out of the category of sentience but this could change as new evidence emerges, continuously ensuring that all beings experiencing harm are morally considered.

Ethical Perspectives

As seen with Bentham's defense of the reality of nonhuman animal suffering, sentience and **utilitarianism** are highly compatible concepts as both find meaning in the capacity for positive and negative experiences. For Bentham, moral consideration for others means promoting their pleasure and minimizing their pain above all else (Bentham, 1789). This makes utilitarianism a consequentialist moral theory, placing value on the results of actions rather than their initial motivations. The foremost example of this theory expanding to include nonhuman animals is Peter Singer's *Animal Liberation* where he presents a worldview that considers their suffering to be comparable to our own (Singer, 2009). This results in a multifaceted critique of the treatment of animals in human domains like food production, scientific experimentation, and habitat destruction, ultimately arguing for their liberation from human interests except in cases where there is an outsized benefit to be gained, such as with some scientific experimentation.

An alternative moral framework that is still compatible with sentientism is **deontology**, which holds that there are universal moral laws that, if interpreted and followed universally, will bring about the best outcomes for societies in various domains like fairness, freedom, and flourishing (Rawling, 2023). These "laws" can be enforced through actual legal systems, where they become "rights" that are protected equally for all individuals included in the theory's moral circle. This rights-based approach to deontology was brought to the realm of non-human animals in Thomas Regan's *The Case For Animal Rights*, where he argues for greater liberation of nonhuman animals than Singer, rejecting their use in any endeavor even if it would result in greater overall happiness (Regan, 2004). To Regan, animals are ends-in-themselves, deserving of rights to life, liberty, bodily integrity, and treatment as individuals. This leads to very different outcomes for utilitarianism and deontology when it comes to asking how we should relate to wild animals.

In Singer's thinking, reducing suffering in the wild is a desirable, but intractable, goal. He sees little issue with humans working to reduce various aspects of natural suffering but rejects the idea that, at least at present, we have the capacity to do so without causing more harm as a result. While he does not fully reject the idea that humans could have this capacity in the future, he uses this limitation to avoid expanding his moral framework to include wild animals beyond calling for a stop to anthropogenic harm against them. Regan is more explicit in how his framework extends to wild animals: it does not. He takes a broadly non-interventionist view, only allowing some intervention to mitigate harm when humans are the originating cause. In all other cases, wild animals should be left to their own devices without human interference, to ensure their right to liberty.

To justify interventions in nature to improve animals' wellbeing, an alternative framework is needed. In Chapter 3, I'll address Singer's, and others', concern over the intractability of wildlife interventions, identifying how his framework can justify extreme interventions that I would prefer to avoid. Instead, I turn to an adapted **ethics of care** approach, first described by Carol Gilligan in the 1980s. The ethics of care emerged as a critical response to the prevailing moral theories at the time, which were centered around justice as an ultimate guiding principle. Gilligan argues that using care, or compassion, as an ultimate principle is equally legitimate to justice, and that justice has only maintained dominance by appealing to and reinforcing traditionally masculine ideals like liberty and autonomy (Gilligan, 1979). An ethics of care emphasizes interpersonal relationships and context; there is no singular rule that can be universally applied in this framework. Importantly, it acknowledges the reality that "in nature,

nothing exists alone" (Carson, 1962). Individual liberty and autonomy can only now be important because of the preceding care that made cooperation and mutual flourishment possible.

While Gilligan did not expand her framework beyond human contexts, other scholars have made this effort. Ned Noddings, who developed her ethics of care around the same time as Gilligan, described extending care toward animals only in very specific circumstances, such as caring for a stray cat or putting a spider outside instead of killing it (Noddings, 1982). Rita Manning pushed this further, proposing context-dependent relations based on listening to the animal with whom one is in relation (Manning, 1996). This focus on contextual flexibility across human/nonhuman animal relations was later echoed in work by Carol Adams and Josephine Donovan, where they defend care as the superior foundation for animal ethics over justice (Donovan & Adams, 1996). Despite this potential, some care ethicists argue that other principles can be added to create more complete and useful theories, such as Stephanie Collins' suggestion of a principle to hold individuals accountable for their own actions (Collins, 2015). This principle, while not derived directly from care, is compatible with care-based theories and may help with their application. In a similar vein, I propose the Capabilities Approach (CA) to Animal Ethics as an addition to an ethics of care to help with its application (Nussbaum, 2023). The CA has been previously described as both highly compatible with sentientism and a marked departure from the anthropocentrism and speciesism that has underlined most of philosophical history, making it an ideal addition to this moral framework (Guerini, 2018). I discuss the CA in detail in Section 3; for present purposes, it identifies ten different areas of life necessary for flourishing, like experiencing emotions and having control over one's environment, which should be protected for all individuals and communities. Adding the ten capabilities in the CA to an ethics of care gives the theory greater specificity and applicability, allowing for greater differentiation across contexts. This is similar to the definition of care proposed in Daniel Engster's 'basic needs' approach: "everything we do to help individuals to meet their vital biological needs, develop or maintain their basic capabilities, and avoid or alleviate unnecessary or unwanted pain and suffering, so that they can survive, develop, and function in society" (Engster, 2007, pg. 28).

Inherent to an ethics of care are relationships of dependency. In the human context, this dependency is recognized universally: every human depends on others from the moment they are born. However, regarding nonhuman animals, Engster (2006) claims that an ethics of care can only be extended when they are in dependent relationships with humans, such as with companion and farmed animals. I argue that this is an expression of the "separate spheres" (Walker, 1989) interpretation of care ethics, where application is limited to private or intimate

contexts, with matters of public policy and international relations remaining guided by other moral frameworks. And this interpretation has received pushback. Joan Tronto summarizes this contradiction, “If caring is used as an excuse to narrow the scope of our moral activity to be concerned only with those immediately around us, then it does have little to recommend it as a moral theory” (Tronto, 1989, p.111). Similarly, Grace Clement (1996) makes the argument that there are many public issues that share features of private relations, thus requiring the integration of an ethics of care. She recognizes that there are unique vulnerabilities in private relations due to the impact our actions and choices can have, but also that our actions and choices can impact those beyond our private sphere, creating an obligation for care to those affected. This ties into Martha Nussbaum’s arguments around the degree to which humans have the responsibility to interfere in the lives of nonhuman animals that are not directly dependent on us. She claims that in today’s world, humans are impacting all wild forms of life in myriad ways to such a point that there really is no “wild” anymore, if the wild is defined as a space beyond human control (Nussbaum, 2023, p. 226). Habitat destruction, chemical/plastic pollution, and climate change have expanded our influence, creating new relations of dependency with wild animals as their ways of life are disrupted. While wild animals may not be directly dependent on us like farmed, captive, and companion animals, relationships of care should be established due to the negative externalities produced by some human societies, just as Tronto and Clement claim they should in contexts of international relations.

While I do claim that an ethics of care can permit greater intervention in nonhuman animals’ lives, it must do so with particular respect toward protecting animals’ agency, autonomy, and sense of dignity. Protecting **agency** means respecting animals’ capacity to make meaningful decisions in their environment. This is most at risk in contexts where animals are held captive in controlled environments, such as in zoos and intensive farming operations (Špinka, 2019). So, it is important to keep in mind that expressions of care should not mimic contexts of captivity. Similarly, captivity is a great threat to **autonomy**, or the capacity to act freely based on one’s own reasoning (Thomas, 2016). Though autonomy is like agency, Thomas claims that autonomy emerges when agency and self-awareness are both present in an individual. Lastly, **dignity** is a tricky concept that has been defined in different ways, from absolute moral value to a property inherent to humans (Challenger, 2023). However, the concept of dignity that I choose to use here emerges from the work of Martha Nussbaum and Lori Gruen. Nussbaum (2005) argues that dignity emerges from the various properties that allow an individual to be a flourishing member of their species. When any of these properties are hindered, and an animal cannot behave like a typical member of their species or population,

dignity is infringed. Gruen (2018) expands on this, adding a relational component to Nussbaum's interpretation. It is not enough for an animal to be able to express all their natural tendencies, they must also be recognized by their species or community as an individual belonging to it for dignity to be preserved.

These concepts are important in differentiating interventions to promote animals' **wellbeing** and those to improve their **welfare**. Animal welfare largely focuses on identifying and alleviating poor conditions or experiences suffered by animals (Broom, 1991), whereas animal wellbeing additionally seeks to positively promote physical, mental, and social health and satisfaction (Lynn et al., 2023). It incorporates respect for animals' agency, autonomy, and sense of dignity, maintaining above all else that "nonhuman animals have an interest in the outcomes of their lives, just as we do" (Baker, 2016, p. 2). It can further include all the domains of life shown in the following figure, making it a robust, general-purpose lens through which to plan intervention, and participation, in wild animals' lives.

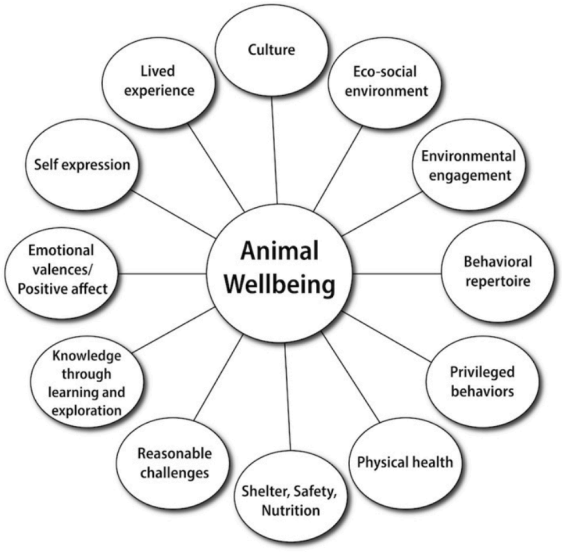

Figure 1: Spheres of Wellbeing (Baker, 2020)

Suffering

Both the avoidance of suffering and the pursuit of flourishing are important for sentient beings. Even in the most ideal cases and contexts, suffering is abundant in the lives of most sentient beings. While scholars debate whether the amount of suffering is greater or less than the amount of total pleasure for the average individual (Fischer, 2022; Palmer, 2022), net suffering will likely always far outweigh net flourishing due to the high number of deaths in childhood. Most animal species are r-strategist reproducers, meaning they have many children

at once, rather than investing heavily in one or two children at a time. Most r-strategist children do not survive to maturity, meaning there are a massive number of animals that live short, hard lives that usually end in suffering in some form (Johannsen, 2021). And this suffering is morally actionable: in the words of Engster, “The reason to oppose animal suffering from the perspective of care ethics is not because we wish to maximize utility or consistently apply our rights theory across species, but because we have relations with animals and care about them” (Engster, 2006, p. 1).

Disease, exposure, starvation, injury, and predation are common threats faced by all sentient beings to some degree, including humans. However, in the case of humans, we have worked to prevent and mitigate these harms as much as possible throughout the history of our species. Some scholars suggest that the first tool invented by humans was the mobile container, or bag, which served myriad useful functions (Langley & Suddendorf, 2020). Bags can hold more food during foraging, allowing for a greater accumulation by each group, thereby reducing hunger and chances of starvation for everyone. Similarly, a bag can hold a newborn baby, allowing their mother to continue using her hands for other tasks until the baby has grown. Another early invention was permanent and semi-permanent shelters, which provided needed protection from the elements and predators (Scarre, 2018). Early humans also developed medical techniques to heal injuries and cure disease, a practice which has continued and grown such that most children now live to see adulthood, a broken bone is largely an inconvenience, and infections are rarely a death sentence (Yuan et al., 2016).

Unfortunately, humans’ mitigation of our own suffering often comes at the expense of other species’ and individuals’ wellbeing. For example, some of those first bags, shelters, and medicines were made from the bodies of animals killed for that purpose (Currier, 2017; *Tools & Food | The Smithsonian Institution’s Human Origins Program*, 2024). Human prowess in hunting with tools certainly made life harder for the species being targeted, many to the point of extinction. Later, human domestication of other species reduced our risk of starvation and exposure, at the expense of those individuals’ interests and wellbeing. One could argue that human domestication of other animals is a fair deal for those animals who get to live in relative safety and health compared to their wild counterparts, but these animals are deprived of their capabilities for life, associating freely with others, and control over their environment, to name a few. Ultimately, the “deal” of domestication is not made for the benefit of the nonhuman animals themselves, and so will always favor human interests (Nibert, 2013). Humans have expanded our habitats, making them safer, but destroying the habitats of countless other species in the process. And the entire field of modern medical research is built on the backs of millions of mice

and other animals used to test new drugs and treatments (Ribitsch et al., 2020). The result of this research has been a steady progression in medical understanding that has drastically mitigated the consequences of injuries and significantly lowered rates of death. And while humans are the primary beneficiaries, we have also developed medical treatments and technology for nonhuman animals that depend on us for care. This is a mostly altruistic effort in the cases of companion animals and injured wild animals, but for farmed animals treatments are only developed to increase efficiencies in industrial meat, dairy, and egg production at the expense of the animals' wellbeing (D'silva, 2006). Additionally, some of these treatment strategies have been transplanted into the sphere of wild animals in the form of wildlife rehabilitation centers, which are also largely altruistic (Willette et al., 2023).

So, while the history of human effort contains a strong throughline of reducing suffering for humans, that effort is not universally undertaken for all beings experiencing it. Still, in the contexts of companion animals and wildlife rehabilitation, there comes an intrinsic understanding that other animals' suffering is comparable to our own, and the same tools and processes can and should be used to help where possible. These intuitions and the actions they spur should be expanded beyond select wild and companion animals and generalized into an ethic that sees all sentient beings as worthy of moral consideration and action.

Section 2: Why is it Our Responsibility?

Intervention vs. Participation

Humans are a part of nature. At the same time, modern levels of human activity are unprecedented in Earth's history and are significantly damaging the rest of the environment. But this was not always the case. For the majority of our species' history, we lived sustainably in relation with other species and the shared environment, at times even working to maintain the environment for both ourselves and other species and individuals. In contrast, modern conservation practice is structured around the concept of **intervention** in nature, where discrete acts are taken to counter certain threats or promote specific goals. Commonly, interventions involve an outside party coming in and enacting some change that they deem necessary. One can contrast this with actions taken by humans living in the target area, like Indigenous fire ecology practices, because of the shared geography and history of those practices (Goode et al., 2022). I propose that this **participation** in nature is distinct from interventions because those responsible for taking action live with the consequences, leading to a deep appreciation of generational knowledge in guiding best practices and avoiding environmental catastrophe

(McGregor, 2004). Participatory acts have respect for a shared environment, shared history, and shared dependence on the outcome of any actions taken. Interventions, on the other hand, often ignore wider contexts in pursuit of specific goals, like the reproductive success of an endangered species. Often, interventions are done by humans who do not live in the area they are intervening in, instead justifying their actions out of existential necessity. This is not to say that all interventions are bad, or that species should fight extinction on their own, but that the interventionist framing of our relationship with the natural world denies the opportunity for mutually flourishing participation.

When looking at the various conservation actions that could be undertaken, how can one delineate between those that are more interventionist and those that are more participatory? One element already discussed is the co-location of the enactor and target. Another is the consideration for the sentience of the animals being targeted. The final element, discussed in the next section, is paternalism, or humans deciding how life should be for nonhuman species and individuals.

Placing Paternalism

Paternalism refers to any action that limits an individual's or group's autonomy with the intention of promoting their own good (Dworkin, 2020). It requires a relationship between a moral agent, one that can have moral obligations, and moral patients, who cannot have moral obligations but are owed them by agents. Paternalism can also imply an attitude of superiority or that the actions are against the will of the patient, but this is not always the case. Parents have a paternalistic relationship with their children, making decisions for them that they are as of yet incapable of making themselves. While this relationship comes with a lot of responsibility for the parent and mistakes can be made, it is not seen as undesirable or inappropriate by wider society (Mill, 2008). Many parents try hard to put their children's desires first when making decisions for them and most do not do so with a condescending attitude of superiority. These healthy paternalistic relationships are necessary for individual flourishment, providing protection and guidance while the child learns how to interact with the world and how they want to place themselves within it. We also accept paternalistic relations when it comes to matters of public safety. It is generally acceptable to levy a fine on someone who disposes of dangerous materials incorrectly or refuses to participate in vaccination programs. In all cases, the properties of **consent** and **assent** are paramount, with the difference being that consent is an informed decision by an adult and assent is a more limited agreement by an individual lacking full consent capacities (Spriggs, 2023). For example, adults who acquire driver's licenses

consent to a system of rules and regulations where their autonomy may be infringed upon if they are pulled over while driving. Importantly, only consent can be relied on for protecting the recipient of an action, so any meaningful assent must be accompanied by valid consent. A child may assent to participating in a study at school, but the child's guardian's consent is still required. So while paternalism is not an inherently bad relation, there is a great opportunity for abuse that can result in hugely problematic relations like those established by enslavers and colonizers throughout history.

When it comes to human participation in the wellbeing of wild animals, there are two objections from paternalism (Kruse, 2017). First is the attitude aspect: superiority and the hubris of thinking we could know what nonhuman animals want or what is best for them. I agree that a paternalistic attitude can not have any place in wellbeing participation; the ideal attitude would be more similar to that of an adult providing as best they can for a child. Centering participation in wellbeing around an ethics of care is one way I encourage a non-paternalistic attitude, orienting thinking around what is lacking for nonhuman animals in their contexts rather than starting from human superiority and guiding animal life to be more like us. Mary Midgely (1998) provides a useful concept for demarcating these relations: kinship. As animals ourselves, we are not completely ignorant of the struggles of animal life. There are many overlaps in how all animals move through and relate to their world, but some species have more significant overlaps with humans either through geographical proximity, evolutionary history, or shared lifestyles. For example, one important shared reality between humans and some nonhuman animals are family structures. While many species' members have little interaction with one another besides reproduction, others will maintain both mating and platonic relationships for extended periods of time. And a significant subset of those species play some role in caring for younger individuals in some capacity. We can recognize these relationships of care because similar relationships have always existed in human populations and are the major driver behind many innovations to improve human wellbeing. Often, it is not one's own suffering that drives innovation, but the suffering of one's mother, father, sibling, or child. Even the suffering of unrelated humans can serve as motivation, as was the case with the inventor of the polio vaccine: Jonas Salk. Salk did not lose any family members or close friends to polio; his research was motivated by concern for public welfare as proved when he refused to patent the vaccine, making it far more accessible than it would have otherwise been (Tan & Ponstein, 2019). By starting from ethics of care and acknowledging the similarities and shared contexts between humans and other animals, we can participate in wild animal wellbeing while rejecting a paternalistic attitude.

Paternalistic actions, on the other hand, will be necessary to mitigate suffering and promote flourishing for wild animals. That being said, the modes of participation that I will suggest may impact autonomy to such a small degree that it may be imperceptible. Still, a loss of autonomy can occur regardless of whether the individual or group is aware of it. At the same time, life in the wild is already extremely limiting for many individuals and species, and human participation may make more autonomy possible overall. To help ensure actions remain beneficial for the animals in question, precaution must be held to alter their lived experience as minimally as possible. The **precautionary principle** states that "when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically" (Kriebel et al., 2001). For the purposes of this thesis, I extend this to include harm to nonhuman animals' health. Kriebel goes on to list four main components of the precautionary principle: preventative action to meet uncertainty, placing the burden of proof on an action's proponents, examining the full range of alternatives to potentially harmful actions, and increasing public participation in deciding which actions to take. These are all important, but the third component about finding alternatives to harmful proposals is most so, as many harmful interventions in nature have been due to a lack of creativity and lack of funding to support that creativity. But by embracing creativity and the precautionary principle, we can identify participatory actions that are minimally invasive, promote flourishing, and respect autonomy. While both participation and intervention are paternalistic, only intervention entails a paternalistic attitude and a desire for certain outcomes. Participation emerges from an ethics of care and kinship, resulting in a more compassionate and respectful paternalism like that of a parent toward a child, promoting overall wellbeing while respecting their agency, autonomy, and sense of dignity.

Section 3: How To Do It?

Theory of the Capabilities Approach

The previous sections emphasized the importance of sentience in determining which beings' interests should be considered and why we should care about them. I designated an ethics of care to be the best way of justifying participation in promoting wild animals' wellbeing but recognized that it can be considered incomplete due to the flexibility in defining care. To add some specificity to this approach, I now turn to Martha Nussbaum's Capabilities Approach (CA) to animal ethics which should help with determining the specific standards of care for various individuals and species across many contexts. It can be used practically within legal systems to

promote and protect nonhuman animals' interests and allows for comparison and resolution of competing interests, which will be especially important in Chapter 4. Now begins the tricky work of discerning what those interests are, how to effectively promote and protect those interests (flourishing), and how to resolve conflicts of interest within and across species boundaries while preserving animals' agency, autonomy, and sense of dignity.

Nussbaum originally developed the CA as a measure of human flourishing for the United Nations (UN) due to existing metrics, like Gross Domestic Product (GDP), insufficiently capturing the full breadth of human experience, especially that of women. The ten capabilities are similar to rights in that Nussbaum believes they should be protected by legal systems, but differ by representing important domains of lived experience rather than specific ideals to be upheld. The original list of ten capabilities is shown below:

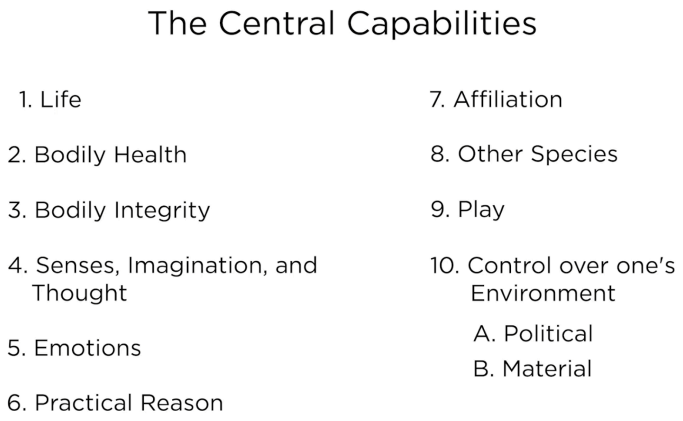

Figure 2: The Central Capabilities (The University of Chicago, 2021, 3:20)

This list of ten capabilities is the same for the human and nonhuman versions of the CA. This is because it seeks to define what is needed to live a good life, and human life is not all that different from nonhuman animal life. Not every individual, human or otherwise, will necessarily seek to express every capability, but ensuring access to these ten provides a solid foundation for anyone to live a good life. Like utilitarianism, the CA is a consequentialist theory, as these capabilities must actually be satisfied for every being who desires them. But it rejects the utilitarian dichotomy of pleasure as good and pain as bad, instead facilitating individual choice dependent on context. It is possible for pain to be a part of satisfying one or more of the capabilities, as is the case for number five: Emotions. There are very painful emotions like grief

that the CA would seek to protect as much as it protects access to positive emotions, ensuring a wide breadth of emotional experience.

Nussbaum does find more commonality with deontological approaches, particularly that of Korsgaard and her recognition of animals' capacity for dignity, though she protests Korsgaard's claim that nonhuman animals lack emotional capacities on the level of humans which places humans in a special category apart from the continuum of existence and experience. This attitude, and a focus on human rationality as the ultimate determiner of morality, is ultimately what makes Nussbaum distance the CA from deontological, Kantian approaches, including rights-based theories like that of Regan. For Nussbaum, a sound theory needs to recognize morality as an aspect of animal nature, emerging from human and nonhuman experiences alike. Any theory that fails this measure risks "a danger of self-splitting and self-contempt (so often linked with contempt for women, for people with disabilities, for anything that reminds us too keenly of the animal side of ourselves)" (Nussbaum, 2023, p. 68). While Korsgaard does address this issue when it arises in her theory, she does not expunge it entirely, maintaining a special distinction for human morality.

Ultimately, the CA surpasses these other frameworks by grounding itself in the lived reality of being an animal. As Nussbaum puts it, "the CA list captures, in effect, the shared terrain of vulnerable, striving animality that each species inhabits in its own way" (Nussbaum, 2023, p. 102). The ten central capabilities, if satisfied, should facilitate the flourishing of both individuals and populations of any sentient species. For wild animals, Nussbaum places the first three capabilities at the forefront: once they are protected, the rest take care of themselves. These first three capabilities, *life, bodily health,* and *bodily integrity* are fairly intuitive and it is easy to see how any animal would care about these things. For Nussbaum, the satisfaction of these capabilities for wild animals would require halting all harmful human activities, from directly harmful activities like poaching and trophy hunting to indirectly harmful activities like pollution. It would further require the protection of environments from threats of climate change and other large-scale human activities, as well as a scaling-down of such activities. Lastly, depending on context, it would require some proactive use of knowledge to protect animal lives and health. The example she uses here is of large wildlife reserves, which are managed by humans but not to the degree of a zoo or small reserve like Oostvaardersplassen. In these contexts, preemptive actions like spraying for tsetse flies are required where safe and possible. Further, all other forms of medical care could be permissible as Nussbaum equates these reserves to "large non-enclosed zoos" (Nussbaum, 2023, p. 235) and animals in zoos receive premium medical care. Still, she cautions against upsetting animals' ways of life with frequent

interventions to promote their health, calling on veterinary experts to continue growing this field and establish guidelines for which medical interventions can be done without overly burdening the animals in question.

For Nussbaum, the remaining capabilities are more of a concern when it comes to companion and captive animals. However, this becomes tricky in conjunction with her first Principle of Ethical Stewardship, that every wild animal habitat is a human-dominated space, presumably somewhere on the spectrum including zoos and large wildlife reserves. If human control is present in all wild environments, then there must exist the possibility of one or more capabilities being infringed upon in some way. For example, the capability for *senses* could be infringed upon by moderate noise or odor pollution: not so much pollution as to noticeably affect health, but enough to interfere with the normal sensing experience. However, I agree with Nussbaum that capabilities for *imagination, thought, emotion, practical reason,* and *play* are largely satisfied for wild animals by the alleviation of human-caused harms. These capabilities seem to emerge naturally when animals are relatively free from bodily pain and able to interact freely with their environment and peers. As Nussbaum puts it “All creatures want the opportunity to make some key choices about how their lives will go” (Nussbaum, 2023, p. 102). This includes choices about which other individuals to *affiliate* with*,* including those from *other species*.The last capability is the *political* and *material* control over one’s environment, which Nussbaum claims all animals seek to some extent. *Political* control simply refers to being able to participate in group decisions that affect one’s life, like a herd deciding where to migrate next or a close-knit family choosing to exclude members like orcas and elephants do when males reach an age where they begin to make problems for the group. This capability is restricted when humans put up fences and disrupt animals’ social units. *Material* control, however, is restricted when humans stifle or obviate animals’ behaviors. A beaver released into an area without trees will be unable to build a dam, causing them harm. Similarly, if the beaver were to successfully build a dam, and humans removed it overnight, that would also restrict the beaver’s capability for material control.

Applying the CA

Nussbaum largely limits the application of the CA to those animals that are nominally under our control. But an ethics of care would expand this to any animal with the capacity for suffering. What would the satisfaction of Nussbaum’s capabilities look like when it comes to animals in the wild? Wild animals face many threats to their lives and health, including hostile weather, natural disasters, starvation, dehydration, parasitism, disease, stress, and injuries from

accidents and conflicts with other animals (Horta, 2017). Presently, wildlife rehabilitation centers are able to remedy much of this harm for the subset of animals they have access to, provided the animals' species is well-studied. Expanding these programs and facilities would increase the number of animals that can be treated, but there will always be animals that are too far away from that aegis of care. There have been some efforts to bring medical treatment to the wild, such as edible rabies vaccines being deployed in areas near human habitation centers. While the ultimate goal is preventing disease in humans, nonhuman animals also benefit when they do not contract rabies.

However, there needs to be a shift in the justifications for these kinds of programs to center the affected animals as ends in themselves. Nussbaum proposes a "virtual constitution", based on the 10 capabilities, that provides a list of tasks for various governing bodies to begin addressing. This is done in recognition of the absence of a real governing body that could promote these capabilities for all animals globally. Instead, they must be protected and promoted through legal systems by individual nations, states, and localities wherever and to whatever extent possible. As the needs of each individual, species, and context will differ, Nussbaum calls for panels of experts to advocate for the specific needs and capabilities of a given individual or population. These surrogate representatives will be the interface between implementations of her virtual constitution and the animals affected by them. This is not to say that Nussbaum advocates for individual animal rights per se, merely that they should have legal standing and representation. With recent developments in granting legal standing to ecosystems, this vision is not so far off from what is currently practiced and growing in popularity.

While Nussbaum describes well the areas of life that should be protected for wild animals, she does not prescribe how far we should go in protecting them. Should every disease in nonhuman animal species be cured? Should every broken bone be set and mended? This calculus she leaves up to veterinary researchers to determine the best care that can be given without causing excess harm or suffering. Even more vague are her pontifications around predation, a conflict that emerges when attempting to satisfy the capabilities for life and health in all animals. The case she uses to illustrate her thinking on this is that of two piping plovers at Montrose Beach in Chicago. These rare birds had their first eggs eaten by a skunk, so in response the city installed a protective enclosure to protect future eggs. The result was four successful hatchings, with two succumbing to predation before maturity. Regarding the two deaths, Nussbaum asks, "Should there have been even more protection of the young chicks?" (Nussbaum, 2023, p. 251). After all, if the nest enclosure was an anti-predation measure then

why should further measures not be taken? To this, Nussbaum points out that further protection of the plover chicks may have prevented them from learning enough skills to survive once they leave the nest entirely. And what of the skunk? Protecting the plover nest merely stops the skunk from harming those individual plovers, but the skunk will go on to predate on other birds' eggs as substitute. In this case, the act of protection merely serves to protect one species over another, simply because we know there are fewer piping plovers than other kinds of birds.

It seems that to help without causing harm requires a greater level of creativity, effort, and participation by the humans seeking to do so. If we seek to reduce harm overall, including harms that result from careful intervention or participation, then larger, more complex **systems of care** need to be created to account for and rectify potential externalities. Such systems would result in a comparatively high level of human influence and control over the natural world, which is why it is important that they emerge from a participatory framework that respects animals' agency, autonomy, and sense of dignity in addition to their various capabilities.

Is Participation Possible?

If it ends up being impossible to participate ethically in wild animals' wellbeing, then there is a good argument for never starting down this path in the first place. But, should ethical theories always require a basis in scientific fact? Or, can facts about the world emerge from good ethical practices? This question of epistemology and ethics is addressed by Cheney & Weston (1999) who claim that an **ethics-based epistemology** is the most fruitful path for environmental ethicists and philosophers to pursue. This is in contrast to the traditional approach of **epistemology-based ethics**, where knowledge about the world is coerced into a rigid framework that invariably lacks contextual complexity. Such is the case with utilitarianism, which uses facts about pain and pleasure to inform all realms of ethical discourse. Similarly, rights-based ethical theories ground themselves in observations about how humans value life, freedom, or other concepts. But these theories have limitations for, "Our task is not to 'observe' at all…but rather to *participate*" (Cheney & Weston, 1999, p. 128). Here, the authors bring in Midgley's (1998) concept of the "mixed community" which calls for relational, ethical ways of being with the nonhuman animals in one's locale. Those still tethered to epistemology-based ethics will protest this framing as arbitrary and unsupported by existing scientific literature, but Cheney & Weston propose as counterpoint, "Hidden possibilities surround us at all times. The world is *not* readily knowable" (Cheney & Weston, 1999, p. 118). Ultimately, defining ethical frameworks under the aegis of current scientific understanding limits the possible futures

available to us. Putting ethics first opens up all potentialities for investigation, debate, and eventually action.

However, despite these strong arguments, in practical conservation the question of **feasibility** must still be addressed. Many scholars claim that any large-scale intervention in the wild will have unknown repercussions that lead to worse outcomes than had no action been taken in the first place (Palmer, 2022; Singer, 2009). This is understandable, as many well-intentioned interventions have not gone exactly as planned. Take for example the countless introductions of Cane Toads to control unwanted species on sugar plantations. In some cases, like in Puerto Rico, the toads did not expand beyond the desired area and effectively controlled the target species (Tyler 1998). This success led to the promotion of widespread cane toad introduction, including in Australia where not only did they not predate on the target species, the absence of natural predators allowed for their rapid multiplication across all of northwest Australia (Shine 2010). Conversely, the reintroduction of gray wolves in the protected Yellowstone region of the United States has been met with unanticipated and varying political opposition. Some states encourage hunting, ostensibly to reduce conflicts between wolves and humans possessing farmed animals (Keiter, 2022), though it would be naive to ignore the sadistic satisfaction enjoyed by men participating in said hunting (Luke, 1998). And as other states retain their protections for wolves, this has led to a situation where wolves who were introduced by one group of humans are now suffering under an ecology of fear imposed by a seperate group. If this consequence had been predicted by the former group, would they still have proceeded with the wolves' reintroduction? Or would priorities have shifted toward minimizing animal agriculture and establishing protections first?

Even scholars who advocate for intervention hold fast to the precautionary principle, maintaining that interventions should remain in the realm of thought experiments until we have enough knowledge about ecosystems to avoid these bad outcomes. In his chapter "The Moral Problem of Predation", McMahan (2015) surmises, "it may well be that any substantial efforts to mitigate the suffering of animals in the wild through the control of predation must await advancements in both our scientific and moral capacities" (p. 291). Johannsen (2021) echoes this, attesting that "With enough research, it will one day be feasible for us to safely conduct large-scale, humanitarian interventions in nature" (p. 12). And in her chapter "The 'Wild' and Human Responsibility" Nussbaum (2023) delivers a warning about intervention in nature: "We still know too little, and research is in its infancy" (p. 252). However, these scholars have not yet provided a picture of exactly what sorts of knowledge would be required, how we could acquire it, and whether it's possible to ever do so in an ethical manner. In Chapter 3, I address this

question of “how much knowledge is needed,” looking at existing and future wildlife monitoring technology to determine how we could get the necessary data without overburdening the species we are attempting to help.

Chapter 3: Remote Monitoring

Section 1: What Data Are Needed?

Animal Data

In order to learn more about nonhuman animals’ behavior, lives, and communities, we have to be able to monitor them in the wild undetected, as detection of any kind can always potentially cause changes in behavior. This is bad both for collecting accurate data (Jewell, 2013) and in the ways it can negatively affect animals’ wellbeing (Cooke et al., 2013; Manville et al., 2024). Presently, conservation monitoring technologies often come with trade-offs between more invasively acquired, individually specific data, and less invasively acquired data depicting general population trends. However, general population-level data are insufficient to fully understand the impacts of potential participation in wild animals’ wellbeing. Ideally, a competent system would gather data on every individual’s movements, communications, and relationships with others. We want to be able to answer questions like, “Did introducing contraceptives reduce the amount of time individuals spend grooming each other?” and “Did supplemental feeding alter the subsequent routes taken by individuals and groups?” We will not always know if an action we take has unintended side effects, or how negative those effects are, but even the most minor unknown effects could prove disastrous if they cannot be observed and mitigated. Take for example the fox-baiting conservation initiatives to support malleefowl populations in Australia. Since at least 1997, baited traps have been used around malleefowl nesting sites to protect this native species from introduced European foxes (Priddel & Wheeler, 1997). But it was only 15 years later that researchers looked into the efficacy of this program and found little benefit for the malleefowl populations protected by fox traps compared to those without (Walsh et al., 2012). Malleefowl face many threats besides predation from foxes, but data on those other threats and the ways they are addressed have not been integrated into the active management plan. Walsh et al. call for more evidence-based initiatives, asking lead conservationists to research ways of addressing threats from competing herbivores, suggesting that prescribed burning could be an effective addition to the malleefowl management plan.

As we are primarily concerned with monitoring the lives of sentient animals, systems to observe them directly are crucial. The specific data being gathered will vary by species and context, but here I cover the essentials for land-based species. Trade-offs in underlying technologies will be discussed in later sections, but the output of the chosen technologies should at least provide the following data.

Movement

Some of the most important and effective data for first learning about nonhuman animals in the wild is their movement in relation to their environment. This is partially why so many conservation initiatives rely on GPS devices and camera traps to inform their work: so little is known about animals' lives that this most basic information is what is most needed. But comprehensive movement data should include any and all data on how animals move their bodies through space over time, including small adjustments to resting positions, sporadic movements both above and below ground, and long-distance travel. This applies both to individuals' movement and the movement of groups of animals. Stepwise measures of direction, acceleration, velocity, and duration should be included such that the movement can be accurately replicated in simulation. Once data on movement is secured, it becomes much more possible to begin gathering more specific data on animals' health and behavior.

Health

If we want to be able to monitor wild populations for disease and injury, then collecting accurate data on their health is essential. Some health issues, like a broken ankle, will be most easily detected through analyzing animals' movement as above, but other conditions require more precise measurements. For fur/skin problems, high resolution cameras may be the only way to determine the nature of the issue and which individuals are affected. Internal injuries may only be detectable by listening to animals' heartbeats and breathing patterns, looking for any changes that could indicate increased stress. Occasionally, eDNA analysis could be useful for detecting the presence of contagious pathogens in animals not yet showing symptoms. Other measures may be useful depending on context, especially in cases where medical conditions can be ascertained through behavioral analysis.

Behavior

Defining what is and is not a behavior can be challenging. Some might include all movement under this category, but Baum (2013) explicitly excludes it, defining behavior as an

action resulting from a purposeful choice that takes time to complete. This is the broadest category of data described as every species and individual may have unique behaviors that need to be recognized as such and recorded in a systematized way. And behaviors that seem identical or nearly identical may have different internal motivations and external consequences. That is without getting into the distinction between behaviors that are mostly or entirely instinctual and behaviors that are exclusively cultural in origin. For example, researchers studying the differences in behavior between populations of orangutans found extreme variance among geographically separated populations. This included differences like only certain groups seeking shelter from rain, hunting and eating slow lorises, and using tools to acquire insects, seeds, and water (van Schaik et al., 2003). Further, researchers had to differentiate between two very similar behaviors: “leaf wipe” during which an orangutan would wipe their face with squashed leaves that they then drop, and “leaf napkin” during which orangutans use a handful of leaves to wipe latex off their chin, without necessarily dropping them afterwards. Even further yet, the “leaf wipe” behavior exists only in the context of another behavior “kiss-squeak with leaves” (not to be confused with “kiss-squeak with hands”), during which an orangutan presses leaves to their mouth to amplify vocal sounds.

This is all to demonstrate the vast diversity, intricacy, and complexity of animal behaviors that need to be captured and analyzed by monitoring systems. Human assumptions about where and when different behaviors are occurring, or even what counts as behavior, are insufficient. Monitoring systems will need to identify and describe novel behaviors as they are observed, continuously questioning their previous assumptions to provide the most accurate view of nonhuman animals’ lives.

Environmental Data

Data exclusively about animals themselves are insufficient to create a reliable model of an ecosystem. Environmental data, such as temperature or humidity are useful and necessary for predicting the various decisions animals in the environment will make. Similarly, data about soil and water composition, the dispersal and densities of various flora, and the presence of different pollutants can help us understand why animals make the decisions that they do, leading to better understanding of their lives. This is especially important to consider because we are in a time of particularly chaotic environmental changes due to human-caused climate change and pollution (Sih, 2013). The types and forms of data that fall under this category are too numerous to fully explore here, but every kind could potentially be useful in some context.

Some species or individuals may not be much affected by above-average wind speeds, but others could be, or could be indirectly affected by how plants or other animals act in response.

Which sensors and measures are used in different contexts should not be predetermined, at least to begin with. Instead, the widest array of possible measures from as many kinds of sensors as possible should be collected. This will allow for later analysis of corollary trends to determine which factors are most important in a given context. In combination with animals' movement, health, and behavioral data, these environmental data will begin to provide a holistic view of ecosystems and their processes, allowing for the prediction of some of the, though likely not all, unintended consequences from participation in wild animal wellbeing.

Simulation

Ecological forecasting seeks to predict future ecosystem states based on the dynamics currently being observed, though some critics claim these practices are "computationally irreducible", or unable to ever truly reflect real life ecosystems (Petchey et al., 2015). However, integrating continuous monitoring data into a simulation forecasting system would enable us to test actions that improve animal wellbeing before deploying them into the wild. This can help avoid the negative consequences of seemingly positive actions. No simulation is perfect, but they can always be improved by continuously gathering and integrating new data, comparing them against the model to identify unexpected changes. Over time, this will result in robust simulation models that can be used to predict the consequences of various actions with as much accuracy as possible. Though, there is always a risk with these systems that the assumptions or values of those developing them will affect the information gained (Acuña et al., 2021). This can be largely validated through the continuous integration and analysis of new data, comparing what is observed with what was predicted through simulation. If there are false biases present in the simulation's design, they should be revealed and resolved through this process. However, correcting for biases in simulation cannot account for biases present in the selection of monitoring technologies and techniques that will form the input to the simulation system. This is not an empty concern; there is currently wide agreement that evidence in conservation research is particularly susceptible to bias due to insufficient funding and a failure to standardize methods of observation over the years (Christie et al., 2021). Mistakes will be made, especially as this technology is first being developed, and enactors will need to determine what kinds of mistakes are acceptable and which are not.

With these data about animals and their environment, we should be able to simulate something like an "average day" for different ecosystems which will then form the foundation of

future simulations. Permutations on the “average day” allow for simulation of various different events and effects, like days filled with rain or days that are unusually dry. Acquiring sufficient data to develop these high-fidelity simulations will allow for the prediction of many unanticipated side effects, though not all. When simulations fail to predict outcomes that are observed in the real world, they must automatically self-adjust to make that prediction in future cases. However, simulation should never be taken as truth and I’ll cover the importance of reversibility when participating in wild animal wellbeing at length in Chapter 4.

Section 2: Impacts of Monitoring in the Wild

Today’s Technology

Some of the data defined in the previous section are already being acquired through common conservation technologies in use today. GPS collars and tags are quite good at providing movement data over a long period of time regardless of distance traveled. Some of these devices even include sensors for acceleration, velocity, and temperature which would help fill other gaps in the data. Similarly, trail cameras provide a lot of movement data and can also support additional sensors due to their high power requirements. Cameras can potentially provide more data on animals’ movement than is possible with GPS trackers due to realistic limits of how many animals can be captured and have individual devices attached to them, but this data is less dense as animals will move in and out of a camera’s view over time (Caravaggi et al., 2017). This limitation is starting to be addressed by ConservationXLabs’ Sentinel cameras, which are capable of real-time networking and analysis in areas with cellular or satellite signals (Conservation X Labs Annual Report, 2022). While their software does not yet coalesce data from multiple cameras to track animals between viewpoints, the devices themselves are capable of providing this functionality when there is sufficient camera density. Still, they are only capable of this as far as the environmental context allows. For example, more densely forested areas reduce overall sightability of large carnivore species when compared to more open areas (Metz et al., 2020).

Remote sensing systems have a role to play in collecting environmental data as well. Active systems like RADAR and LiDAR are useful for monitoring plant biodiversity over large areas, informing researchers of where different plants are located and their relative densities (Bouvier et al. 2017). Unlike passive sensing systems like cameras, these active systems do not rely on natural lighting to acquire data, making them able to gather data regardless of environmental conditions (Kerry et al., 2022). Another technology seeing ever greater use is

environmental DNA (eDNA) monitoring. By analyzing the various kinds of DNA in a given source such as a body of water or animal droppings researchers are able to determine the relative densities of various species in that area. This technology has become much more accessible in recent years, with Conservation X Labs developing NABIT, a handheld eDNA analyzer for rapid on-site analysis (Conservation X Labs Annual Report, 2022). This eliminates the need to send samples to a lab which can take a long time especially when the samples are collected in hard-to-access areas. Analysis of animal droppings can reveal even further information, such as the relative effects of stress under a predator-induced ecology of fear (Valerio et al., 2021). DNA analysis can also be used on fur captured from fur traps and the resulting DNA is complete enough to be used for individual identification (Woods et al., 1999). This could be used in conjunction with existing methods identifying individuals like their unique body movements, footprints, and sounds (Petso et al., 2021).

Negative Effects

If it is impossible to gather the necessary data about animals' lives without noticeably impacting them, then we should refrain from doing so. GPS collars are effective, but significantly impact the animal that they are attached to. Not only does the animal need to be captured, possibly sedated, and restrained to attach the device, the devices themselves can negatively impact the animals after they are released. Cooke et al. (2013) found that, at least for fish, effects from capture, confinement, crowding, handling can all increase post-release mortality from injury, disease, and predation. They also point out the need for well-trained technicians to be carrying out internal device implantation in sterile surgical environments, with the use of anesthetics wherever possible. Failing to do so increases post-release mortality which both harms the individual fish and the results that may be gleaned from the study. Dennis & Shah (2012) report similar post-release behavior changes in possums from stress, with additional, but comparatively small, effects from the GPS collars used. It is important to note that different species and individuals will have varying responses to capture and device attachment. For example, scimitar-horned oryx will increase head-shaking behavior for several days following device attachment, but return to normal levels of this behavior following that period (Stabach et al., 2020). Measures of stress markers in their droppings supported this finding, with stress levels returning to baseline five days post-attachment. But other species may not be so lucky. Even another ungulate species like spotted deer sees a 22% mortality rate post-release due to capture myopathy (Ashraf et al., 2019), highlighting Cooke et al.'s call to cease reuse of tagging

methods across species and contexts without validating the effects of tagging in the novel species.

Unfortunately, while cameras provide excellent data in all three categories, they are easily detected by most animals. This is in part because camera traps are often baited to attract more animals in the area. But in any case, their lenses reflect light in a similar way that eyeballs do, making them stand out against the background. They also produce a smell that, while hardly noticeable to humans, is distinct enough to be noticed by many other animals. These are minor issues when the camera trap is already baited with food, but become major issues when trying to scale up this system in a way that minimizes interference with the observed ecosystem. Already, cameras demand massive battery power, which in turn requires conservationists to frequently travel to their locations to replace their batteries. As the video and image data produced by cameras is relatively large, replacing memory cards somewhat frequently is required when wireless infrastructure is unavailable or insufficient.

I have already mentioned that eDNA analysis is minimally invasive, and this is largely true in most contexts. Researchers may need to hike into animals' habitats to collect samples for analysis, but that is far less than what is required to maintain a fleet of GPS trackers or cameras. Even in the case of fur-traps, devices that capture a small amount of animals' fur as they brush past them, impact on the animal is negligible (Ausband et al., 2011). Still, the data they provide is only part of what is necessary to gain a holistic understanding of ecosystems and the animals that live in them.

Other-than-Negative Effects

It would be hubristic to assume that any time an animal becomes aware of humans or our technology, they are affected negatively. How they are affected will depend on what was noticed, the species in question, individual personality, and context of the interaction. Species of deer are known for being particularly sensitive to the sound and sight of camera traps, sometimes briefly stopping what they were doing and observing for threats, though rarely fleeing outright. However, in other contexts they have been observed spending an inordinate amount of time in view of and around camera traps. This could be due to lucky coincidence of camera placement, but it is likely somewhat due to the "human shield effect" observed with how some animals behave toward human presence and our artifacts. The clearest example of this is with female polar bears in Manitoba who seek out tourists when they are caring for cubs in order to protect them from males' violence (Steyaert et al., 2016). And it is this example precisely that

makes me most hopeful that humans can positively impact nonhuman animals' wellbeing, and most worried for the possible future where humans decide to leave "nature to be nature".

Not all species take advantage of the human shield effect as intentionally as polar bears, but it appears wherever we leave a trace of our presence (Atickem et al., 2014; Gutierrez et al., 2020; Rodrigues et al., 2023). It could be that the smell of humans and our devices repels carnivores, creating safe zones for preyed-upon species. Of course, some individuals and species do not notice human artifacts at all, and others grow used to their presence over time especially if humans are not making frequent visits and re-scenting the area. Ultimately, conservationists need to weigh the observability of their monitoring devices with the potential effects on the animals in question. Some will avoid them intentionally, others will flock to them for the perceived protection they offer, but failing to account for these effects leads both to poorer data and the chance for negative outcomes for animals' wellbeing.

Section 3: Future of Monitoring Technology

Future Public Priorities

Advances in monitoring technology alone will not solve the ethical monitoring problem. While future developments to improve the quality of data gathered, increase overall reliability, and lower costs will undoubtedly result in better monitoring solutions, there are many improvements that could be made today with adequate public funding for conservation and research initiatives. Often, the technological methods available to conservationists are far from the cutting edge, leading to increased trade-offs in impact to animals vs. data gained. Satellite-capable cameras would eliminate the need for researchers to manually change memory cards, which currently requires them to visit each camera, leaving scent trails and other evidence of their presence which can alter animals' behavior in the area afterwards. They would also allow for continuous video data recording, rather than intermittent video or images currently stored on memory cards. Normally, this would create too much data for researchers to analyze, but there are already several AI-based tools in use for analyzing massive video data for animals' presence to help automate this process.

In addition to a necessary increase in funding for these projects, there also needs to be a publicly-led integration of academic and practical conservation initiatives, particularly in the U.S. Presently, conservation researchers are most interested in novel problems due to incentives in the academic publishing industry. There is very little work that can readily be used by conservation practitioners, who primarily work for state agencies. Even the work that is useful

is often inaccessible as state governments do not pay for access to academic publications for their conservation departments. Further, state conservationists are not funded enough to have the time to translate their own work to academic publications, meaning academics, and other conservation departments, lack access to this potential bounty of data. This “research-practice gap” is counterproductive to overall conservation goals, but could be solved with increased public investment and integration of the fields of practical and academic conservation.

Future Technologies

The most promising field for low-invasivity, high-scale, high-fidelity data collection is acoustic monitoring. Other technologies will be needed to cover every category of necessary data, but systematized acoustics alone could provide more accurate movement data than cameras while remaining virtually undetected by the animals under observation. Data from individual audio monitoring devices is already used in avian point counts (Mennill, 2024) and endangered species detection (Thomas et al., 2017), but a system of multiple audio devices will be capable of far more. At the most basic, this can be accomplished through detecting sounds of movement like brustling or footsteps from multiple microphones and triangulating the location of the source. In other contexts, such as for species that make use of vocal communication, microphones can be used to identify individuals based on unique elements in their vocalizations that can be detected by machine learning algorithms (Wierucka et al., 2024). Microphones are less costly than cameras, both in actual cost, the power required to run them for long periods of time, and the bandwidth necessary to transmit data gathered. This makes a microphone-based system a good general-purpose tool for all kinds of environments and contexts, perhaps even the foundation upon which holistic systems of monitoring are built.

Still, microphones are not able to provide all the necessary data. For example, while some injuries to animals could be detected through changes in their breathing pattern, walking gait, or sounds of pain, others may only be identifiable visually. It would be challenging to deploy enough cameras to continuously monitor for this, but drone-based imaging may be a solution in some contexts. This could include contexts where individual identification is required as facial recognition algorithms for nonhuman animals are already under development (Clapham et al., 2020). Normally, drones would be an undesirable monitoring technology because of the loud sound they make, but a deployment-on-demand solution would allow drones to fly high enough to be undetectable from the ground (Hernandez-Santin et al., 2019). Some birds may notice the drones, so their use should be limited in areas inhabited by sensitive species, but elsewhere they could surpass the limitations of static camera traps.

Future Systems

More important than any single monitoring technology is the need to coalesce and systematize them. Multiple cameras working together can gather more information than each working independently and the same is true for similar technologies like microphones and RADAR. When cameras are able to work in conjunction with microphones, RADAR, eDNA, soil sampling, and all other possible measures, the information output is greater than the sum of its parts. Data can be analyzed for previously unknowable correlaries in environmental outcomes, continuously building up our total knowledge of ecosystem processes. New sensors and methods of analysis can be incorporated over time, further solidifying our predictive capabilities of ecosystems and the species and individuals that live there.

In addition to providing the necessary data to understand animals and their ecosystems, complex monitoring systems can serve as an early warning system in cases of emergencies. Fast-spreading diseases, natural disasters and new species arrivals could all be detected through this system, making the early mitigation of their effects possible. Diseases can be treated before they spread beyond control, injuries from accidents can be assessed for treatment, and species newly entering an ecosystem can be found and relocated if there is a substantiated concern that they will have a negative impact on species already present. If such monitoring systems are designed to have minimal effect on the species they observe, then it will be possible to glean much more information from our observations of animals and ecosystems than is possible at present.

Chapter 4: Future of Wild Wellbeing Participation

Section 1: Proposed Interventions in Wild Animal Wellbeing

Predation

Perhaps the largest challenge to promoting wild animal wellbeing is the existence of predation. It is a controversial topic, with some seeing it as a structural inequality that needs rectification (Johannsen, 2021; McMahan, 2015), and others viewing it as a necessary evil or “sad good” because of the role it has in balancing ecosystems and promoting biodiversity (Lynn, 2006; Ripple & Beschta, 2004). From those who argue that some mitigation of predation is morally required, there are two main paths they propose for doing so. The first, and simplest, is

deliberately causing all carnivorous and omnivorous species to go extinct. This could be accomplished in a variety of ways, from gene drives to delebrite extermination campaigns, but the end result would be the extinction of a multitude of species from obligate carnivores like wild cats to omnivores like foxes. The second, more challenging solution is the use of gene drives to coerce carnivorous and omnivorous species toward an herbivorous diet and lifestyle. The end goal with this strategy is to bring about a world much like that described in the story of the peaceable kingdom from the book of Isiah in the Bible. The story is a prophetic prediction by Isaiah, imagining a world where:

> The wolf shall lie down with the lamb;
> the leopard shall lie down with the kid;
> the calf and the lion will feed together,
> and a little child shall lead them.
> The cow and the bear shall graze;
> their young shall lie down together;
> and the lion shall eat straw like the ox.
> (*New Revised Standard Version Updated Edition*, 2021, Isaiah 11:6-7)

The prediction here is that when certain animals are no longer able to gain nutrition from predation, all will come to live together in copacetic harmony. In reality, factors like ecologies of fear and ingrained hunting instincts will prevent this unless additional gene changes are included that are able to address these various behaviors. Or, sufficient time and generations passing could potentially eventually erase most ecologies of fear and predatory instincts in the absence of any real threat/need.

Those promoting intervention in predation are not ignorant to the ecological fallout that would ensue were it done prematurely without sufficient knowledge of ecosystems, their processes, and the animals that inhabit them. To mitigate animals' suffering in the near-term, Johannsen (2021) suggests one additional use for gene drives: removing animals' capacity for suffering during the first two weeks of animals' lives. While this might seem even more unlikely than developing gene drives to modify carnivores' diet to be herbivorous, research summarized by Shriver (2009) indicates a distinction between the **sensory** and **affective** dimensions of pain, with the affective dimension equated to what we call suffering. At least in humans, each dimension can be independently suppressed, leading to patients who either experience some vague suffering but cannot pinpoint the cause or patients who can describe the pain they feel,

but are not bothered by it. So, for Johannsen, preserving the sensory dimension of pain while temporarily suppressing the affective dimension would greatly reduce the suffering experienced by nonhuman animals, while preserving the ecological role of predation. And his time period of two weeks for the suppression to last is informed by data showing that this time period is when the majority of individuals in r-strategist species suffer death from any number of natural causes, including predation. Beyond this two-week marker, juvenile animals have a much better chance of surviving to maturity and may need an affective dimension of pain to maximize that chance. Johannsen also believes that without suffering, or an affective dimension of pain, one's ability to experience pleasure is necessarily reduced, which would deprive nonhuman animals of the experiences such interventions are meant to protect and promote. Still, Johannsen only views this as an inferior, but more feasible, alternative to the ideal of using gene drives to modify carnivores' behavior and reduce rates of reproduction.

Reproduction

As predation, and the ecologies of fear produced by it, contribute significantly to reducing the populations of preyed-upon species, mitigating it in any significant way would simultaneously require intervention in those species' rates of reproduction. Otherwise, deaths from predation would be replaced with deaths from malnutrition, parental neglect, or any of the other natural causes of mortality. Further, without an ecology of fear, species have more time to eat and reproduce, leading to even greater population increases than would be expected from the removal of predation alone. Therefore, multiple scholars including Johannsen, McMahon, and Nussbaum have proposed that taking action to reduce population growth is both acceptable and necessary. Some propose using gene drives for this goal as well, especially as it is far more feasible than gene drives for herbivorification, but others leave it up to future researchers to determine the best method for achieving this at scale.

However, there are already initiatives in progress to suppress nonhuman animals' rates of reproduction, particularly in contexts where there is a lot of human-wildlife conflict. In the continental United States, white-tailed deer are virtually omnipresent as a consequence of human activity. As colonialists continued to grow and expand their settlements across the continent, they killed and drove away wolves to make easier their way of life. Like with some Indigenous cultures, including the Koyukon people of Alaska (Nelson, 2020), this was done to make more hunting available for humans. However, colonial wolf hunting was also done specifically to protect farmed animals and out of a misplaced fear of dangers wolves would pose to their communities (Musiani & Paquet, 2004). And unlike Indigenous wolf hunting, which was

undertaken when deemed ecologically necessary, colonialist wolf hunting continued unabated until wolves were entirely extirpated from the continental United States in 1970. This, in combination with the wide-spread development of suburbs (Urbanek & Nielsen, 2013), has created numerous largely safe and hospitable environments for deer where their populations have experienced unprecedented growth and now frequently come into conflict with the humans that made this possible.

The primary conflict at play is an increase in collisions between deer and human vehicles. While suburban human communities may have a lot of advantages for ungulates, they also rely heavily on roads for car-based travel. Deer need to travel frequently to find fresh forage, so it is easy to see why they are frequently crossing roads and inevitably being injured and killed in the process of doing so. Humans are also harmed in this interaction, both due to the financial burden of car repair and the chance for injury or death, though the human mortality rate in these incidents is only 150 per 1,500,000 collisions (*New State Farm® Data Reveals the Likelihood of Hitting an Animal While Driving in Every State*, 2023). To address this, some municipalities are trying a variety of solutions to regulate their deer populations, either by reducing their numbers or controlling their movement. For decades, this was mostly done through enabling and encouraging local hunters to yearly cull the nearby population. This is still done in some areas, but more and more municipalities are finding that not enough people want to hunt for them to meet their yearly culling goals. Instead, they are now turning to alternative management strategies including fencing, repellants, relocation, and contraception (Shono, 2003).

Health

Presently, most attention toward animals' health is in the areas of wildlife rehabilitation and veterinary medicine. The former primarily treats animals that have been harmed by human actions or presence, the latter treats animals under our care including companion, farmed, and captive animals, including those at wildlife rehabilitation facilities. Outside these domains, there are a few small initiatives that can improve health outcomes for animals, mainly different forms of mass vaccine dispersal for rabies (Mähl et al., 2014). The oral rabies vaccine has contributed greatly to the reduction of rabies worldwide and its complete elimination in several areas like Switzerland, Estonia, and France. While this is done to protect human populations from the virus, nonhuman populations benefit too. Importantly, administering these vaccines does not greatly interfere with animals' daily lives and may go virtually unnoticed. Nussbaum (2021)

hinges her reasoning about levels of adequate medical care in different contexts on this one measure, “we run a grave risk of upsetting the animal’s form of life, if intervention is too frequent and too disruptive” (p. 235).

To illustrate this, Nussbaum uses the example of a tiger at the Brookfield Zoo who had recently received a hip transplant (Chicago Zoological Society, 2021). Since captive animals in zoos regularly receive medical treatment, their way of life is not as severely impacted by treatment as it would be for wild animals. The hip replacement was done to treat arthritis which may or may not have been caused by captivity. On one hand, tigers live far longer in zoos than in the wild which gives them time to develop age-related diseases like arthritis (Barton, 2022). On the other hand, since this has only been observed in captive settings, it is possible that a long-lived tiger in the wild with a large natural range would take longer to develop arthritis, or never develop it in the first place. Nussbaum contrasts this case with that of animals in large reserves. Though reserves are vastly different from a zoo, animals in them are still under human care and receive less-invasive treatments to repel tsetse flies and other hazards. However, should an animal in a large reserve receive a hip replacement if experts decided their quality of life would improve as a result? This is the gray area that Nussbaum encourages veterinarians to engage with, judging on a case-by-case basis what is best for each animal. At the same time, she highlights the intolerability of a tiger in Chicago receiving the care necessary to walk again, while a tiger living on a reserve in Asia would not receive that care, “just because the reserve is larger than the zoo! (And what other relevant difference is there, other than that the reserve is a better habitat?)” (Nussbaum, 2023, p. 235). Overall, Nussbaum promotes additional investment in producing good health outcomes for animals that are under our care, even nominally, so long as the solutions are respectful of “what the animal needs in order to live as itself” (Nussbaum, 2023, p. 232).

Section 2: Principles of Participation to Promote Wellbeing

Precaution

This principle serves two purposes. First, it is a warning against actions that affect or alter an animal’s lived experience. Herbivorizing carnivores would be a prime example of an action that violates this principle. And precaution here is not limited to the unknown ecological effects this would cause; it is also possible that there are aspects of carnivores’ individual and group psychologies that would go unsatisfied without hunting.

Second, this principle helps with the political palatability of proposed participation. Many of us have negative instinctive reactions to the thought of such wide-scale changes to ecosystems, or simply to the thought of humans changing the natural world at all. Highlighting precaution in these discussions helps to assuage common concerns that the animals affected will experience a sudden and drastic change in their environments, leading to an inevitable population drop-off. Ideally, any changes would go virtually unnoticed by the affected animals as we do not want to confuse a change's efficacy with its initial impact.

Reversibility

Some actions can be taken back, others cannot. A large concern when proposing actions that could have unforeseen outcomes is that those outcomes will be unavoidable and permanent. Instead, if every proposed action had to be easily reversible at the slightest hint of an unforeseen negative effect, then there could be far less concern in attempting to implement these solutions. The worst outcome would just be reverting to how things were prior to the action.

This principle is simple, but powerful. If there is an existential risk in taking actions that affect ecosystem dynamics, then ensuring those actions can be quickly and easily reversed is the best way to avoid the worst outcomes. A counterexample of a reversible solution are gene drives. As commonly described, this technology would spread a genetic change to an entire population from just a handful of individuals with the change released into the wild. For the entire population to be affected, this process would take generations. If at any point during that time an unforeseen consequence were observed, the only way to revert the process would be to release new individuals with the gene change reverted, which would then take generations to overtake the previous gene drive, assuming no further unforeseen consequences. While they might technically be reversible given enough time, gene drives do not have sufficient reversibility for ethical participation in wild animals' lives. Other suggested actions, like the deliberate extinction of carnivores, would be truly irreversible.

Minimizing Harm

When it comes to predicting the outcomes of various actions we could take to improve wild animals' wellbeing, one rule is clear: excess reproductive success will always disrupt environmental homeostasis. Even eliminating the most minor disease in a species can cause knock-on effects for both that species and those they interact with. To call back to my example

in Chapter 1, if we eliminate a disease that normally kills 10% of rabbits in their first week of life, then a mother rabbit would have 10% more babies to care for. This could cause increased stress for her if she cannot find enough food or does not have enough time for individual grooming and care. For those same reasons, the babies themselves could feel greater stress than they would otherwise. Even if all still survive to adulthood, the ecosystem might not have enough food for all the "new" rabbits, leading to starvation. This is an example of the commonly used "counterproductivity objection" to improving the lives of animals in the wild. To move past it, participation to improve wellbeing must account for it when implementing solutions.

This problem does not disappear when the species in question is carnivorous or omnivorous rather than herbivorous. The same dynamics around resources in the ecosystem are maintained, with newly excess offspring potentially suffering as a result. The difference is that species that are preyed-upon by carnivores will also have their wellbeing negatively affected due to outsized predation pressure. Participation in animals' wellbeing requires attention to these factors to ensure that, in attempting to aid one individual or species, others are not harmed in consequence.

Context

The modes of participation that I suggest in this thesis are not possible without significant changes to human societies and culture, particularly those of colonial origin that rely on capitalism to manage their resources. Already, conservation initiatives that emerge in these contexts are often underfunded which limits the available options and reduces overall effectiveness. For example, species deemed invasive will often be shot, poisoned, or trapped as these are very low-cost methods for addressing the issue. However, these initiatives rarely succeed completely, requiring continuous culling to maintain improvements in native species abundance. Not only is this an ineffective solution, it is immeasurably cruel to the individuals and populations targeted by these programs. Take for example the issue of red foxes in Tasmania, who were introduced between 1998 and 2001 and pose a significant threat to Tasmania's native species (Sarre et al., 2013). Efforts to eradicate them have been ongoing: in 2015, researchers even believed these efforts would soon be completed (Caley et al., 2015). However, proving these programs' success has been difficult, with researchers calling on the wider community to develop novel ways of detecting fox presence due to the inefficacy of existing scat-detection methods (Ramsey et al., 2018). Even if the foxes are extirpated, the presence of cats in Tasmania (Lazenby et al., 2021) and studies on cat-fox dynamics in South Australia

(Stobo-Wilson et al., 2020) indicate that negative impacts on native species will remain unchanged as cats fill the niche.

All of this is to show the inherent limitations of conservation initiatives that are constrained by budget, time, and scope. With additional funding, conservationists could have instead developed an ongoing program of trapping and relocation for both foxes and cats. This would have been far kinder to the individuals affected as well as encouraged the early development of better monitoring techniques that Ramsey et al. now deem necessary. In order to make this level of funding available for conservation, capitalistic systems of excess and growth must be supplanted by systems where waste is minimized through the equitable distribution of resources. In Half-Earth Socialism, Vettese and Pendergrass (2022) discuss their vision for how to move from the world we are in now to a world where catastrophic climate change is prevented, the sixth extinction comes to an end, and socialist democracy is omnipresent. They suggest radical changes to human societies and our geographic distribution, with at least half of the land on Earth earmarked for wildlife preservation or rewilding. This depiction of **eco-socialism** is argued to be the best path by which we can hope to overcome the problems created by centuries of capitalism and exploitation, "producing a society which constantly revises itself towards a more just and environmentally stable civilization through conscious choice" (Vettese & Pendergrass, 2022, p. 123).

Capitalism is just one system that needs to be deconstructed to make ethical participation in wild animals' wellbeing possible. It often co-occurs with systems of colonialism, particularly settler colonialism, which similarly works against the goals of eco-socialism. Failing to originate ontologies of conservation within an anti-colonial perspective accepts, tacitly, "the givenness of the white-supremacist, settler state" (Smith, 2010, p. 10). In failing to recognize this history and the violence entailed, animal ethics scholars falsely arrive at platitudinal conclusions such as:

> Wildness might be intrinsically valued based on the belief that some parts of the world should be free, so far as is possible, from being formed or shaped by humans' 'abstractly conceived ends' (Palmer, 2022, p. 860)

In reality, many groups of humans have lived as part of the natural world sustainably for hundreds of thousands of years, shaping it to better suit their needs and even sometimes the needs of nonhuman species that they live alongside. It is the actions of, relatively new, colonizing cultures that have disrupted these sustainable practices, supplanting them with the

unsustainable growth of colonial enterprise (Lempert & Nguyen, 2011). And many of these sustainable cultures also take much more nuanced views toward the relationships between humans and nonhuman animals, recognizing shared interests where they exist (Belcourt, 2015).

Deconstructing colonialism will be challenging and require efforts across many different domains, but a primary requirement is the repatriation of lands to native peoples (Tuck & Yang, 2012). Then, in a context of land repatriation and eco-socialism, significant efforts can be made toward improving wild animals' wellbeing. Recall that in Chapter 2, Section 2, I made a distinction between intervention and participation, with participation being a relational, ongoing practice performed by those living in proximity with the animals in question. The use of lands under settler colonialism is incompatible with such a model, as made evident by our destructive animal agriculture, endless mono-cultured suburbs, and ceaseless growth. Only after settler colonialism has been deconstructed can we move toward "a decolonial politics that conceptualizes animals as kin who co-produce a way of life that engenders care rather than and contra to suffering" (Belcourt, 2020, p. 24-25).

Responsible Technology Use

There are many ways to define technology, but I prefer the deliberately broad: "application of knowledge." This includes physical creations like tools and medicine, but also systems and processes, like mutual aid and governments and pre-digital. Technology often refers to the former physical creations, but often tools are created from existing systems and processes, and vice-versa, making the difference between them less meaningful. For example, ecologists in the past would compile species' demographic information by hand according to a standard procedure, making it usable by the wider community. Nowadays, statistical computing software processes that information in a very similar way, just more of it, and more quickly. In most cases, creating a tool to replace a process is faster and more reliable, but processes can still be used for almost anything a tool can do. And it is pointless to talk about technologies irrespective of the systems they are used in. For example, in Indigenous fire ecology practices, which part is the "application of knowledge"? Is it knowing how to start fires, or knowing when and where to light them? I argue that the entire process is the "application of knowledge," comprising a technological solution to a problem.

This definition is important because there exists a contingent of animal ethicists who, rather than fearing unexpected consequences from intervening in nature, fear what happens if these interventions succeed (Palmer, 2022). Palmer summarizes the argument thus:

> Large-scale interventionist projects to genetically shape wild animals, for instance, may be beneficently inspired, but on this view they are redirected projects of domination, based on a confidence in the human ability to understand and judge wild animals' experiences, and seeking to use human technological power to control animals and the natural world in order to make them fit the humanitarian patterns humans think best. (Palmer, 2022, p. 860)

Palmer claims that these objections emerge from a position of human humility (Hill, 1983), de-centering human priorities and perspectives in an attempt to avoid the "humanization" (Hettinger & Throop, 1999) of the natural world. Such beliefs may seem justly precautionary, but they are based in the falsehood that humans are somehow categorically distinct from every other part of the natural world, and worse, incapable of relating to it authentically or sustainably.

Using technology as part of authentic, sustainable relationships with nonhuman animals does not cross some metaphysical boundary beyond which no "true nature" can exist. It is merely a continuation of our ever-evolving relationship with the natural world, allowing us to understand other animals' lives in new ways and making available paths previously unknown. An early human would have recognized the pain felt by a wolf pup with a broken leg, but competently caring for the pup while healing the injury would have proved challenging. Today, we have the collective knowledge to be able to care for many species with all sorts of injuries and diseases. We know the right kind of milk a wolf pup needs, how to apply a cast, how long the bone will take to heal, and how to avoid over-exposing them to human presence in the meantime, making their survival post-release more viable. Applying this knowledge, wildlife rehabilitation centers are collectively able to help hundreds of thousands of animals every year, nearly twenty thousand in New York alone (Hanson et al., 2021). Therefore, I claim that using technology in the context of relationships of care is morally permissible, and likely required.

Section 3: Participating to Promote Wellbeing

Oostvaardersplassen

In this section, I rely heavily on the case study of Oostvaardersplassen (OVP), a controversial nature preserve in The Netherlands built on land reclaimed from the sea. Originally intended for industrial purposes, the land went unused until several species of wetland migratory birds began to rest and nest there, which eventually led to formal enclosure and protection of the land under the state nature conservancy. At this point, officials became worried

that the bordering willow trees would spread into the new land, eventually overtaking the wetland and displacing the birds newly calling it home (Vera, 2009). To remedy this, they introduced several species of ungulate, primarily red deer, to eat the willow saplings and keep the forest at bay. This was effective, but the small size of the preserve (35 km^2) and lack of corridors to other areas eventually led to a mass starvation event in the winter of 2005. Nearby residents, able to see the starving ungulates through fences, began providing them with supplemental food as assistance.

The following year, officials held a culling of deer to prevent another mass starvation, at the protest of the general public. This did lead to some population stability up until 2017 during which another mass starvation event resulted in the deaths of at least 3,300 ungulates, 65% of the population, though most were shot by authorities rather than fully undergoing starvation (Barkham, 2018). Culls have been held yearly following this, with meat from the events available for purchase online. There has been much debate over how to handle the ungulates in OVP moving forward. Some criticize the original plan for not introducing apex carnivores alongside the ungulates to control their population through predation and an ecology of fear. While officials have never justified this decision, the small size of the reserve and proximity to large human populations may have been a concern. Others criticize the small size of the reserve itself, claiming it is far too small to contain these traditionally migratory species (Kopnina et al.2019). The original plan did include a corridor to another reserve, but this never came to fruition due to protests from local farm owners. Presently, consensus from academic conservationists demands that ungulates be removed from OVP and relocated to a larger habitat, but for now the ungulates remain.

Medical Care

As mentioned in the ‘Health’ topic of Section 1, animals in reserves tend to receive basic, non-invasive medical treatment when deemed necessary and appropriate. This is not the case in OVP, where animals’ only interactions with humans are when they are distantly observing or culling them. I agree with Nussbaum that animals in reserves should receive medical treatment when it does not overly interfere with their way of life, and I claim that the existing practice of culling interferes with their lives far more than all but the most extreme medical interventions. With the small size of the reserve meaning that injured or sick animals could be located fairly quickly, OVP should have a small rehabilitation center on-site. This would coalesce with their

overarching mission of protecting wetland birds, as those individuals could be healed and released like they would be if they lived in a more human-proximate environment.

Further, animals at OVP could easily receive preventative treatments in the form of oral vaccines. While this is not the largest priority since disease transmission is somewhat prevented by the fenced enclosure, it could easily be incorporated into overall treatment plans when deemed beneficial. In general, there are a huge number of illnesses, conditions, injuries, and parasites suffered by nonhuman animals that humans could potentially play a role in mitigating. While some treatments may be overly burdensome to individuals, many are not and advancements in technique will continue to move options into the latter category. As these systems of prevention and treatment evolve, it will become possible to help many more animals than we do currently without compromising their way of life.

Supplemental Feeding

In the case of OVP, there is a clear need for additional nutrition for ungulates leading up to and during the winter months. The mass starvation events have shown that, without intervention, ungulates will continue to starve once they deplete OVP's yearly food supply and cannot migrate to new foraging areas. However, the ongoing intervention of preemptive culling is incredibly unethical and cannot be allowed to continue. An obvious solution is to follow the recommendations of Kopnina et al. (2019) and relocate the ungulates to somewhere else where they can live more normal lives. But there are two issues with this. First, not many places remain where ungulates can live truly undisturbed. Especially in Europe, their natural ranges will inevitably overlap with human populations and be restricted by the artificial boundaries we create. This is not necessarily the worst outcome, but it would be naive to say that all the harm that ungulates experience in OVP would be eliminated if they were relocated. And while relocating the red deer to areas with existing populations may be relatively straightforward, the other two species in OVP, Konik Horses and Heck Cattle, do not have existing natural ranges and may require sanctuaries instead. Since red deer represent over 90% of the ungulates in OVP, relocating them could make available sufficient space for the remaining ungulates, especially as these species are less susceptible to starvation than the deer. Still, until such a time as relocation is achieved, additional fodder is required to prevent mass starvation and suffering in the ungulates living there.

However, even if the ungulates in OVP were to be relocated, supplemental feeding may still be needed. Presumably, in the ungulates' absence, the rabbit population would grow and take over more of the reserve until they begin to experience mass starvation events themselves.

It is also possible that the fox population will be able to suppress the rabbit population through an ecology of fear, but too little is known about these species' relationship in OVP to say for certain. In any case, a supplemental nutrition plan should be in place so that if starvation begins to occur, it can be quickly remediated. Even if starvation is not imminent, supplemental nutrition also plays a role in protecting plant biodiversity. One of the benefits ascribed to carnivore reintroduction is that the ecology of fear they create makes preyed-upon populations eat less and move more frequently (Brown et al., 1999; Gaynor et al., 2021). This ensures enough plants are left in an area to reproduce and provide enough food for the preyed-upon population when they next visit. With the addition of supplemental nutrition, it is similarly possible to protect endangered plant species from overconsumption by ensuring that their consumers' appetites are satisfied.

Starvation is a threat every animal faces, not just those in wildlife reserves. While addressing it in that context may be more feasible, ensuring that all animals have adequate food is an intrinsically valuable goal, although not without challenges. For herbivorous species, the primary obstacle is distribution. It is easy enough to grow a variety of edible plants for different species in indoor environments that minimize agricultural impact, but getting those plants out to every animal that might be experiencing starvation is seemingly impossible. However, with large-scale monitoring systems in place, determining which individuals are at threat from starvation and locating them for distribution is realistic in some contexts. Actually delivering this food without excessive human activity in these habitats is challenging but not insurmountable. Air- and ground-based drones can deposit food near individuals or populations identified to be most in need. Food can also be air-dropped across a large area, useful when trying to help widely dispersed species. Eventually, it may be best to shift efforts toward encouraging the growth of edible plants in animals' own environment by contributing additional nutrients via below-ground irrigation systems and germinating additional seedlings, though this will require some technological advancement to be realized.

Contraception

Life as an animal has always been full of threats. In response, animal life has always ensured enough individuals will be born such that some sufficient percentage reach reproductive maturity without succumbing to disease, injury, starvation, or predation. When these threats are removed or mitigated, reproduction continues as usual, leading to a growth in population. This is part of the process of dispersal and differentiation, but can lead to tragedy in contexts where relocation is impossible and alternate food sources are inaccessible. The mass

starvation events that can occur in these contexts are horrifying to witness, as was the case with OVP and nearby residents being moved to action by what they saw. The additional food these activists provided was surely appreciated, but did little to help the ungulates in the long run. Instead, park officials now carry out yearly culls of red deer, both reducing their overall numbers and manifesting an ecology of fear that further reduces population growth. Officials did consider contraception as an alternative to culling, but ultimately found existing methods either cost-prohibitive, ineffective, or dangerous to the ungulates treated (ICMO2, 2010). However, effective, safe contraception would enable ungulates to live in OVP in stable populations without the fear and harm imposed by yearly culling.

The most viable option for this, immunocontraceptives, already see widespread use in managing human-wildlife conflict with minimal health impact on the individuals affected (Miller et al., 2013). ICMO was concerned that immunocontraceptives would prove too costly or harmful, either requiring extensive monitoring to determine which individuals have already been dosed and/or received their yearly booster, or yearly capture of nearly every female deer for controlled administration. Gupta & Minhas (2017) concur that the delivery of these contraceptives is the most challenging, and potentially harmful, part of the process. They discuss options including capture-and-release, dart guns, and oral bait, but each have their downsides. Capturing the percentage of animals required to slow population growth is logistically unsound for all but a few cases where the number of individuals is low and they are easy to locate. Dart guns are particularly effective for large animals like deer, but can injure smaller animals if the dart hits a sensitive area. Oral delivery is effective for a variety of contexts, but extra care must be taken if non-target species are able to find and eat them. Unfortunately, the hormone used in most immunocontraceptives does not function when ingested orally, meaning this method can only be used in other capacities, such as for the distribution of rabies vaccines (USEPA, 2009).

It is possible that with advanced monitoring immunocontraceptives could be administered effectively and safely. Identification of individuals would ensure that each has their own health record listing prior doses of immunocontraceptives to ensure that overdosing does not occur, and that enough individuals are being treated to produce stable outcomes for the population. However, this solution does not best exemplify the principles of participation, particularly reversibility due to the high variation in how long the contraceptive will remain effective, anywhere from one to four years. For example, if earlier predictions of high population growth fail to pan out, it is difficult to quickly course-correct later on when the population begins to dwindle. Ideally, contraceptive solutions more similar to human progesterone pills, which must be taken daily, would prevent this outcome. Further, relating to the principle of precaution,

immunocontraceptives must necessarily be given only to a sizable subset of a population. Likely, this subset is skewed toward individuals who are more comfortable with human proximity, with warier individuals taking an outsized place in the reproductive pool. I am not sure what effects this could have, either on the individuals or the long-term consequences for the species. Thus, according to the principle of precaution, a less-risky solution is needed.

I believe the best solution is one briefly mentioned by Gupta & Minhas: genetically editing plants to produce contraceptive compounds. There are hundreds if not thousands of plants that have been used as contraceptives by humans throughout our history, with many more still waiting to be discovered (Bhatt & Deshpande, 2021; Pradhan et al., 2013). The relevant hormones, peptides, and proteins can be grafted onto the plants being consumed by the target species in whichever concentration is deemed safe and appropriate for that context. By putting the contraceptives in the plants already being eaten by that species, we reduce the risk of other species' exposure to them. Further, since the plants will be eaten by most if not all members of a target population, the selection effect created by immunocontraceptives is largely eliminated. This solution synergizes well with that for supplemental feeding: the compounds can be put in that food rather than needing to be genetically introduced to plants in a wide area. Though I suspect that as it becomes possible to grow supplemental food in situ, so too will it become possible to add contraceptive compounds to those plants directly. Still, ensuring only the target individuals and species are affected is paramount. The advantage of plant-based contraceptives is that there are thousands to pick from and they can be combined. This will allow researchers to develop specific formulas for different species in different contexts, testing for negative effects on target and non-target species to prevent worst-case scenarios.

Even if contraceptives can be administered safely and effectively, is it fair or ethical for one species to deliberately control the population growth of another? If it can, it can only be when it is done in tandem with and proportionate to other initiatives. Curing a genetic disease that normally kills 1% of a population would have to be attached to a corresponding reduction in effective fertility when, through monitoring, it is known or suspected that there are few extra resources in the environment to support an increased population. In OVP, where ungulates are protected from predation, competition, and novel diseases, a larger reduction in fertility would be necessary to stabilize their population and avoid mass starvation events. Similarly, white-tailed deer in suburban areas of the United States could have their fertility reduced since they are currently being protected from predation. But in any context, contraception should only be considered when human actions, either purposeful or not, have led to a reduction in mortality compared to the species' average.

Satisfying Carnivores' Capabilities

It might seem that without apex carnivores, OVP is a poor case study for looking at ways to participate in carnivores' wellbeing. However, in addition to the ungulates, officials also introduced a small number of red foxes and rabbits, presumably to help round out the nascent ecosystem. OVP lacks detailed monitoring of the behavior of animals living there, but based on foxes' behavior in other regions, they are likely predating on baby fawns and the rabbits, in addition to eating bird eggs when possible (Jarnemo et al., 2004). It is also important to note that the foxes are likely not the only species occasionally engaging in predation. There have been many cases where ungulate species have been found opportunistically consuming baby birds, especially in contexts where access to food or natural salt licks is limited. But, if the ungulates are removed from OVP as most conservationists continue to call for, then this will no longer be a concern.

But even without the ungulates, the foxes will continue their predation on the rabbits, causing them death, injury, and manifesting an ecology of fear that will stifle their natural impulses to feed, socialize, and mate. However, this relationship of force is not unidirectional. Foxes, too, experience suffering in this dynamic as many preyed-upon species have evolved defenses to fight back against carnivores (Brown et al., 2016). Even if injury is minimal, impairing carnivores' ability to hunt can potentially lead to their starvation and the starvation of their dependent offspring (Mukherjee & Heithaus, 2013). And the meat itself poses a risk. Parasites and pathogens thrive in carcasses and can potentially harm the consuming animals. This is especially true in cases where carnivores are scavenging rather than hunting directly. Ideally, carnivores should not have to risk harm from hunting or suffer the effects of poor quality food.

If the solution to this is not to extirpate or herbivorize the foxes, then the only way forward is to change their environment such that they can still express their capabilities without causing harm to others. And there are examples of this from which to draw inspiration, primarily in the context of carnivorous companion animals. Dogs and cats are both natural hunters so over time we have come up with numerous ways to satisfy their instinctual behavior in the domestic environment. Zoos also face this challenge with their carnivorous captives, but their solutions are less developed than those competing in the companion animal space. I particularly want to draw attention to the CHASE! system developed by SwiftPaws, which uses a wire track combined with several pulleys to create an immersive chasing experience.

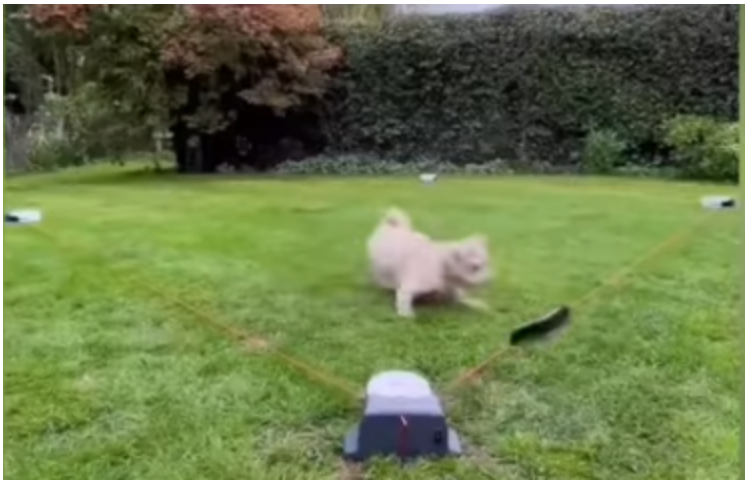

Figure 3: CHASE! System from SwiftPaws (Let's play SwiftPaws 🐾)

This is only a basic application of the technology. A more complex system could include tracks hundreds of feet long, connected by any number of pulleys, and include underground sections. And unlike with companion animals, a system for wild animals would need to directly tie into how food is distributed. Otherwise, we run the risk of over-exerting individuals to the point where their normal behavior is impacted, or causing abnormal repetitive behavioral issues similar to those reported by cat owners who use laser light pointers as a major source of enrichment (Kogan & Grigg, 2021). Thus, these systems should have food for the carnivores at the end of the tracks to integrate the hunting and feeding experience. But, what kind of food? Procuring supplemental nutrition for herbivores does not require other unethical actions, but additional food for carnivores would need to come from farmed animals. This is ethically difficult because a major reason to provide supplemental food in the first place is to prevent the suffering and death of rabbits in OVP. Replacing this suffering and death with equivocal suffering and death for farmed animals is not much of an ethical "win" (Milburn, 2022). Fortunately, lab-grown or cultured meat is rapidly becoming available and would be the ideal solution for feeding carnivores ethically. It also has far fewer dangerous pathogens and can be kept sterile up until the moment of delivery, meaning it would be the safest way for carnivores to get nutrition. And because no hunting is actually required, elderly carnivores and carnivores with injuries can be cared for by giving them the meat directly, or hiding it nearby.

In OVP, several lure systems based on CHASE! could be deployed to cover much of the area that foxes inhabit. With information from monitoring systems on foxes' locations and which individuals are hungry, lures could be launched to ensure those individuals are the ones who end up consuming the food at the end. The systems may need to be changed over time as

foxes learn to recognize existing paths, but they should provide an experience analogous to hunting without any externalities of harm. Of course it is possible that foxes will continue to hunt the rabbits even with these systems in place. If it is not possible to coerce their behavior toward the safer, potentially tastier alternative, then partitioning OVP between the two species is likely the next best solution. It may be necessary in any case if the rabbits are still experiencing an ecology of fear from shared proximity with the foxes.

One purpose of including precaution in the tenets of ethical participation in animals' wellbeing is to prioritize indistinguishable experiences for the animals affected. We do not know and cannot predict every possible outcome from changing things in animals' environments, so it makes sense to change as little as possible and make those changes unnoticeable. The prior example of tracks and lures would not provide an indistinguishable experience for the foxes, but I see it as the next best step on a path that will inevitably enable us to create truly indistinguishable experiences for carnivores. Over the next few decades, robotics will likely advance to the point where many small robotic units can be deployed into a target area, acting autonomously for hours or days at a time. Already, robotic animals have been deployed into environments for observational purposes, as seen with the BBC's *Spy in the Wild* miniseries. For this series, John Downer Production Ltd. developed several robotic facsimiles of animals, including a bushbaby, wolf cub, and warthog. Some robots were sent into areas where they would primarily be "interacting" with members of their copied species, but others were sent into situations involving cross-species interactions. In the case of the warthog, producers tried to see if they could get meerkats to groom it like they were grooming other warthogs in the area. Seemingly, the meerkats recognized this robotic warthog as real-enough, encouraging it to sit down for easier access. Though the meerkats shortly moved on as the robot had no parasites for them to eat, they interacted with it as they would a real warthog. This leads me to believe that applying a similar concept in the context of predation is both technologically feasible and ethically permissible with the proper precautions.

Unlike the spy robots, robots for predation would need to have an edible component, otherwise carnivores would be wasting their energy for no reward. While these robots would have to have an artificial skeleton, cultured meat could then be affixed to their frames in a detachable way, such that carnivores do not accidentally bite or consume the artificial skeleton, which can then be reused. And the technology of cultured meat production is not limited to muscle tissue. Organs can be added for additional nutrition and skin can be stretched over the robotic frame to make the robot visually more appealing to carnivores. The behavior of these "soft robots" can be based on the real behavior of the species in question, as monitoring

systems will ensure we have rich data of the populations being robotically replicated. There are already biohybrid soft robots being created that integrate artificial and natural tissue (Guix et al., 2021) far beyond what is required for this solution, so I see it as a real technological possibility in the near future.

Finally, if these biohybrid robots prove insufficient and a truly indistinguishable experience is the only way that harms from predation can be mitigated, then likely less than a century is needed to develop the field of biobotics and enable the creation of fully biological robots that are indistinguishable in terms of appearance, behavior, scent, and taste. This technology is in its infancy, and researchers are primarily focused on small, novel living machines (Kriegman et al., 2020), but as various obstacles are overcome researchers predict a wide range of applications due to the general-purpose nature of the technology (Kamm et al., 2018). Only we will know that these robots lack sentience, with behaviors encoded to mimic the actual animals that are safeguarded by this system.

Chapter 5: Conclusion

Overall Thoughts

In this thesis, I have made the argument that an ethics of care provides the best justification for participating in wild animals' wellbeing compared to ethical theories that emerge from justice. So long as participation acknowledges and respects animals' agency, autonomy, and sense of dignity, it can be done regardless of how much net suffering or net pleasure an individual or population has. When combined with the Capabilities Approach, it provides the best moral framework for structuring what this participation would look like, focusing on acts that allow animals to better exercise their various capabilities. Discerning specific acts of participation requires deep knowledge of animals and their ecosystems to minimize the possibility of unforeseen negative effects. Gaining this knowledge without harming animals in the process is difficult, but I have laid out one path by which it may be possible through dense monitoring systems and simulation. With sufficient knowledge in hand, we can then begin participation. Curing diseases, healing injuries, and providing supplemental nutrition become possible when systems of contraception are able to counteract the counterproductivity objection and prevent mass starvation events like those in OVP. And when satisfactory substitute experiences can be provided it becomes possible to participate in mitigating the harms of predation, creating interactive experiences for carnivores that result in safe cultivated meat

rewards and releasing preyed-upon species from the ecologies of fear experienced under predation pressure.

Developing all the necessary technologies for ethical participation will take decades, but there are some contexts where participation can be attempted in the nearer future. Foremost in my mind is OVP: it is small and contained so issues with scaling can be avoided and the animals there are desperately in need of a more caring adaptive management approach. From there, participation in other contexts can evolve as technologies are developed, made more ethical and sustainable, and distributed equitably to where they can be used best. At this point, I think there is a path toward participation that does not infringe animals' agency, autonomy, or sense of dignity. However, if it is determined at some point that this is truly impossible for reasons I have not considered, I believe the next best path is toward a world where human harms to nonhuman animals are minimized, allowing them to live the best possible lives that nature will permit.

Next Steps

The systems of care that I have proposed are only the beginning of what may be possible, and morally required, in the future. I largely focused on systems for land-based contexts involving vertebrate species, ignoring invertebrates and non-land-based contexts as I feel the solutions for those spaces will be far more complicated than those for contexts we are already familiar with. Still, invertebrate animals suffer in similar ways to vertebrates, likely more so in some cases due to the unique brutalities possible in those contexts, like how parasitoid wasps lay their eggs in various beetle species, which are then eaten alive from the inside-out (Price, 1973). But how could an interspecies relationship like this be supplanted with a compassionate alternative? Growing beetle facsimiles for wasps to use instead of real beetles is an option, but keeping wasps and beetles geographically separated is impossible at present. Similarly, there is no method for geographically separating species that live in the water, especially ocean-dwelling species. But many of those species do face harms that could be mitigated, so continuing to research technologies that could help is a worthwhile endeavor.

Still, even the bare minimum possibilities for participation are highly untenable in the context of our current systems of economics and governance. Transitioning global food production to be plant-based, minimizing the waste generated by capitalism, and protecting land rights for indigenous communities will all be necessary to make available the necessary resources for ethical participation to improve nonhuman animals' wellbeing. The technologies involved in monitoring systems, cultivated meat, and robotics have vast energy and material

requirements that are likely impossible to meet ethically without changes in power production and mining operations. The need for batteries is especially difficult to justify given that most batteries today are made with cobalt, which is mostly made available through supply chains involving forced labor and child exploitation (Deberdt & Le Billon, 2022). And all of this becomes much easier if human population growth is contained to reduce the intense material requirements for sustaining massive populations (Ripple et al., 2017). While raising concerns over human population size has been associated with ideologies of white supremacy, making the subject taboo for many environmentalists, these concerns are again starting to enter mainstream discourse (Coole, 2013) and may be required to fight against neoliberal, pronatalist, patriarchal narratives of endless growth (Bajaj & Stade, 2023). When all these factors are addressed, an ethics of care can manifest across human and nonhuman animal populations, ensuring all individuals and communities are able to live their lives to the fullest, as free as possible from ecologies of fear, starvation, and other natural sources of suffering.

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