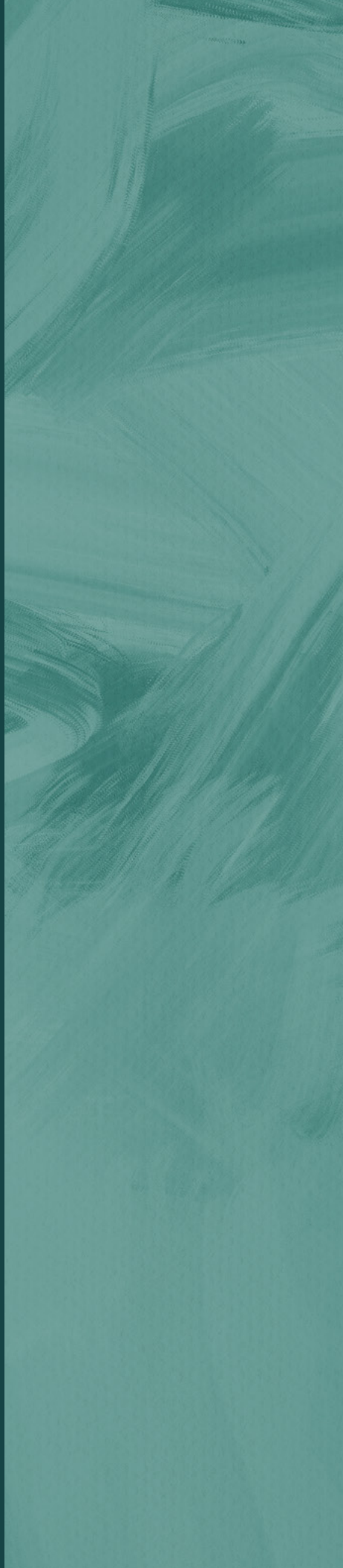
MORE THAN HUMAN LIFE

NYU LAW

Listening To Our Animal Kin

Legal and Ethical Principles for Nonhuman Animal Communication Technologies



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Executive Summary

Nonhuman animal communication technologies (NACTs)—tools and systems that use artificial intelligence, machine learning, and advanced robotics to record, analyze, and potentially translate animal communications—represent a rapidly emerging field with profound implications for human–nonhuman relationships. While these technologies hold extraordinary promise for conservation, wildlife protection, and deepening our understanding of the more-than-human world, they also pose serious risks to animal welfare, autonomy, and ecological integrity.

This report addresses the regulatory vacuum surrounding NACTs by proposing a comprehensive set of legal and ethical principles designed to guide the responsible development and deployment of these technologies. The proposed framework is designed for voluntary adoption by researchers, funders, engineers, and all actors involved in NACT design and deployment. As the field matures and more actors adopt these standards, the principles could evolve into binding regulations at institutional, professional, and governmental levels.

Part I of the report provides essential context. It defines NACTs as any tool or system leveraging AI, machine learning, or advanced robotics to facilitate translation of or bilateral communication with nonhuman animals—excluding simple passive monitoring and low-tech augmentative devices.

The report then catalogs four categories of risks: physical and physiological harms (injury, death, exploitation); mental harms (distress, confusion, privacy violations); relational harms (disruption of social structures and interspecies dynamics); and ecological harms (habitat damage, ecosystem-wide impacts). These risks are amplified by potential commercialization, military applications, and use by untrained actors.

The Framework's ethical foundation rests on recognizing nonhuman animals as subjects with intrinsic value, not mere objects for human use. It adopts an ecocentric rather than anthropocentric perspective, emphasizing kinship with the living world over domination.

Part II presents the Framework, including its twelve principles organized under four pillars directing NACT actors to Prepare, Engage, Prevent, and Protect (PEPP).

Key principles include adherence to rigorous research design standards and the "3Rs" framework (replace, reduce, refine); establishment of transparent ethics and data governance protocols; meaningful consultation with diverse stakeholders including Indigenous communities; comprehensive risk analysis and mitigation; application of the precautionary principle; respect for nonhuman autonomy and non-coerced participation; prioritization of animals' best interests; and urgent remediation of any harms.

Most existing NACTs remain in developmental stages for use by research-oriented collectives. The structure and the content of the PEPP Framework reflect this current state of affairs, with due regard for likely developments in the near future. However, the NACT field is rapidly expanding and may develop in unexpected ways. When it does, standards to guide NACT-related conduct—such as this Framework—will have to evolve to account for new challenges and risks. Hence, the MOTH Program will publish updated versions of the Framework in future online reports, which will draw on additional feedback and new information from diverse NACT stakeholders.

At a moment of accelerating biodiversity loss and climate change, the PEPP Framework is part of a larger dialogue to ensure that technologies that hold considerable potential to help us listen to our animal kin and reconnect with the more-than-human world do not instead become instruments of further harm. It provides a foundation for iterative development and global collaboration in service of life (human and nonhuman alike), ecological integrity, and the responsible, compassionate pursuit of knowledge.

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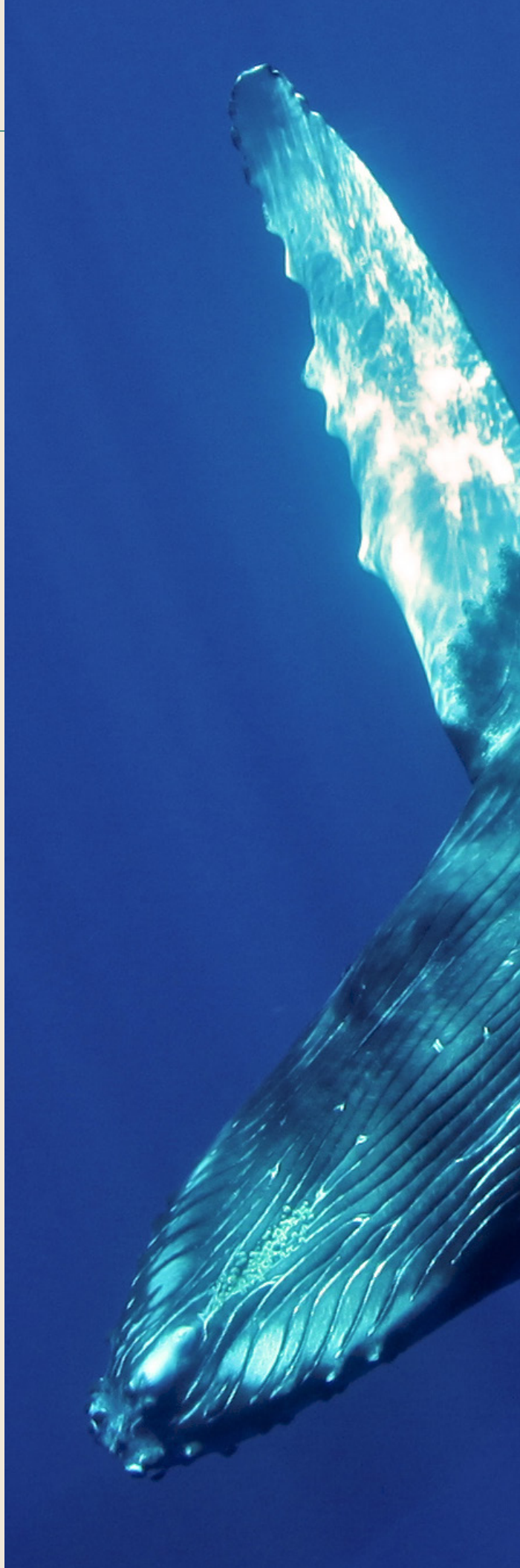
i. Introduction

Imagine a near future where humans could unlock and understand what nonhuman animals are saying. A world where we could translate how whales coordinate their complex social lives or comprehend the busy communication among elephants in the wild. Once the realm of science fiction, studies using nonhuman animal communications technologies (NACTs) today form a dynamic scientific field. Just like the application of artificial intelligence (AI) to translate human languages, scientific collectives are deploying cutting-edge ideas and tools from biology, machine learning, linguistics, robotics, and other fields to record nonhuman animal communication, identify hidden patterns within, and uncover its fundamental elements.

The positive potential of NACTs is enormous. They could help to generate curiosity and empathy with nonhuman animals, as Roger and Katy Payne's *Songs of the Humpback Whale* did when it catalyzed a global movement fifty years ago.

They could prevent human–wildlife conflicts and collisions by providing insight into nonhumans' migration patterns, informing conservation and protection strategies, and helping researchers better understand the impacts of human activity on wild nonhuman populations and ecosystems. NACTs could support legal actions for animal rights by providing evidence of nonhuman animals' health, preferences, suffering, and social lives. They could even elevate and amplify nonhuman species' voices, as perhaps our translations of their communication systems could be used in human legal decision-making processes. Picture a flourishing ecosystem restored based on what trained scientists "overheard" its inhabitants discussing, or a courtroom where messages of distress from whales about noise pollution, which upends their highly auditory lives, prompt changes to shipping routes.

However, NACTs also pose serious threats to the well-being of nonhumans and the nature of human relationships with the more-than-human world. While the NYU More-Than-Human Life (MOTH)



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Program's research has contributed to publications that explore NACTs' considerable potential for positive ecological and legal impact,[1] this report focuses on the risks associated with NACTs and how to address them. Past technologies offer cautionary tales. While cameras, drones, microphones, and hydrophones have been used to identify, understand, and protect nonhuman animals, they have also been used to track, exploit, harm, and experiment on them. Digital technologies and machine learning could exponentially increase the scale and speed of these harms. As NACTs attract more attention and funding, those risks may be compounded by pressures on actors in the field to accelerate data collection or monetize their findings.

As with AI and social media, the paucity of government rules or widely shared ethical and legal standards on NACTs has created a regulatory vacuum that needs to be urgently addressed. In this report, the MOTH Program contributes to filling this gap by advancing a set of legal and ethical principles that are meant to serve as guardrails for the responsible development and deployment of NACTs. The proposed guardrails emerged as the end result of a multi-year research project and collaborative process. We began with an analysis of the risks posed by NACTs. We then examined existing legal and ethical frameworks—including laws, regulations, jurisprudence, ethical and professional standards, and codes of conduct—that, by their nature and subject matter, bear on the legal, ethical, and practical considerations raised by the possibility of technology-augmented human communication with the nonhuman animal world.

Several fields of study and practice consistently emerged as especially germane to the growing NACT field.

These include animal welfare and research, research ethics, bioethics, environmental law, data governance, corporate accountability, and AI. More specifically, these frameworks include, among many others, legal, regulatory, and professional frameworks relating to research involving nonhuman animals, such as Directive 2010/63 of the European Union and the Terrestrial Animal Health Code of the World Organisation for Animal Health;[2] certain international and regional environmental legal frameworks like the Rio Declaration and the Convention on Biological Diversity;[3] international and institutional corporate responsibility accountability frameworks, such as the United Nations Guiding Principles on Business and Human Rights;[4] certain regional frameworks related to AI and data governance, such as the European Union's Artificial Intelligence Act;[5] and certain international and regional frameworks relating to the protection of human and other fundamental rights, such as the International Covenant on Economic, Social and Cultural Rights and ILO Convention No. 169.[6]

To ensure as rigorous and forward-looking a framework as possible, both the NACT-related risks and the resulting Principles were expanded and refined in collaboration with a diverse and interdisciplinary group of experts and peer reviewers. This group included experts from the fields of animal welfare, human and animal research ethics, environmental law, data governance, and AI. That collaborative process culminated in a workshop held at NYU School of Law in November 2024, which was co-hosted by the MOTH Program and Project CETI (Cetacean Translation Initiative).

This report presents the resulting Principles. We refer to them as the PEPP Framework, as the Principles are grouped under four pillars that direct NACT researchers and other actors to *prepare* for the deployment of those technologies, *engage* the relevant human and nonhuman stakeholders, *prevent* harm, and *protect* all of the nonhuman animals.

Part I of the report provides the background to the Framework. It starts with an overview of NACTs and the corresponding field of research and practice. It then lays out the risks associated with the use and proliferation of NACTs. Part I closes with a brief explanation of the methodology, values, and intended function of the Principles. Part II starts with an overview of the PEPP Framework. The rest of the section presents the content, the rationale for, and practical examples of each of the twelve Principles.

Finally, this report and Framework are offered in the context of many decades of bioacoustics research. Many of the thoughtful and dedicated scientists conducting this research have kept in mind the best interests of nonhuman animals and see AI as a productive new tool to enhance their inquiry. As a result, there is a growing interest among scientists in engaging in a dialogue about addressing the risks posed by NACTs. The PEPP Framework is intended to be of service in that collective endeavor and for all actors found within the NACT field.

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As such, this Framework is offered as a starting point for iterative, constructive dialogue according to which NACT actors may be able to converge on a shared set of principles to inform their work in the context of these new technologies.

As with similar initiatives, the uptake of the Framework is meant to be gradual. Initially, the PEPP principles are slated to be an initiative taken up voluntarily by research collectives and other actors involved in the use of NACTs. If and when adopted by a critical mass of NACT actors—from researchers to funders to animal ethics review boards and others—the Framework could provide a common normative language for the field. Eventually, the emerging norms and rules could be incorporated into binding regulations at different scales, from research institutions to professional associations to state and national governments.

Part One: Background

01. Overview of NACTs

A. Defining NACTs

Nonhuman animal communication technologies (NACTs) include any tool or system intended to assist in the translation of nonhuman animal communications or support bilateral interspecies communications. This includes, but is not limited to, AI models, machine and deep learning algorithms, large language models (LLMs), and biofeedback systems.[7]

In other words, NACTs are technological tools and processes that leverage data related to nonhuman communications to listen to and attempt to "translate" those communications into language comprehensible to humans. Some NACTs may also endeavor to translate human communications into communications intelligible to nonhumans, thereby enabling bilateral interactions.[8]

In practice, the use of NACTs often means collecting vast amounts of data—for instance, acoustic, geospatial, physiological, and behavioral data—from nonhuman animals before feeding that data into models and algorithms that can make sense of its patterns and content. There are many methods through which a NACT could be constructed, and different NACTs may employ different tools to accomplish their goal.

To make the concept of NACTs actionable, it is important to clarify what is *not* included in this definition.

First, NACTs relate exclusively to the communications of *nonhuman animals*. Therefore, for the purposes of this report and framework, a technology that purports to translate the communications of living organisms other than nonhuman animals—like a plant or fungus—is not included in the concept of a NACT.

Second, NACTs are nonhuman animal communication *technologies*. Broadly understood, NACTs include any application of scientific knowledge in order to change and manipulate the environment, including living organisms, in the context of nonhuman animal communication. This means that interspecies communication that occurs without technology—for instance, calling a dog in from the yard or recognizing that an exposed belly is a cue for human touch—does not fall within the definition of NACTs. This also means that whether a technology is designed for and deployed in a wild setting versus a controlled or laboratory environment does not determine whether that device is a NACT. NACTs may be designed for, and used in, any environment.

Yet, for the definition of NACTs to be useful, the understanding of "technologies" needs to be further specified, with an eye toward the most likely and severe risks. Therefore, this report is concerned with technologies involving the use of AI models, machine and deep learning algorithms, LLMs, neural networks, and advanced robotics. This more limited class of NACTs should be distinguished from augmentative interspecies communication (AIC) devices,[9] such as lexigrams, pictograms, and keyboards.

Third, the definition of NACTs is delimited by the *purpose* of the use of these technologies— that is, *communication* with nonhuman animals. As noted, communication may consist in humans listening to nonhuman animal vocalizations (and, in some cases, potentially "translating" them into human languages) or in bilateral exchanges between human and nonhuman animals. What is excluded from this definition are well-established forms of bioacoustics research that consist of passive acoustic monitoring, which yield data that is not intended for use in communication through the aforementioned technologies. However, if researchers planning to conduct passive acoustic monitoring wish to be exempt from the legal and ethical framework proposed in this report, they would need to commit to not selling or otherwise transferring data produced from such monitoring to organizations or entities involved in the translation of or bilateral communication with nonhuman animals. This includes data which has already, to date, been produced through such monitoring activities.

B. The NACT Field

NACT actors comprise all individuals and collectives who play roles in the design, construction, and deployment of NACTs at any stage in their lifecycle.[10] This definition includes researchers,

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data scientists, data providers, engineers, funders, and experts; system designers, developers, operators, and deployers; impact assessors; organizational management; and end users.[11] NACTs' lifecycle encompasses the planning and design of the technology; the collection, processing, and storage of data via NACTs; the creation and deployment of NACTs, including verification and validation processes; all monitoring, impact assessment, refinement, remediation, and reporting activities; and the sale or commercialization of data or models acquired from the use of NACTs.[12]

Over the course of only a handful of years, the development of NACTs has become a burgeoning field with a variety of participating actors from around the world. Such interest in these technologies has been amplified by growing funding directed at NACTs, including through international contests that aim to "reward scientific research on interspecies communication algorithms."[13] Among them is the Coller Dolittle Challenge,[14] with another challenge in development at XPRIZE as of this writing.[15] Some existing NACTs are meant only to collect, process, and translate nonhuman animal communications. Other NACTs seek to enable bilateral interspecies communication—that is, translating human communications into nonhuman communications and "playing back" those communications to the animals themselves.

Whales, for example, have been the source of much intrigue with respect to the application of NACTs, given their sizable brains, complex social structures, and other remarkable characteristics. Various scientific collectives, including the nonprofit Project CETI,[16] have focused on using applied computer sciences—including AI and unsupervised machine translation—and advanced robotics to try to make sense of whale communications. Some corporate entities, such as Google, have shifted this gaze to other cetaceans, like dolphins, with the express goal of establishing bilateral communication between humans and dolphins.[17] Yet other organizations, like the Earth Species Project, work by analyzing archival data and by requesting data from researchers working across a wide range of nonhuman animal species.[18]

Meanwhile, other groups have sought to make use of NACTs to understand terrestrial creatures, including rodents. One organization, for instance, is noninvasively recording and analyzing the ultrasonic vocalizations produced by rodents to construct "biomimetic, deep, artificial neural networks" that can "optimize

automatic syllable classification, perform automatic syntax analysis," and ultimately—it is hoped—provide new dimensions of insight into rodent behavior.[19] This technological infrastructure has also been adapted and applied to other species, including monkeys and birds.[20] Other researchers using similar tactics are working to understand and communicate with nonhuman animals from honeybees[21] to dogs and cats to livestock, primates, and still other animals.[22]

While most developments thus far have occurred within the context of scientific research, there are already some indications that commercial actors may seek to apply NACTs within the context of new business ventures. One consumer-facing startup, for example, is using algorithms and observed behavioral patterns to translate dog communications into human speech—with plans to develop a mobile application.[23]

As of writing, most existing NACTs remain in developmental stages for use by research-oriented collectives. The structure and the content of the PEPP Framework reflect this current state of affairs, with due regard for likely developments in the near future. However, the NACT field is rapidly expanding and may develop in unexpected ways. When it does, standards to guide NACT-related conduct—such as this Framework—will have to evolve to account for new challenges and risks. Hence, the MOTH Program will be publishing updated versions of the Framework in future online reports, which will draw on additional feedback and new information from diverse NACT stakeholders.

A NACT LIFECYCLE

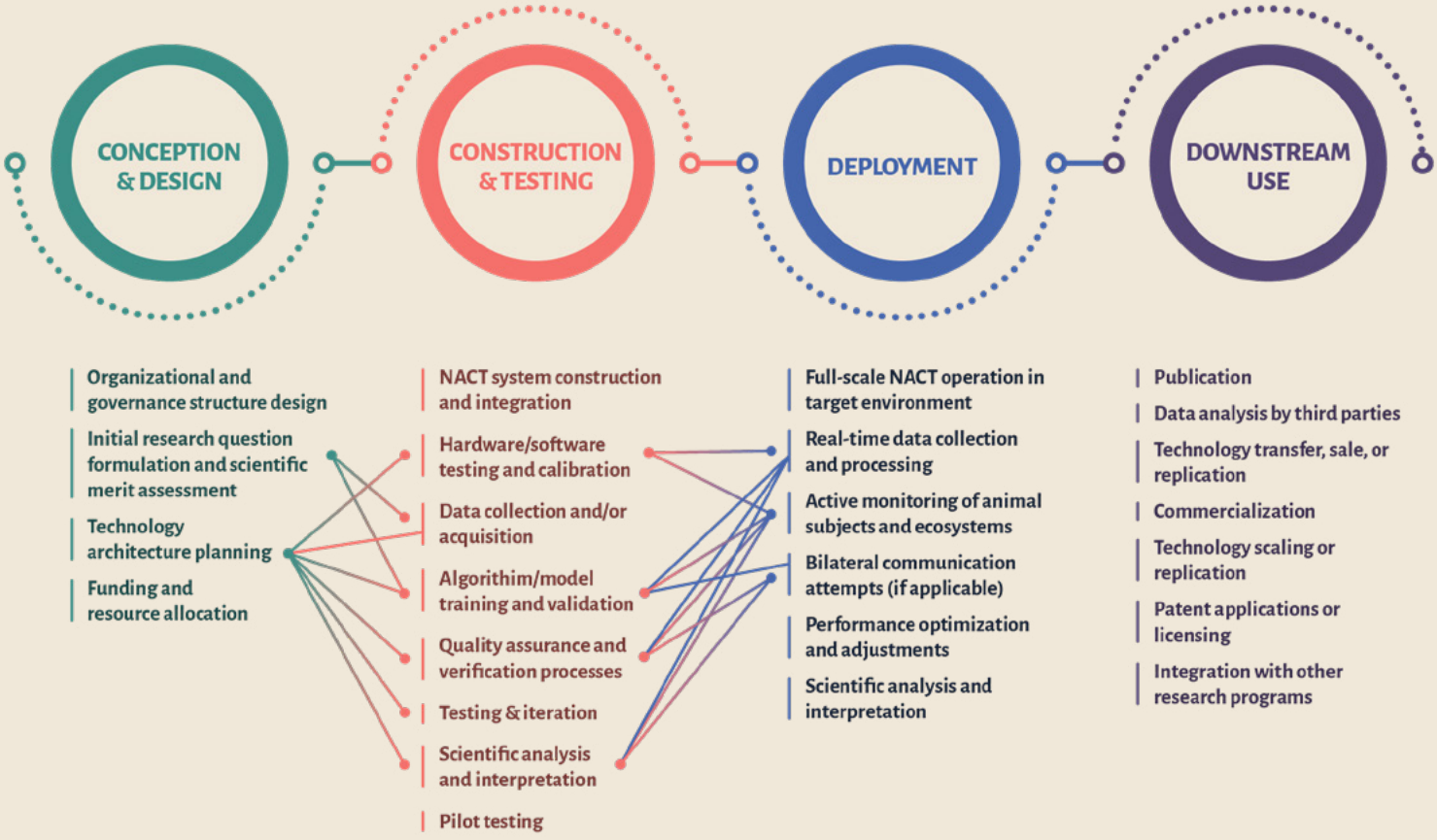


Figure 1: NACT lifecycle infographic: NACTs' lifecycle encompasses the planning and design of the technology; the collection, processing, and storage of data via NACTs; the creation and deployment of NACTs, including verification and validation processes; all monitoring, impact assessment, refinement, remediation, and reporting activities; and the sale or commercialization of data or models acquired from the use of NACTs.

02. Risks

Given that NACTs may allow humans to communicate across species lines, they may radically alter human relationships with nonhuman animals and the larger living world. With this comes risks that vary in kind, scope, and severity. We identify four primary kinds of risks:

i. physical risks;
ii. mental risks;
iii. relational risks; and
iv. ecological risks

Within this typology, a *risk* is defined as a statistically relevant possibility that a harm will occur. A *harm* should then be understood as a risk that has materialized.

The list of risks below is not exhaustive. The PEPP Framework assumes that our understanding of the risks at stake will inevitably be incomplete. As a result, the landscape of identified risks serves as a starting point for further discussion and must undergo continuous revision as the NACT field matures. Further, risks are not mutually exclusive. One type of risk can and often will interact with others, perhaps exacerbating them. Materialized physical risks, for instance, may also produce mental harms, and vice versa. Similarly, materialized ecological risks—for example, acute underwater noise pollution—may also generate mental harms like distress or exhaustion, which can in turn lead to relational harms, such as the breakdown of social fabrics and diminished communal ties—for example, among highly sociable marine animals like whales.

Additionally, the risks described below may arise not only with respect to the intended subjects of NACT research or use, but also with respect to nonhuman animals and ecosystems in the areas in which NACTs are applied. Thus, while a risk such as acute acoustic pollution may be most likely to impact those beings closest to the acoustic disruption—likely the research or target subjects of NACT use—or to harm them most severely, such pollution is also likely to have consequences for nearby nonhuman animals. It also affects the surrounding environment and organisms who may not be physically present but who could suffer as an indirect result by virtue of their interrelationship with those directly impacted.

With these caveats in mind, this section analyzes the types of risks and their associated challenges in turn.

A. Physical Risks

NACTs entail a range of physical and physiological risks for nonhuman animals. These risks can arise directly or indirectly and without regard to NACT actors' original intent. They include the injury, exhaustion, starvation, illness, reproductive failure, reduced survivability, and death of nonhuman animals.

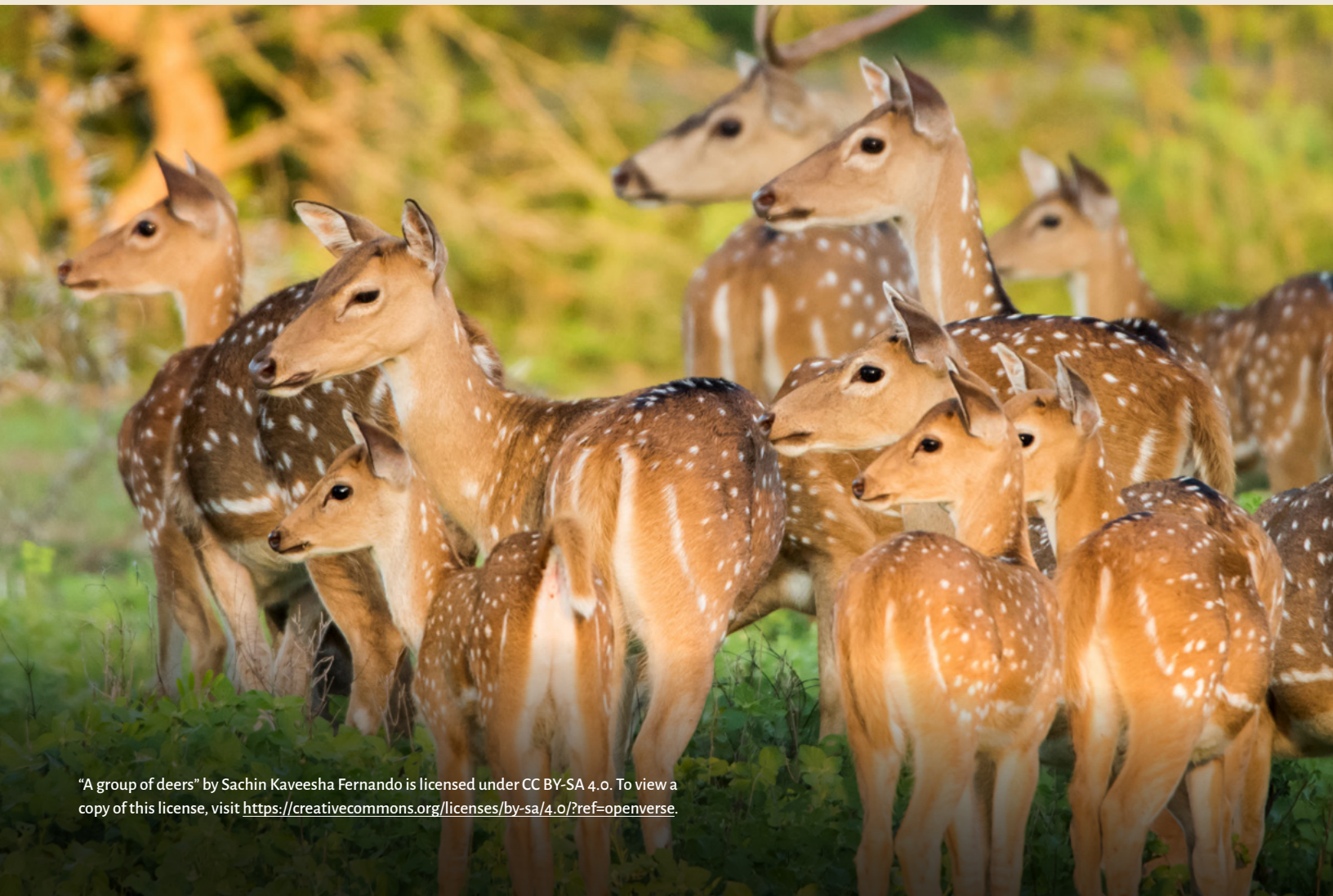
As a starting point, NACTs that rely on even standard techniques to collect data or monitor nonhuman research subjects—including the taking of blood or skin samples, or the attachment of tracking tags to research subjects—may cause at least some physical discomfort or pain.

Once deployed, NACTs pose other meaningful physical risks. In general, widespread use of NACTs could increase the frequency, intensity, and duration of encounters between humans and nonhuman animals; the nature of such interactions can range from mutually beneficial to harmful. Even where NACT users deploy those technologies only to unilaterally listen to nonhuman animals

(as opposed to attempting to engage in bilateral communication), this proximity may nonetheless increase the physical risks to which many nonhumans are already subject. These include physical risks arising from human means of transport (e.g., ship and vehicle collisions with nonhuman animals) and the anthropogenic pollution that can accompany the presence of humans. Such pollution can include auditory and light pollution, which can compromise nonhuman animals' ability to hunt, navigate, and communicate; chemical pollution, which can threaten nonhuman animals' reproductive health; and physical pollution, which can compromise the availability of food sources and lead to injuries such as those sustained from the consumption of plastic or entrapment in nets.

The likelihood of physical risks increases when NACT actors deploy those technologies for purposes beyond unilateral listening—that is, if such actors "talk back" to nonhuman animals or "play back" the nonhumans' own communications. Communications or communicative "cues" played for or otherwise demonstrated to nonhuman animals could, in theory, cause physical injury by being, for instance, too loud. Moreover, adding new noises into already cluttered acoustic landscapes and seascapes could exacerbate existing physical harms related to noise pollution.

These risks, and the scope of nonhuman animals impacted by the use of NACTs, are magnified by the possibility of NACT commodification, sale, or licensing at scale. Within this context, NACTs could be deployed by untrained actors (e.g., individual consumers) in addition to trained professionals. The use of NACTs is magnified by the possibility of NACT commodification, sale, or licensing at scale. Within this context, NACTs could be deployed by untrained actors (e.g., individual consumers) in addition to trained professionals. Use of NACTs by individual consumers or other untrained actors could lead to the harassment—intentional or otherwise—of wild and domesticated nonhuman animals



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en masse. Given increasing pressure to mine the living world for behavioral data and digital content, such a development in the NACT space would risk making zoos and circuses of entire ecosystems. Indeed, the mass commodification or monetization of NACTs could introduce widespread and newfound intrusion into nonhuman animal lives, whether driven by human curiosity, a desire to understand domesticated nonhuman animals, or the pursuit of profit.

In practice, NACTs could also intensify existing forms of human violence against nonhumans, creating additional physical risks. Acute threats arise, for instance, from the economic value of nonhuman animals themselves—that is, the monetary value of hides, meat, ivory, fins, furs, and beyond. NACTs could be used to capture and kill nonhuman animals for profit, particularly those that are endangered, rare, or otherwise highly valuable. In some instances, the availability of NACTs and their successful application to certain species may adversely increase public attention, exacerbating the risk that those nonhuman animals will be targeted by harmful sightseeing crowds, poachers, or others. Indeed, other related technological interventions, like GPS tags, have already resulted in tech-enabled incidents of "cyber-poaching" across the globe.[24]

Another way in which NACTs could be used to entrench existing patterns of human violence against nonhuman animals relates to the misappropriation of nonhuman animal perspectives. For instance, NACTs could be falsely or misleadingly deployed to suggest that nonhuman animals hold particular preferences which they in fact do not, or are not suffering harms which they in fact are. Misuse of NACTs in this way could make "false witnesses" of unwitting animals and serve to justify ongoing harms or patterns of violence (e.g., the prevalence of concentrated animal feeding operations). In other words, there exists the risk that NACTs will enable humans to better understand nonhuman agency and subjectivity just in time for certain human actors to usurp those nonhuman voices for their own material advantage.

NACTs could also intensify existing human–nonhuman conflicts over resources and territory, further elevating the risk of physical and physiological harm. NACTs could be deployed to exploit nonhuman animals for their specialized knowledge of their surrounding environments, given that they could, for example, indicate the existence and location of valuable resources. For instance, NACTs could be used to detect, from communications data on cetaceans, information on the whereabouts of economically valuable species like bluefin tuna, over whom humans and nonhuman animals already compete. Relatedly, NACTs could be used to manipulate nonhuman animals away from resources over which there is human–nonhuman competition, or to trick nonhuman animals into driving valuable resources—like a school of bluefin tuna—toward human hunters. Using NACTs in this way could deprive nonhuman animals of critical nutrition and exacerbate widespread food scarcity.

NACTs could also create new forms of exploitation that result in physical harm.

For example, they could plausibly enable a range of nonhuman animal services, aggravating the risk that humans will continue to make use of nonhuman animals, wild and domesticated alike, as mere means to certain human ends in a manner detrimental to their well-being. Of particular significance are the physical risks arising from the potential use of NACTs by military actors. That militaries around the world already employ nonhuman animals in myriad ways suggests that the availability of NACTs is likely to facilitate the further exploitation of nonhuman animals for military purposes.[25] The potential range of nonhuman animal services could thus extend far beyond bomb-sniffing, cadaver-finding, and working as service animals to include seemingly far-fetched services such as sea mine detection and underwater surveillance. Nonhuman animals, from sea lions to chickadees to moths, could be used, with the assistance of NACTs, as remote sensors, surveyors, saboteurs, and, indeed, weapons—new forms of exploitation that could force nonhuman animals into physically harmful conduct.

B. Mental Risks

NACTs also entail a wide variety of cognitive and emotional risks for nonhuman animals. These include the possibility of causing nonhuman animals to lose cognitive capabilities as well as to experience anxiety, confusion, emotional distress, grief, and fear.

Any physical harm resulting from the use of NACTs is likely to entail corresponding cognitive or emotional harm. For instance, physical pain experienced by a young nonhuman animal is likely to cause mental suffering and fear in that same animal, and may cause feelings of distress in nonhuman kin or community members who witness the physical pain.

NACTs also raise distinct cognitive and emotional risks. There may be instances in which proximity to—or interactions with—humans give rise to cognitive confusion, anxiety, and danger due to the foreignness of interactions with humans, the intrusive nature of those interactions, or the contemplation of previous harmful interactions with humans. This risk may exist even in circumstances where NACT actors intend to merely survey or "eavesdrop on" nonhuman animals' communications with each other.

Beyond that, significant cognitive and emotional risks arise with respect to attempts by humans to engage nonhumans in bilateral communication using NACTs.

Simply witnessing an alien species (i.e., humans) utilizing a non-alien (e.g., dolphin) communication framework could be sufficient to cause significant confusion, distress, and fear in those nonhuman animals. The same could be said for attempts by those animals to discover the source of those communications.

Further, the specific contents of such a communication—assuming, for the purposes of this risk analysis, that humans successfully "translate" their messages into a nonhuman animal language—could, intentionally or unintentionally, cause mental harm. For instance, in the event that humans leverage sounds or communications from existing nonhuman individuals to construct their own communications, nonhuman research subjects may interpret those communications as belonging to one of their own species or community, thereby creating confusion (if the assumed source of the communications is alive) or even grief and distress (if the assumed source of the communication has died). Alternatively, NACTs leveraged to communicate threatening or disturbing messages to nonhuman animals are likely to cause significant distress in much the same way they would if their recipient were a human.

NACTs may also infringe on the autonomy and privacy of nonhumans.[26] This presents particular challenges when such activities would necessitate obtaining consent in human contexts, given that it may be difficult, if not impossible, to obtain consent—or some equivalent, like assent, modified for nonhuman animal perceptual worlds—from nonhuman animals for their participation in activities that make use of NACTs.

In this vein, the use of NACTs and the attendant gathering of data from nonhuman animals also raises a substantial risk of constant or near-constant surveillance that could harm nonhuman animals not only physically (e.g., through interference with nonhuman animals' sensory organs) but also mentally, by limiting their ability to be left alone, which may be their preference. Such surveillance may also limit their ability to manage the information they share and to maintain control over their relationships—physical and informational—with other creatures. Informational asymmetries complicate this threat. While nonhuman animals might voluntarily participate in human activities related to NACT data-gathering, those same nonhuman animals would not be able to comprehend the potential consequences of downstream data use, thereby "expos[ing] animals to serious [mental *and* physical] threats which they would arguably want to escape if they were able to perceive the danger they were in."[27]

As is the case with respect to physical risks, these mental risks are magnified when certain incentives are introduced (e.g., monetary or reputational incentives associated with commercial or research activities that risk mental harm) and certain actors are involved (e.g., untrained actors, large numbers of consumers, and for-profit or military enterprises).

C. Relational Risks

Beyond impacts on individual nonhuman animals, NACTs entail certain relational risks. They could result in harmful impacts on social functioning, community structures, and habitual patterns both within and across species.

NACTs could weaken or otherwise compromise communal ties within species. For instance, the use of NACTs that causes or contributes to acute underwater noise pollution could disrupt the ability of whales to communicate among themselves, thereby compromising their ability to manage group behavior, work collaboratively, and maintain social coherence. Compromised ability to communicate could also impact the nature and strength of nonhuman animals' interpersonal relationships, endangering the social roles that nonhuman animals play within their communities

by, for example, making it difficult to coordinate the hunting of prey or caretaking for the young.

Physical or mental harms occurring at scale may be sufficiently severe to impact the social fabric of a given nonhuman community or even species; even mere surveillance, particularly if conducted frequently or constantly, could suffice in certain circumstances to dramatically change the way nonhuman animals interact with each other and with members of other species.

Additionally, the use of NACTs could disrupt certain habitual patterns critical to nonhuman animals' maintenance of relational ties and responsibilities. The use of NACTs could, for instance, lead nonhuman animals to avoid certain regions or ecosystems they once frequented, either as hunting grounds or as sanctuaries to raise their young. It could also prevent nonhuman animals from using their normal migratory routes, perhaps limiting contact with others of their kind (e.g., for mating, social, or cultural exchanges) or forcing them into proximity with new communities and species.

Last, NACTs could also impinge on relations across different species, perhaps disrupting formerly mutualistic relationships. This risk also applies to relationships between nonhumans and humans. Applying NACTs to facilitate communication between humans and nonhuman animals could, for instance, unduly acclimatize nonhuman animals to humans, thereby reducing their defenses to risks posed by human presence or otherwise facilitating an overreliance on particular human actions.[28] Feeding provides a helpful analogy here, as humans who feed nonhuman animals can generate an overreliance on human-provisioned food as well as a reduced fear of humans (when such fear would be useful to maintain).

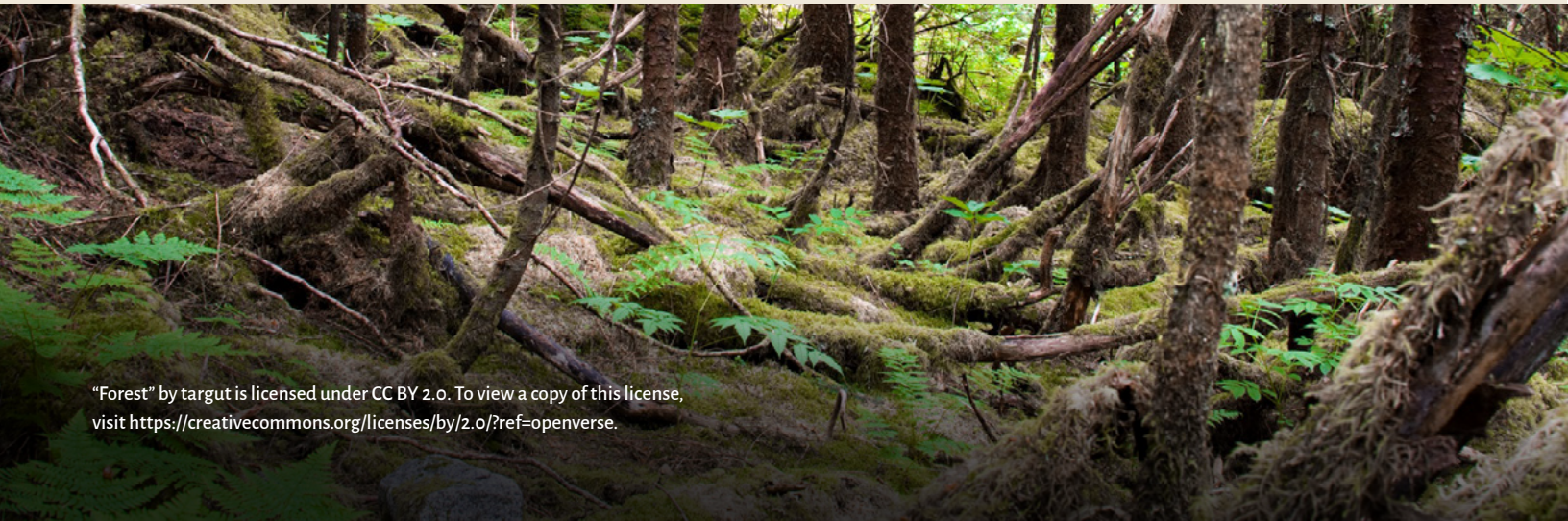
D. Ecological Risks

Ecological risks go beyond individuals—even communities of individuals—and relate to the functioning of ecosystems and the ecological processes in which individuals are embedded.

These include the risks of habitat damage and ecosystem-wide impacts such as acoustic pollution; the removal or disruption of keystone species; the disruption of interactions; and impacts on carbon storage, oxygen production, and nutrient cycles.

In general, any widespread physical, mental, or relational harms to individuals or communities—with potential for negative spillover effects for research subjects, related kin, or the wider ecosystems in which animals are embedded, including those that may not be predictable from the outset[29]—also pose significant ecological risks.

For example, NACT-generated noise that pollutes the soundscape of the more-than-human world could interfere with nonhumans' ability to communicate and navigate, track down prey and other food sources, and maintain communal ties, among other functions. This effect, in turn, could have wide-ranging consequences for communities and, indeed, entire species' reproductive capacity[30] and overall survival.



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03. Values: More-Than-Human Rights and Ethics

As stated in its preamble, the starting point of the PEPP Framework is the recognition that nonhuman animals are subjects, not objects. This, in turn, compels respect for the dignity and autonomy of nonhuman animals—that is, their ability to direct the course of their own lives free from undue intervention, manipulation, or categorically usurpative control or direction by humans.[31] Respect for dignity also includes a respect for their autonomy, including their right to be left alone in specific circumstances.

Human use of nonhuman animals as mere means to certain human ends—for instance, in pursuit of profit, human amusement, or military advantage—is incompatible with respect for nonhuman animals as moral subjects free to pursue their own interests.[32] This value foundation implies that humans should, to the greatest extent possible, desist from conduct that treats nonhuman animals—wild and domesticated alike—as mere means to an end, particularly in a manner detrimental to the animals' well-being.

Therefore, the Framework is based on a non-anthropocentric perspective that expands the circle of legal and moral concern to nonhuman beings. In line with the notion of "more-than-human rights,"[33] it departs from moral and legal approaches that conceive human beings as morally superior to all other living beings and that justify the domination of the more-than-human world by humans.

Specifically with regard to NACTs, the Framework is based on the awareness that these technologies are emerging against the background of a recent history of human manipulation, control, and massive destruction of more-than-human life. Given the power, scale, and speed of NACTs—as well as the imperative of protecting life on Earth at a time of climate and biodiversity loss emergencies—the Framework adopts a precautionary approach that seeks to mitigate and, ideally, help reverse those destructive patterns of relation between humans and the more-than-human world.

The inappropriate application of NACTs could further cement the assumption that humans can understand and manipulate—and thus are superior to—all other living beings, reducing the complex more-than-human world to only those elements intelligible by modern science and foreclosing pathways to understanding cultivated by different ontologies and epistemologies.

Moreover, if NACTs are used to express or pursue dominion in place of kinship, it would entrench anthropocentrism and drive a further wedge between humans and the wider world, with cascading consequences for the well-being of nonhumans.[34] It follows that NACTs should be used to facilitate a sense of kinship with, not domination over, the more-than-human world.

Therefore, while the PEPP Principles aim to prevent harm to nonhuman animals through NACTs, they go beyond this *non-maleficence* standard. Indeed, they seek to encourage forms of NACT design and deployment that actively promote the well-being and protection of the rights of nonhuman animals.[35]

Similarly, the adoption of an approach aligned with ecocentrism, rather than anthropocentrism, means that privileges should not be meted out by virtue of nonhuman animals' possession of certain human-like qualities alone. If NACTs are utilized in a manner that results in de facto preferential treatment for those animals that, for example, communicate in human-like ways or demonstrate a degree of sentience or intelligence comparable to that of humans, it could reinforce paradigms that define moral value in exclusively anthropocentric terms and simultaneously justify the continued exclusion and harm of other species. Such use could also facilitate an undue expectation that nonhuman animals ought to communicate in ways similar to or intelligible by humans, in contrast to having humans learn ways to communicate similar to or intelligible by nonhumans. To maintain consistency with the intrinsic value approach rooted in ecocentrism, NACT users should guard against the threat of NACT-aided anthropomorphism of nonhuman animals.

Relatedly, legal and ethical approaches that maintain or suggest that certain narrowly defined capacities (e.g., the capacity for language)

represent limiting principles for moral and legal subjecthood pose particular risks for non-animal forms of life, including plants and fungi, whose communication systems are radically different from those of humans. Further, they are incompatible with an approach that recognizes the intrinsic value of all living beings and the wider ecosystems of which they are part. The PEPP Framework, therefore, encourages NACT actors to avoid entrenching such exclusionary paradigms.

04. The Evolving Nature of NACTs and the PEPP Framework

The Framework is founded upon the recognition that NACTs are an emergent, highly experimental, and rapidly evolving field that interacts with related developments like AI technologies, which are themselves nascent and rapidly changing. Consequently, this Framework does not anticipate that it can either incorporate or respond comprehensively and definitively to fields in such flux. Compounding this regulatory uncertainty is the fact that risks particular to AI use are poorly understood and undergoing constant revision, and the development of an ethics of artificial intelligence is in its infancy.

As a result of this and other factors, this Framework is constrained by the context of its development at the time of writing. As such, it responds in particular, though not exclusively, to a dominant NACT use case—that of NACT development and use within scientific research collectives.

The Principles contained within the Framework are only as effective as their implementation. Thus, their impact can be seen as a function of, among other things, the urgency, thoroughness, and fidelity of NACT actors' implementation; the sufficiency of resources allocated toward achieving implementation; the collaboration of a great many actors across NACT lifecycles and value chains; and the breadth, depth, and appropriateness of the expertise and data sought and applied in the Principles' fulfillment.

Moreover, as an exercise in standard-setting, the PEPP Framework will be applied to specific factual situations occurring under varying circumstances. As with any set of standards, how they apply to specific factual situations will need to be determined and refined in practice. In short, implementing bodies—which may include review boards, certifying organizations, scientific collectives, or corporate compliance offices—will have to balance and assess the relative weight that should be given to different principles in light of specific circumstances.

In sum, the PEPP Framework must respond to a quickly evolving context, with respect to both the rapid evolution of NACTs and changing ecological conditions, to help direct the future of these technologies toward one that promotes human and more-than-human flourishing. As such, the Framework's legal and ethical principles are proposed as a living foundation for iterative development and as a framework for global and interdisciplinary collaboration. As noted, the MOTH Program will be publishing updated versions of the Framework in future iterations of this report.

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Part Two: The PEPP Principles

PREPARE

01. RESEARCH DESIGN

02. GOVERNING PROTOCOLS

ENGAGE

03. DIVERSE AND MEANINGFUL STAKEHOLDER ENGAGEMENT

04. RECOGNITION

05. TRANSPARENCY

PREVENT

06. BURDEN OF JUSTIFICATION

07. RISK ANALYSIS AND MITIGATION

08. PRECAUTION

PROTECT

09. AUTONOMY

10. BEST INTERESTS OF THE ANIMAL

11. IMPLEMENTATION

12. REMEDIATION OF HARMS

Consisting of twelve Principles organized according to four guiding pillars, the PEPP Framework establishes standards for legal and ethical conduct with respect to NACTs and provides guidance to shape decision-making.

The Framework can be tailored to fit the specificities of different cases and scenarios and applies across every stage of the NACT lifecycle. The Framework applies to all NACTs and is intended for a wide range of NACT actors, meaning those researchers, practitioners, funders, engineers, designers, and scientists involved in the design, construction, and deployment of nonhuman animal communication technologies.

Four pillars organize the Framework Principles around critical imperatives for NACT actors, who should:

Prepare

...to meet the Framework's substantive and procedural obligations by operationalizing experimental design best practices and robust governance protocols with continuous diligence and accountability;

Engage

...a diverse set of stakeholders and perspectives to ensure that the Framework is implemented with expertise and equity, and in a spirit of kinship with the living world;

Prevent

...harms resulting from the use of NACTs by embedding precautionary and risk management practices across the full lifecycle of NACT activity; and

Protect

...the autonomy, best interests, and rights of all humans and nonhuman animals, in the context of their ecological surroundings, implicated by the use of NACTs.

OVERVIEW OF THE PEPP FRAMEWORK

No.	Pillar	Principle	Content
1	Prepare	Research Design	From design through deployment, operational plans and protocols for NACTs should adhere to scientifically rigorous and protective research standards, including the 3Rs of animal research.
2		Governing Protocols	Prior to the design, construction, and deployment of NACTs, there should be transparent and robust ethics and data governance protocols in place.
3	Engage	Diverse & Meaningful Stakeholder Engagement	From design through deployment, NACT actors should pursue diverse and meaningful stakeholder engagement. At all stages in the lifecycle of a NACT, such actors should consult, to the maximum possible extent, the knowledge and practical guidance held by independent scientific experts, cultural leaders, and Indigenous and traditional community knowledge-holders.
4		Recognition	NACT actors should recognize the contributions of nonhuman subjects to their research findings. Recognition should extend to the sharing of NACT-derived benefits, where feasible.
5		Transparency	From design through deployment, NACT actors should operate with proactive transparency in their activities and in their reporting of impacts.
6	Prevent	Burden of Justification	From design through deployment, NACT actors carry the burden of justifying any risk of harm to humans and nonhumans and should satisfy this burden of justification by reference to robust, independent, and scientifically sound evidence.
7		Risk Analysis & Mitigation	To the maximum extent possible, NACT actors should implement processes to identify, analyze, and mitigate all possible direct and indirect risks—including those of a cumulative nature and those affecting humans, nonhuman animals, and ecosystems—raised by the use of NACTs over the course of their lifecycles. Where severe risks cannot be mitigated, NACT Actors should cease the relevant NACT activities or else justify the benefit-harm balance in line with Principle #6.
8		Precaution	NACTs should be conceived, designed, assembled, and used in a manner consistent with the principle of precaution.
9	Protect	Autonomy	NACTs should respect the autonomy of nonhuman animals, who should be understood as subjects rather than objects. Respect for autonomy entails a respect for nonhuman animals' right to be left alone.
10		Best Interests of Animals	NACTs should be conceived, designed, assembled, and used in a manner consistent with a "best interests of the nonhuman animal" standard.
11		Implementation	NACT actors should comply with all existing law and act with continuous diligence, accountability, and urgency to implement these Framework Principles within their operations from design through deployment.
12		Remediation	NACT actors should urgently and thoroughly remediate any harms resulting from the construction or use of NACTs. This obligation to remediate extends to harms arising from the foreseeable misuse of the technology.

Figure 2: A high-level overview of the content and organizational structure of the Framework Principles. The rest of Part II presents the rationale (Preamble) and the content of the Principles. Each Principle is accompanied by a short commentary and a set of examples.

00. Preamble

RECOGNIZING
rapid advancements in nonhuman animal communication technologies (NACTs) and their profound implications for nonhuman animal welfare and rights, ecological integrity, and the nature and quality of human relationships with the more-than-human world;

ACKNOWLEDGING
the interdependence, interrelation, and interconnectedness of humans and nonhumans within and across ecosystems and the importance of safeguarding ecological balance to ensure the health and flourishing of all living communities;

AFFIRMING
that we humans are ourselves animals. Coevolved with the other organisms of Earth, we are thoroughly situated within the planetary web of life;

EMPHASIZING
that ecological flourishing is essential to the fulfillment of human and more-than-human rights;

URGING
an ethic of kinship among the living, which directs humans to act in a manner that reflects respect and empathy toward all beings, and the need to prioritize the dignity, well-being, and wild sovereignty of nonhuman animals over other considerations, including profit and the accumulation of economic resources, prestige, and power over others, human and nonhuman alike;

RECOGNIZING
the intrinsic value of nonhuman beings, ecosystems, and diverse forms of life beyond human understanding, which is neither generated by human cognizance nor diminished by limitations on human understanding thereof;

ENCOURAGING
respect for ways of being, living, sensing, knowing, and communicating that do not resemble those of humans;

EMPHASIZING
that use of new technologies should cultivate empathy, care, and reconnection with, as opposed to dominion over, the living world;

ACKNOWLEDGING
that profound, existential risks arise when human capabilities and ingenuity exceed human comprehension and caution;

This report proposes the following *Legal and Ethical Principles for Nonhuman Animal Communication Technologies* for the responsible development and use of such technologies, to be implemented as voluntary commitments and as a foundation for ongoing deliberation and future regulation in the service of life, ecological integrity, and the responsible, compassionate pursuit of knowledge.

NACT Actors Should **Prepare**

01

PRINCIPLE 1

Research Design

From design through deployment, operational plans and protocols for NACTs should adhere to scientifically rigorous and protective research standards, including the 3Rs of animal research.

01. Research Design

Operative elements of this Principle include:

MEASURES GOVERNING EXPERIMENTAL DESIGN

I. Adoption of operational plans and protocols, including ethics protocols, that reflect and adhere to scientifically rigorous and protective experimental design standards.

II. Adherence of operational plans, protocols, and processes to the 3Rs framework.

MEASURES TO REDUCE AND LIMIT IMPACTS ON NONHUMAN ANIMAL SUBJECTS, NON-TARGET NONHUMAN ANIMALS, AND THE SURROUNDING ENVIRONMENT

III. At inception, experimental planning and design that uses the minimum sample size, avoids repetition through meta-analyses of already published studies, and avoids redundant measurements or data collection.[36]

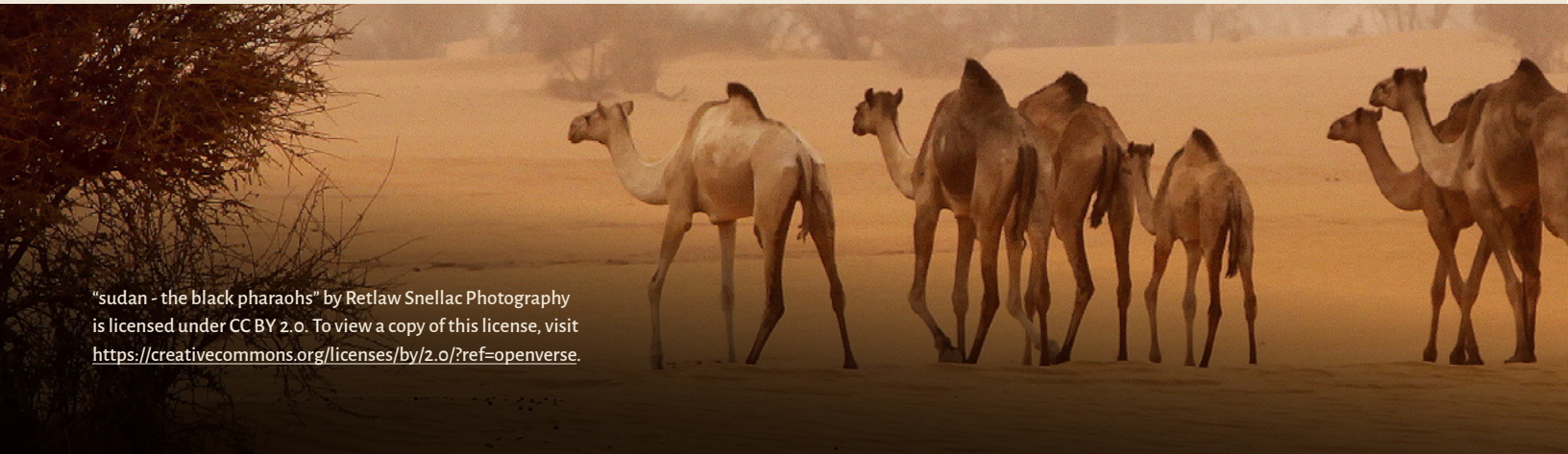
IV. While using NACTs, efforts to avoid removing nonhuman animals from their wild habitats and social groups to the maximum extent possible.

V. Efforts to minimize any impacts on the environment in which NACTs are being used to the maximum extent possible, including impacts on the relationships among the target research subjects, as well as non-target species.

VI. Efforts to reduce the physical handling of nonhuman animals, wherever possible—for example, by identifying individual nonhuman animals via remote visual or audio collection, through the collection of e-DNA, or by reference to natural markings rather than by recourse to capture and tagging.

VII. Implementation of pre-established and transparent standards for the identification, assessment, and expedited remediation of nonhuman discomfort or distress, suffering, or withdrawal of non-coerced participation. This includes processes that facilitate the iterative design of research processes to respond to and mitigate harms or distress to nonhuman animals as new evidence emerges.

VIII. Efforts to explicitly and unequivocally prohibit activities resulting in or likely to result in serious bodily or mental harm to nonhuman research subjects, including but not limited to death.



"sudan - the black pharaohs" by Retlaw Snellac Photography is licensed under CC BY 2.0. To view a copy of this license, visit https://creativecommons.org/licenses/by/2.0/?ref=openverse.

EXPERT INPUT

IX. Explicit provisions for veterinarian, biologist, or taxon-trained experts to provide input throughout the lifecycle of a NACT, but particularly when NACTs are actively deployed.[37]

Commentary:

This Principle, recognizing that the "how" of NACTs matters as much as the "why," calls on NACT actors to adhere to best experimental design practices and act with the utmost care in creating NACTs and their integral processes.

In general, individuals and organizations planning to design or deploy NACTs should structure their operational plans, including their ethics protocol, to reflect and adhere to scientifically rigorous and protective experimental design standards. These include demonstrating that NACT-related experiments and conduct have scientific merit and are conducted in accordance with prevailing best experimental design practices.

In general, the use of NACTs should be well-controlled and well-organized, meaning that the *ad hoc* use of NACTs must be avoided.[38] NACT actors should also make use of maximally non-invasive techniques to the greatest possible extent,[39] while NACT researchers and designers should look to the best available non-invasive procedures while also proactively and meaningfully striving to formulate improved methods of data acquisition.

Additionally, operational plans and protocols should adhere to the 3Rs, a longstanding framework for ethical action in research involving nonhuman animals.[40] Broadly speaking, the 3Rs framework requires researchers, where possible, to *replace* nonhuman animal research with alternatives not requiring nonhuman animals; *reduce* the number of nonhuman animals materially affected by the research; and *refine* research design, techniques, and methods to minimize harms and potential threats to nonhuman animal subjects to the maximum extent possible.[41]

While the traditional application of the 3Rs framework concerns itself principally with the well-being of individual nonhuman animals, given the context of NACTs and the Principles elaborated in this report, NACT actors should expand the application of the 3Rs framework to account for harms and impacts that extend beyond the individual nonhuman subjects to wider social groupings, species, and the larger environment.[42] The 3Rs framework should be reflected in ethics protocols, data security and governance protocols, risk assessment and mitigation processes, and research and operational design.

Examples:

- An organization studying the communications of sperm whales identifies clan individuals using their fluke shapes, other unique markings, and the remote collection of e-DNA rather than capture-and-tag techniques.
- A collective amassing data to analyze and replicate certain bird species communications utilizes another nonprofit's library of piping plover auditory data to reduce the number of nonhuman animals subject to data-gathering techniques and the intrusive presence of humans.
- Before ever going out into the field, an organization working to translate dolphin communications into human speech identifies several criteria indicative of distress that, if observed, justify the immediate cessation of NACT activity. One day, they notice one of these distress criteria in a research subject dolphin and cease all activity immediately.

02

PRINCIPLE 2

Governing Protocols

Prior to the design, construction, and deployment of NACTs, there should be transparent and robust ethics and data governance protocols in place.

02. Governing Protocols

Operative elements of this Principle include:

ETHICS PROTOCOL

I. Prior to NACT use, the establishment and transparent publications of an ethics protocol, which will, *inter alia:*

A. Incorporate and commit to relevant guiding principles and standards, including those enumerated herein.[43]

B. Identify the individual or individuals in the organization specifically tasked with ensuring ethical conduct as well as compliance with applicable law and regulations.

C. Consider how applicable legal frameworks govern research or NACT activity.

D. Establish standards and procedures for evaluating the scientific and ethical merit or justifications for NACT research or deployment, while also providing concrete benchmarks and risk thresholds that, if met, would require the termination of NACT deployment or activity.

E. Reflect on the production of a culture of care and an ethic of kinship with the living world, laying out concrete steps for their realization.

F. Reflect on past and ongoing similar efforts and, if there is significant overlap with a past or ongoing effort, provide justification for why the repetition is warranted.

G. Identify and evaluate alternative methods of research, if any.

H. Provide for an assessment of whether nonhuman animal(s) are suitable as research subject(s), which does not make cost a sufficient justification for the selection of a particular species.

I. Make the well-being of the nonhuman animal research subject(s) a foremost priority.

J. Reflect species-specific information and standards tailored to the interests, needs, and functioning of the particular species within the ambit of impact (i.e., nonhuman animals to whom the technology is applied and nonhuman animals who can otherwise be reasonably expected to be impacted by the use of such technology).

K. Provide mechanisms for the independent evaluation of the "best interests of the nonhuman animal" (e.g., consultation with or validation by an independent scientific expert).

L. Provide for the implementation of the 3Rs framework.

M. Provide explicit mechanisms for the evaluation of potential harms or threats to individual nonhuman animals, groups of nonhuman animals, or ecosystems.

N. Establish, in line with animal welfare best practices, precise guidelines and standards that define nonhuman animal harm and distress and that presume, in the absence of evidence to the contrary, that a procedure which would ordinarily cause a human discomfort would likewise cause discomfort to the nonhuman animal in question.[44]

O. Establish how researchers plan to measure negative impacts on both individuals and on wider social structures, and identify what baseline measurements should be established prior to any NACT deployment or activity.

P. Include plans for long-term monitoring and care[45] as part of an approach that reflects controlled contact.[46]

Q. Relate what measures have and will be taken to eliminate or reduce to the maximum extent possible any individual, relational, or ecosystemic harms from the use of a NACT throughout its lifecycle.

R. Establish measurable, objective, and humane endpoints or benchmarks that, once achieved, would require the immediate cessation of NACT activity.[47]

S. Establish how NACT actors intend to ensure that benefits from NACT use flow to the research subject(s), including any plans to share monetary benefits and other forms of benefit.

T. Provide for internal complaint and ethics review mechanisms.

DATA GOVERNANCE AND SECURITY

II. Prior to NACT use, the establishment and transparent publication of a data governance and security protocol.

III. Development of mechanisms and policies, informed by risk analysis and management procedures, that safeguard the privacy and security of data acquired from the use of NACTs.[48]

IV. Strict implementation of limits on the dissemination of sensitive data, information, and digital machinery to third parties.

IMPLEMENTATION OF ETHICS PROTOCOL AND DATA GOVERNANCE AND SECURITY PROTOCOL

V. Compliance of all NACT organizational units and partners with the most rigorous animal welfare framework applicable to any one of its partners or sites.

VI. Establishment of an independent ethics review entity tasked with evaluating the scientific merit, ethics, and compliance of NACT activities with the ethics protocol.

VII. Continuous monitoring of governing protocols' efficacy.

VIII. Updates to the terms of governing protocols if evidence suggests gaps or shortcomings remain.

Commentary:

This Principle establishes two baseline mechanisms necessary to effectuate the Framework meaningfully.

It provides that individuals and organizations designing or deploying NACTs should establish and make accessible, prior to NACT use, transparent and robust ethics[49] and data governance and security[50] protocols. Consultation with independent experts and relevant stakeholders should inform the structure, content, and scope of both the ethics and data governance protocols, which should be updated continuously to account for new evidence and expertise.

The ethics and data governance protocols should be publicly accessible. Individuals and organizations involved in the design or deployment of NACTs should continually monitor the efficacy of the governing protocols and update their terms if evidence suggests there are gaps or shortcomings.

The **ethics protocol**, specifically, should detail how NACT actors intend to comply with industry best practices and with existing laws and regulations related to animal welfare and ethics, research, artificial intelligence, and machine learning.

In practice, NACT actors should commit to complying, at a minimum, with the animal welfare laws of the European Union (EU) and, where no EU regulation exists, with the animal welfare laws and regulatory requirements of the United Kingdom (UK), both of which are considered by experts as providing highly protective animal welfare frameworks relative to other jurisdictions. Where a NACT project or organization consists of multiple partners or geographic sites, each of which falls within the jurisdiction of a different regulatory framework, the entire NACT organization and all its constituent or associated parts should comply with the most rigorous animal welfare framework applicable to any one of its partners or sites and, at a minimum, with the EU or the UK standards specified above. It should also describe the standards and procedures adopted to prevent and mitigate harm, ensure ethical conduct, and promote accountability and transparency.[51]

The individual or individuals specifically tasked with ensuring ethical conduct as well as compliance with applicable laws and regulations should be identified within the ethics protocol. Lastly, NACT actors should establish independent ethics review entities—adequate analogues of which can be found in animal welfare advisory boards and ethics advisory committees—charged specifically with evaluating the scientific merit, ethics, and compliance of NACT activities with the ethics protocol.

The **data governance and security protocol** should detail how NACT actors and data-holders will ensure the responsible and ethical use of data to safeguard the nonhuman research subjects' well-being and autonomy. The acute vulnerability of nonhuman animal subjects necessitates stringent data protection protocols[52] by NACT actors and data-holders, who should act as responsible stewards of nonhuman research subjects' data.[53]

To this end, all actors collecting, storing, or analyzing data—or who anticipate doing so in the future—should develop mechanisms and policies that safeguard the privacy and security of data acquired from the use of NACTs.[54]

NACT risk analysis and management procedures should inform the structure and stringency of these protocols. They should, moreover, comply with best practices for data governance and security and ensure equitable data use and attribution, while also accounting for and addressing the significant risks posed by the misuse of data, biopiracy, and "cyber-poaching," or access to data by nefarious actors.[55]

Additionally, funders of NACT research and experimentation should encourage data policies that robustly protect the nonhuman and human community interests at stake. Other relevant considerations for the development of data security and governance protocols include: contributing to the advancement of scientific knowledge and capacity, the well-being and autonomy interests of nonhumans, and the preservation and flourishing of the environment.

Interests in data accessibility and the open exchange of information should be balanced against the need for data caution and data security,[56] which may be compromised by the risk of data exploitation by nefarious actors. The risks associated with unlimited open-data policies may outweigh the benefits, in particular those accruing to nonhuman subjects, and would thus favor more restrictive data access protocols. NACT actors should be aware of the risks associated with patenting and licensing in both open- and public-data models, including—but not limited to—the risks of downstream commodification, related restrictions on the use of derivative technologies, infringements on Indigenous and traditional community intellectual property rights, patent thickets, and barriers to innovation.[57] In light of these risks, NACT actors should consider conditional open-source licensing or defensive patents as lower-risk alternatives to open-data policies.

In harmony with the Best Interests of the Nonhuman Animal, Risk Analysis and Mitigation, and Precaution Principles (see Principles 10, 7, and 8 below), and recognizing that global regulatory

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frameworks support[58]—and, in some cases, demand[59]—reduced data transparency and restricted access where data or algorithms present a high risk of serious danger if misused, NACT actors should commit, at a minimum, to limits on the dissemination of sensitive data, information, and digital machinery congruent with the risks.[60] Specifically, nonhuman data should not be sold to or shared with third parties absent a compelling need justified by reference to benefits to nonhuman subjects.[61] Geospatial coordinates and data used to identify unique nonhuman individuals should under no circumstances be published, sold to, or shared with third parties. Further, conflicts arising from the application of the Principles contained herein should be resolved by reference to the Best Interests of the Nonhuman Animal Principle.

Examples:

- A group of scientific collectives, each of which is involved in the design, deployment, or use of NACTs, forms an independent, external review body tasked with monitoring their conduct and objectively analyzing the sufficiency of their governance protocols.

- A scientific NGO working to "decode" the communications of elephants receives a compelling financial offer for their algorithm from a private company that runs wildlife tours and safaris. The NGO rejects the offer.

NACT Actors Should **Engage**

03

PRINCIPLE 3

Diverse and Meaningful Stakeholder Engagement

From design through deployment, NACT actors should pursue diverse and meaningful stakeholder engagement. At all stages in the lifecycle of a NACT, such actors should consult, to the maximum possible extent, the knowledge and practical guidance held by independent scientific experts and Indigenous and local community knowledge-holders.

03. Diverse and Meaningful Stakeholder Engagement

Operative elements of this Principle include:

CONSULTATION WITH SCIENTIFIC EXPERTS

I. Significant consultation with independent scientific experts on the particularities and needs of nonhuman animal subjects, as well as the wider social groups and ecosystems in which they are embedded.[62] This includes, to the maximum extent possible, consulting with scientific experts with species-specific, region-specific, or population-specific knowledge.[63] Such expertise should be solicited for and used within:

- **A.** NACT design;
- **B.** determinations of a nonhuman animal's best interests;
- **C.** harm-benefit assessments;
- **D.** risk analysis and risk mitigation efforts;
- **E.** refinement of research and experimental methods and design;
- **F.** the observation of a nonhuman animal's non-coerced participation and monitoring for signs indicating a lack of desire to participate; and
- **G.** harm remediation efforts.

ENGAGEMENT WITH OTHER KNOWLEDGE-HOLDERS, PARTICULARLY INDIGENOUS AND TRADITIONAL COMMUNITIES

II. Respect for and engagement with nearby and local human communities, including meaningful consultation with nearby or affected Indigenous and traditional communities, particularly communities that have either historically lived near relevant species or in whose ancestral territory nonhuman animal research subjects live.

RESPECT FOR THE RIGHTS OF INDIGENOUS AND TRADITIONAL COMMUNITIES

III. Exclusion of data of Indigenous or traditional communities resulting from NACT use or stakeholder engagement from data collection and storage processes unless free, prior, and informed consent (FPIC) is obtained from the community. For non-Indigenous and non-traditional communities, NACT actors should, to the greatest extent possible, safeguard any human data that may incidentally be collected through NACT use, though the existing international legal framework around FPIC is not directly applicable in this context.

IV. Where a NACT is proposed for use within or near an Indigenous territory or a traditional community:

- **A.** Respect at all times for the privacy, security, and right to freedom from surveillance of communities and individuals.
- **B.** Every feasible precaution to ensure the confidentiality and security of data that, while not directly related to nonhuman research subjects, is inadvertently collected.[64]

C. Recognition of community control over data collection, storage processes, provenance, and use when data is collected in the territories of Indigenous or traditional communities.

D. Respect for the intellectual property rights of Indigenous and traditional communities.

E. Compliance with international human rights law, including standards and practices related to business and human rights, and to the free, prior, and informed consent (FPIC) of Indigenous and traditional communities.

F. Creation of meaningful and substantive opportunities, when possible, for Indigenous and traditional communities to deliberate on the social, cultural, and scientific parameters of NACT design, use, objectives, and limits.[65]

Commentary:

This Principle serves to ensure that a diverse wealth of knowledge and expertise is brought to bear on NACT activities.

This enables the comprehensive assessment of risks and prevention of harms, encouraging the inclusive development of NACTs, and facilitating respect for Indigenous and traditional communities. It provides that in designing, constructing, and using NACTs, NACT actors should engage, to the maximum extent possible, a diverse and informed set of stakeholders.[66]

Additionally, NACT actors should seek stakeholder engagement not only with the technical and scientific dimensions of NACTs but with their social, cultural, and ethical implications as well. The design and deployment of NACTs should reflect the advice and perspectives proffered by diverse stakeholders. In general, NACT actors should recognize the value of exchange between different knowledge systems, including Western and Indigenous sciences.

Examples:

- An organization using NACTs and operating in a coastal region works closely with local communities that have close ties to—and understandings of—local salmon populations. The community expertise helps the organization resolve conflicts between nonhuman animal interests and informs their risk analyses.

- A nonprofit closely studying the auditory communications of pigeons inadvertently collects recordings of conversations between humans. All such communications are permanently eliminated.

04

PRINCIPLE 4

Recognition

NACT actors should recognize the contributions of nonhuman subjects to their research findings. Recognition should extend to the sharing of NACT-derived benefits, where feasible.

04. Recognition

Operative elements of this Principle include:

I. Explicit recognition of nonhuman animal subjects' contributions when publishing, sharing, or otherwise making use of information obtained through the use of NACTs.

II. Where possible, creation of benefit-sharing mechanisms assigning nonhuman research subject(s) and affected ecosystems a share of any NACT-derived benefits.

Commentary:

This Principle encourages NACT actors to acknowledge the value of nonhuman knowledge and aligns NACT conduct with evolving standards for research ethics, which increasingly emphasize collaboration and interconnection.

It also enhances the ethical framework for scientific inquiry and acknowledges the integral role that nonhuman animals have played and continue to play in advancing human knowledge and innovation.

NACT actors are also encouraged, in harmony with the Principle of Autonomy and the values laid out in the preamble, to assign nonhuman research subjects and affected ecosystems a share of any NACT-derived benefits.

Examples:

- An organization using NACTs to study the behavior of southern right whales publishes an academic paper based on their findings. In the "Acknowledgements" section, the authors thank the population of southern right whales for their contributions to the research, without which the paper would not have been possible.
- Years later, the organization's work is celebrated in an award-winning documentary, a portion of the profits from which flow to the organization. The organization directs a portion of its profits to conservation efforts for southern right whales.

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05

PRINCIPLE 5

Transparency

From design through deployment, NACT actors should operate with proactive transparency in their activities and in their reporting of impacts.

05. Transparency

Operative elements of this Principle include:

I. Public documentation and record-keeping of any key decisions bearing on the ethics or prudence of NACT conduct.

II. Freely accessible records, to the maximum possible extent, of:

- **A.** Applicable ethics protocols.
- **B.** Applicable data governance and security protocols.
- **C.** Decisions resulting from the assessment and balancing of nonhuman interests or the resolution of conflicts among nonhuman interests.
- **D.** Information regarding efforts to refine deployment methods or assess less intrusive or less harmful alternatives.
- **E.** Efforts to continuously assess the non-coerced participation of nonhuman subjects or the adequacy of efforts to respect nonhuman autonomy.
- **F.** Reports on the probability, scope, and severity of potential risks.
- **G.** Accurate and timely reports of the occurrence of harmful impacts, incidents, or violations of existing laws, regulations, or professional standards; and
- **H.** Accurate reports on the scope and adequacy of any harm remediation measures.

III. Admissions of shortcomings in the NACT process or its effect.

IV. Commitment to a process of continual learning.

V. Engagement in good faith with all stakeholders.

Commentary:

This Principle provides that NACTs should be conceived, designed, assembled, and used in a manner that reflects rigorous, proactive, and meaningful transparency.[67]

Transparency with respect to NACT design, conduct, and impacts helps ensure that NACT actors can be held accountable for implementing these Principles and for remedying any harms that may arise from the design, deployment, or use of NACTs. It also enables NACT actors to learn from the experience of others in the field and contributes to the beneficial evolution of the NACT field through heightened oversight and engagement by other NACT actors and the public.

Limitations may arise if the operationalization of this Principle conflicts with other Principles identified herein. Such conflicts should be resolved by reference to the Best Interests of the Nonhuman Animal Principle. For example, the knowledge-sharing and open-data imperatives of the 3Rs approach may conflict with the need for data security. In such a case, the balance of Principles would weigh against absolute open-data policies and in favor of appropriately limited forms of knowledge-sharing.

Examples:

- An organization working to translate the communications of the endangered black rhinoceros is debating their data governance policy. On the one hand, making their data open-source would benefit the work of conservation scientists. On the other hand, making their data open-source would provide valuable information and tools to would-be poachers. Ultimately, they decide to limit who has access to their data, sharing the information on a case-by-case basis only with vetted scientific organizations and placing special safeguards on their geospatial data.

- An organization dedicated to studying the communications of honeybees updates and publishes its ethics protocol and its data security and governance protocol on its website in PDFs available for download by all.

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NACT Actors Should **Prevent**

06

PRINCIPLE 6

Burden of Justification

From design through deployment, NACT actors carry the burden of justifying any risk of harm to humans and nonhumans and should satisfy this burden of justification by reference to robust, independent, and scientifically sound evidence.

06. Burden of Justification

Operative elements of this Principle include:

I. Where risks have been identified as flowing from proposed NACT conduct, publication or provision of:

- **A.** The ethics protocol and steps taken to comply with it;
- **B.** The risk assessment and mitigation analyses;
- **C.** The analysis of the best interests of the animal;
- **D.** Expert analysis relating to the likelihood, scope, and severity of the risks, as well as the adequacy of mitigation measures;
- **E.** Any other information that may bear on the sufficiency of NACT actors' processes, decision-making, and conduct.

II. Where a harm has directly or indirectly resulted from NACT activity, publication or provision of:

- **A.** The ethics protocol and steps taken to comply with it;
- **B.** The risk assessment and mitigation analyses;
- **C.** The analysis of the best interests of the animal;
- **D.** Expert analysis relating to the likelihood, scope, and severity of the harm, as well as the adequacy of risk mitigation and harm remediation measures;
- **E.** Information relating to remedial measures taken, as well as their timeliness and efficacy;
- **F.** Any other information that may bear on the sufficiency of NACT actors' processes, decision-making, and conduct.

III. Robust and scientifically sound analysis justifying:

- **A.** Preliminary conclusions of research or experimental merit;
- **B.** Findings resulting from the assessment of the best interests of the nonhuman animal;
- **C.** The adequacy and outcomes of risk and harm analyses;
- **D.** The adequacy of risk mitigation and harm remediation measures;
- **E.** The adequacy of data governance and security measures;
- **F.** The adequacy of measures to refine methodology and design, including with respect to the identification of less intrusive alternative methods of data collection and NACT deployment;
- **G.** The adequacy of findings identifying benefits predicted to flow from NACT use;
- **H.** The adequacy of findings identifying benefits predicted to flow to nonhuman research subjects;

I. Demonstrations of compliance with applicable law and best industry practices;

J. Demonstrations of respect for, and meaningful engagement with, human communities;

K. Demonstrations of adequate consultation with independent and conflict-free experts with knowledge of the target nonhuman animal species and the ecosystems in which the NACTs are being deployed.

Commentary:

Communicating across species lines is a high-risk endeavor meriting all possible safeguards and caution.

The potential for irreversible or material damage to vulnerable subjects demands a high standard of affirmative responsibility and accountability from NACT actors.[68] This Principle functions to operationalize that accountability and incentivize responsible, meticulous NACT design, use, and governance.

Therefore, this Principle provides that NACT actors who make decisions throughout the NACT lifecycle—from conception to design to assembly and utilization—bear the burden of justifying their actions as (i) conferring benefits to research subjects and affected entities that outweigh potential harms, and (ii) as legally and ethically appropriate. This burden of justification should be met through robust, independent, and scientifically sound evidence.

Examples:

- A research team proposes using NACT systems to communicate with whales. Before beginning trials, the research team must provide independent scientific evidence that the frequency ranges and volumes they intend to use are not expected to interfere with the whales' echolocation, communication, breeding behaviors, or migratory patterns.
- An international turtle nonprofit is interested in using NACTs to better understand how turtle hatchlings fare in an era of rising temperatures. They plan to conduct this study on a beach in Chennai, India, where a certain species of turtle lays their eggs once a year. To understand the risks associated with their study, they hire a local biologist familiar with the seasonal and year-long ecological processes of that beach to review the nonprofit's analysis of risk and risk mitigation measures. The biologist writes an expert review, and based on that, the nonprofit updates its risk analysis and risk mitigation measures.
- An international scientific collective starts, for the first time, conducting research in Brazil. They hire a Brazilian legal expert to audit the collective's practices to ensure they comply with local and national laws.

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07

PRINCIPLE 7

Risk Analysis and Mitigation

To the maximum extent possible, NACT actors should implement processes to identify, analyze, and mitigate all possible direct and indirect risks—including those of a cumulative nature and those affecting humans, nonhuman animals, and ecosystems—raised by the use of NACTs over the course of their lifecycles. Where severe risks cannot be mitigated, NACT actors should cease the relevant NACT activities or else justify the benefit-harm balance in line with Principle #6.

07. Risk Analysis and Mitigation

Operative elements of this Principle include:

RISK ANALYSIS

I. Establishment of, and compliance with, comprehensive measures to identify and assess risks prior to the deployment of a NACT.

A. To the maximum extent possible, NACT actors should map all known and potential harms to nonhumans, humans, and ecosystems that may plausibly flow, directly or indirectly,[69] from the deployment of NACTs.[70]

B. Assessment of risks should, at a minimum, consider their likelihood, severity, and potential scope.[71]

II. Analysis and mitigation of spillover effects.

A. Adequate analysis requires considering the entire ecology within which a course of action will be taken. This, in turn, means that consideration should be given to potential adverse impacts at different units of analysis and across different time horizons. Specifically, NACT actors should assess the potential for adverse impacts on:

i. individual nonhuman animals;

ii. social groupings of nonhuman animals, including the relationships characterizing these groups;

iii. nonhuman animals at a species level; and

iv. habitats and ecosystems, including impacts on non-target species.

B. Assessment of the potential for spillover effects should be continuous and should reflect the specific application of the NACT in a particular environment at a particular time.

C. Assessment should consider whether nonhuman subjects occupy central or unique ecological niches, provide critical ecosystem services, engage in symbiotic relationships with other species, constitute keystone species, or have been identified as endangered or at-risk.

III. Publication of the findings associated with the identification of risks.

IV. Solicitation and implementation of meaningful input from relevant stakeholders, identification of embedded value choices and assumptions, and transparent publication of the justifying logic behind risk determinations.

RISK MITIGATION

V. Implementation of adequate measures to mitigate risk or, where necessary, cessation of the relevant NACT conduct.[72] Mitigation measures should be concrete, actionable, and informed by rigorous consultation with conflict-free and species-specific experts and other relevant stakeholders.[73]

VI. Proactive, continuous monitoring—and, where necessary, updating—of risk identification and mitigation procedures, analyses, and determinations.

Commentary:

This Principle deals with the risks that may arise through the development and use of NACTs.

It asks NACT actors to, first, develop an accurate and comprehensive accounting of potential risks arising from those technologies and, second, act to prevent and mitigate those risks systematically.

To this end, this Principle provides that all actors involved in the design, construction, or use of NACTs should establish comprehensive measures to identify and assess risks prior to[74] the deployment of a NACT and then comply with those procedures throughout the NACT lifecycle.[75] In the context of mapping all known and potential harms which may plausibly flow, directly or indirectly, from the deployment of NACTs, harms should be broadly construed to include, at a minimum, physical, psychological, relational, and ecological harms. Particular attention should be paid to harms that may overlap, accumulate, or compound over time.

Analyses of risk should be proactively and continuously monitored and revised as needed. Additionally, in accordance with other Principles contained in this Framework, risk analyses should not assume the absence of risk based on a lack of scientific evidence to the contrary. Activities or interactions that would ordinarily be offensive, distressing, or painful to a human, for example, should be presumed to impact nonhumans similarly, absent evidence to the contrary.[76] However, the absence of harmful human impacts should not be used as a basis to presume the same activity is harmless to nonhuman animals.

The scope of risk assessment procedures should also extend to incorporate and guard against spillover effects. Spillover effects refer to impacts unintended by the course of action pursued and which extend beyond target subjects to non-targets or to the external environment.[77] They should be distinguished from impacts that are unanticipated by virtue of their novelty alone, although the two are not mutually exclusive (for more information on unanticipated impacts, see Principle #8, which emphasizes the prevention of these impacts as well as spillover effects).

In defining what constitutes a "serious risk" or a risk requiring mitigation measures, NACT actors should seek and implement meaningful input from relevant stakeholders, identify embedded value choices and assumptions, and make their justifying reasoning publicly accessible and transparent.

This Principle provides that NACT actors should implement adequate measures to mitigate risks.[78]

The scope of mitigation measures will necessarily depend on the identified risk, its likelihood, and its severity. Where identified risks do not entail the possibility of serious or irreversible damage, mitigation measures should reasonably, proportionally, and meaningfully reduce potential threats of harm to the maximum extent feasible. Where identified risks entail the possibility of serious or irreversible damage to individual nonhuman animals, nonhuman communities, species, or ecosystems, the use of the NACT should not proceed as proposed.

Mitigation measures should be concrete, actionable, and informed by rigorous consultation with conflict-free and species-specific

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experts and other relevant stakeholders.[79] NACT actors are encouraged to develop processes to share knowledge with experts and with NACT designers and users in the interest of collecting relevant learnings and consolidating robust and effective risk mitigation standards.

NACT actors should, for example, aim to develop or co-develop species-specific thresholds for communication frequency, duration, and disruption; monitoring systems to detect early signs of distress; mechanisms to account for seasonal variations in nonhuman behavior and sensitivity; mechanisms to prevent the disruption of natural nonhuman communication patterns; and technical limitations such as frequency ranges or maximum sound levels for different species and environments to ensure that adverse impacts on nonhuman life and flourishing are minimized to the greatest possible extent.

In harmony with the Principles of Precaution and Implementation, mitigation measures should also be continuously monitored and revised as needed. Following the implementation of risk mitigation measures, relevant risks should be re-analyzed regularly to ensure the adequacy of the implemented measures. If previously successful mitigation measures become less effective or new evidence suggests they are not as effective as previously thought, risk analyses and mitigation measures should be revised, and the NACT activity halted, if necessary.

The implementation of risk mitigation measures will necessarily interact with and reflect research design best practices, particularly the 3Rs goal of refinement (for more information on the 3Rs, see Principle #1).

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Examples:

- A team planning to research sperm whales is conducting the necessary risk assessment. They assess not only the potential for adverse spillover effects impacting individual sperm whales, but also for effects impacting sperm whale clans, the social relationships within clans, the sperm whale species, and the environment in which the sperm whales dwell, including other species within that environment.

- A research team using NACTs to study loggerhead sea turtles correctly identifies that the outboard-motor boats they plan on using to travel to their research sites pose risks to the safety of the loggerheads and would increase auditory pollution in an already high-traffic maritime area. They map out several mitigation strategies and ultimately decide that it's feasible for them to use sail-powered boats instead.

08

PRINCIPLE 8

Precaution

NACTs should be conceived, designed, assembled, and used in a manner consistent with the precautionary principle.

08. Precaution

Operative elements of this Principle include:

I. Measures to ensure individual and organizational conduct consistent with the precautionary principle.

II. Cessation of NACT activities where there are threats of serious or irreversible damage to an individual nonhuman animal, a group of nonhuman animals, or an ecosystem.

Commentary:

This Principle aims to defend against the risk of serious or irreversible harm arising from NACT activity.

As captured in the 1992 Rio Declaration, the precautionary principle provides that "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."[80]

In the years since, the precautionary principle has become a general principle of international environmental law.[81] It also features in law and policy related to research ethics, human rights, public health, animal welfare, biotechnology, nuclear energy, and artificial intelligence.[82]

Sometimes termed the "principle of prudence,"[83] the precautionary principle emphasizes the prevention of harm as opposed to the post-hoc remediation of harm.[84] It requires that action be taken to prevent threats of serious or irreversible harm from materializing, and therefore limits the utilization and application of technologies that raise the prospect of such harm.

Relevant actors should apply this Principle throughout the lifecycle of the given NACT. At a minimum, the precautionary principle bars actors from relying on scientific uncertainty or a lack of information as a justification for inaction or failure to mitigate risks arising directly or indirectly from NACTs. Actors should also consider the risks that may arise from the uncertainty surrounding how generative AI operates and produces information.

To comply with this Principle, actors should refrain from using NACTs where there are threats of serious or irreversible damage to an individual nonhuman animal, a group of nonhuman animals, or an ecosystem. This may prevent the development and application of a number of potential NACTs.

Examples:

- Researchers studying bats are alerted to the findings of an experimental new study, which suggests that the use of their high-frequency NACT communication device could interfere with the bats' echolocation. Even though the scientific evidence is not conclusive, the researchers abandon the device.

- A conservation organization in the French Alps is interested in studying the communication systems of a population of Alpine ibex that live near a steep cliff. Their initial risk assessment indicated that, if the NACT were used while these animals were resting on that cliff, there was a slight chance that the NACT could startle the animals and cause them to slip down the cliff. The organization discontinued its plan to apply the NACT to this ibex population.

NACT Actors Should **Protect**

09

PRINCIPLE 9

Autonomy

NACTs should respect the autonomy of nonhuman animals, who should be understood as subjects rather than objects. Respect for autonomy entails a respect for nonhuman animals' right to be left alone.

09. Autonomy

Operative elements of this Principle include:

NON-COERCED PARTICIPATION

I. Development of guidelines, based on species-specific knowledge, on how to ensure the non-coerced participation of nonhuman animals and how to interpret behavior for signs of coercion or lack of willingness to participate.[85]

II. Disengagement with nonhuman animals if there are signs that their participation is coerced or not desired.

III. If future development of NACTs allows humans not only to understand the content of nonhuman animal communication but also to engage in bilateral communications, NACT actors should seek the free consent of nonhuman animals before engaging in NACT activities.

IV. Satisfaction of the burden of demonstrating that there are no clear signs of nonhuman animal suffering or unwillingness to engage with NACTs.

MINIMIZING BURDENS ON AUTONOMY

V. Use of the least intrusive means of data-gathering and surveillance possible.[86]

Commentary:

This Principle ensures that NACT activity respects nonhuman animals as moral subjects rather than passive objects or as a means to instrumentally serve human ends.

It provides that NACTs should be conceived, designed, assembled, and used in a manner that recognizes and protects the autonomy of nonhuman animals, particularly—though not exclusively—the nonhuman subjects of NACT research and use. In the context of interspecies communications, nonhuman animal autonomy refers, at a minimum, to the ability of animals to direct the course of their own lives free from undue intervention, manipulation, or categorically usurpative control or direction by humans.[87]

Respect for autonomy also includes a respect for the dignity of nonhuman animals. NACT operational plans and protocols should be implemented in a manner that respects the self-determination, dignity, wild sovereignty, and subjectivity of nonhuman beings.[88]

Respecting nonhuman autonomy entails respecting how nonhuman animals would behave in the absence of human intervention. As a result, NACT actors, in using NACTs, should facilitate the non-coerced participation of nonhuman animals and should disengage if there are signs that participation is coerced or not desired.[89] The application of this Principle precludes the harmful manipulation of nonhuman animals while utilizing NACTs.[90]

By definition, NACTs seek to enhance human understanding of nonhuman animal communication. If such technologies advance to the point of allowing humans to understand the content of nonhuman animal communications and engage in bilateral conversation with the nonhuman subject of their research, NACT actors should seek the consent of those subjects before engaging in

NACT research. In that future scenario, NACT actors should not only demonstrate that nonhuman animals have not been coerced but also that they voluntarily participate in NACT research.

NACT actors carry the burden of demonstrating that there are no clear signs of suffering or unwillingness to engage with NACTs. In instances in which it is reasonably clear, based on species-specific knowledge, that the subjects either do not want to engage with the technology or are suffering as a consequence of its application, the acting individual or organization should desist from the given course of action. Under all circumstances, non-coerced participation by one nonhuman animal subject should not be interpreted as an indication of non-coerced participation by all members of that social grouping or species.

Respecting autonomy additionally demands respect for nonhuman animals' right to be left alone and to pursue spaces free from human interaction and construction.[91] Information gathering and data retention should be approached with heightened sensitivity and care.

Examples:

- A pod of orcas has consistently expressed disinterest in the tentative outreach of a group of researchers hoping to communicate with the pod using a NACT. Recognizing that the orcas desire to be left alone, the researchers cease attempts to engage them.
- A scientific collective using NACTs to communicate with primates establishes clear behavioral indicators of non-coerced participation and withdrawal, immediately ending sessions when the primates demonstrate apathy or distress.

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10

PRINCIPLE 10

Best Interests of the Animal

NACTs should be conceived, designed, assembled, and used in a manner consistent with a "best interests of the nonhuman animal" standard.

10. Best Interests of the Animal

Operative elements of this Principle include:

ANALYSIS OF THE "BEST INTERESTS OF THE ANIMAL" AND THE APPLICABLE STANDARD

I. Analysis based on a comprehensive mapping of the various interests of nonhuman NACT subjects, including their physical, social, psychological, communal, and environmental interests.[92] Such a mapping should also account for how these interests may evolve, as well as the short-term and long-term survival and well-being of the individual nonhuman animal subjects and the community in which they are embedded.

- **A.** Analyses should be grounded in relevant data and conflict-free, species-specific scientific knowledge and consultation.
- **B.** Where available, taxon- or species-specific behavioral expertise and population-specific guidance should also be used.
- **C.** Wherever possible, analyses should take into account the input of Indigenous peoples and traditional communities possessing particular or ancestral knowledge of the nonhuman species or population in question.

II. Balancing of the proposed procedures and courses of action involving NACTs against the diverse interests of the nonhuman animals affected, using the comprehensive mapping of interests laid out above.

III. Prioritization of the best interests of the nonhuman NACT subjects throughout the NACT lifecycle.

INTEGRATION OF THE "BEST INTERESTS OF THE ANIMAL" ANALYSIS INTO OPERATIONAL PLANS AND PROTOCOLS

IV. Modification or discontinuation of conduct where the above balancing demonstrates that nonhuman animals' interests would be materially harmed by the course of action as proposed.

V. Integration of the findings associated with the above analysis into the design of institutional warning or endpoint thresholds, risk analysis and mitigation processes, and research or methods design.

VI. Adoption and transparent publication of official policies or codes of conduct that detail the standards and processes associated with assessments of "best interests."

TRANSPARENCY IN ANALYSIS OF THE "BEST INTERESTS OF THE ANIMAL"

VII. For any specific "best interests" assessment, the recording and publication of:

- **A.** Which individuals, organizations, and groups may contribute their perspectives to the analysis of the best interests of the animal;
- **B.** An account of the perspectives offered;
- **C.** Any decisions made during/as a result of assessment.

VIII. Record and publication of the rationale for resolving a conflict between interests, making transparent the assumptions that may underlie a given decision.

Commentary:

This Principle serves to ensure that the interests and preferences of nonhuman animals are accounted for and prioritized, given their relative vulnerability and the power and informational asymmetries embedded within NACT activities, and indeed, within human–nonhuman interactions more generally.

It therefore establishes the Principle according to which NACT actors should prioritize the best interests of the nonhuman NACT subjects throughout the NACT lifecycle. While not equating nonhuman animals with human minors, this standard draws loosely upon the "best interests of the child" standard, a pillar of children's rights law that recognizes the need to maintain the best interests of the child as a foremost consideration, given their heightened vulnerability and limited ability to voice and defend their interests.[93] Nonhuman animals, too, experience heightened vulnerability and a more limited ability to defend their interests vis-à-vis human adults; as a result, the "best interests of the animal" is a relevant and applicable standard for the application of NACTs.

Compliance with this standard calls on NACT actors involved in the design, assembly, or use of NACTs to comprehensively map the various interests of nonhuman NACT subjects, including their physical, social, psychological, communal, and environmental interests.[94]

According to this Principle, proposed procedures and courses of action involving NACTs should be balanced against the diverse interests of the nonhuman animals affected, taking into particular consideration the physical, mental, relational, and ecological interests that may conflict with the proposed course of action.[95] Where such balancing demonstrates that the proposed course of action would materially harm nonhuman animals' interests, the action should either be modified to accord with the nonhuman animals' best interests or should be discontinued altogether.

Such analyses should be grounded in relevant data and conflict-free, species-specific scientific knowledge and consultation. In general, priority weight should be given to the judgments of best interest made by actors who know the nonhuman animals best. While owners and attending veterinarians may know animals best in domesticated and confined settings, it is fitting—where research involves wild nonhuman populations—to prioritize the judgments of researchers and local communities with longstanding familiarity with a specific nonhuman social group or an individual nonhuman animal.

This balancing should inform, among other things, institutional warning or endpoint thresholds, risk analysis and mitigation processes, and research or methods design. Should the use of NACTs become more widespread, NACT actors should consider establishing a central, independent entity authorized to monitor and validate analyses of best interests or help crystallize consensus around best practices for assessing the best interests of nonhuman animals.

Any conflicts or tensions arising from or between the application of the Principles contained in this Framework should be resolved or mitigated by reference to the Best Interests of the Animal Standard.

Limitations may arise when relevant interests—including those belonging to the same individual nonhuman animal or community—conflict. Resolution of such conflicts should be based on an assessment of which interest is more urgent or salient and should thus be granted priority. Conflict resolution should also take into account the relative completeness of potential remediation measures for harms to each conflicting interest; whether harm to one interest is less likely to result in cumulative, long-lasting or spillover effects; and whether it is possible, in favoring a given interest, to assure that fewer overall harms materialize without reducing the knowledge acquired or without compromising the goal of the course of action.[96] The rationale for resolving a conflict of

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interest in a particular instance should be recorded and should make transparent the assumptions that may underlie a given decision.

Additionally, NACT actors should take care to avoid reducing the application of this to an exercise in anthropomorphic imagination while also recognizing the inevitable, profound limits on cross-species understanding. To the extent possible, the central concern should be to determine what a nonhuman animal would choose for themselves.[97]

Examples:

- A team using NACTs to study hummingbirds discovers that, while their NACT does not cause obvious distress, it may nonetheless interfere with the natural learning processes of juveniles. Although they are hoping to collect enough data and publish a paper by the end of the year, they have paused all NACT-related work until after the juveniles have matured.

- A conservation group dedicated to the study and protection of rare wild cats is planning to study the communication frameworks of a rare species of diminutive jaguar in a nature reserve in the tropics. A park ranger at a scientific station in the nature reserve has lived there for several decades and has become intimately familiar with the lives of these jaguars. The conservation group asks the park ranger for input on how to assess the best interests of these jaguars.

11

PRINCIPLE 11

Implementation

NACT actors should comply with all existing laws and act with continuous diligence, accountability, and urgency to implement these Framework Principles within their operations from design through deployment.

11. Implementation

Operative elements of this Principle include:

ADOPTION OF MEASURES TO IMPLEMENT THE FRAMEWORK

I. Organizational identification, from the outset of NACT activities, of the individual or individuals responsible for ensuring compliance with these Framework Principles.

II. Adoption of processes that continuously monitor compliance with the Framework Principles.

III. Adoption of processes and procedures whereby NACT actors may raise or report, internally or to an external monitoring body, legal or ethical concerns regarding NACT design, deployment, or impact.

IV. Adoption of an effective mechanism for the review and redress of complaints regarding violations of these Principles, as well as harms stemming from the use of NACTs.

A. This may include participation in external monitoring organizations dedicated to monitoring the implementation of these Framework Principles, once such organizations have been established.

V. Creation of internal working groups, committees, or review boards to assess potential improvements to diligence and accountability processes and assist in the review and remediation of adverse incidents or processes.

COMPLIANCE WITH EXISTING LAW

VI. Compliance at all times with applicable international, regional, and national laws, standards, and regulations.[98]

A. Where applicable laws or regulations are less protective than recognized best practices or are nonexistent—or where multiple sets of standards exist, any one of which may plausibly apply—participants should comply with recognized best practices or the standards most protective of nonhuman animals' best interests.[99]

MONITORING AND ENSURING IMPLEMENTATION

VII. Continuous monitoring of NACT use for evidence of harm.

VIII. The diligent & timely investigation and reporting of harms, adverse incidents, breached protocols, or other threats.

IX. Continuous revision of risk analyses to reflect new evidence.

X. Continuous implementation of updated preventive and risk mitigation measures as necessitated by new evidence.

XI. Continuous updating of, and adherence to, ethics protocols.

XII. Meaningful engagement of diverse and independent stakeholders, whose varied perspectives may call attention to unforeseen risks and provide critical guidance.

Commentary:

This Principle promotes the realization of the PEPP Framework Principles in practice and aims to hold NACT actors accountable to them by centering the operationalization of concrete measures, processes, and institutional infrastructure.

CONTINUOUS DILIGENCE

entails the proactive, consistent, and rigorous monitoring of all risks and harms associated with the use of NACTs as well as compliance with applicable standards. Such monitoring should not abate at any point in the NACT lifecycle.

ACCOUNTABILITY

asks NACT actors to assume responsibility for harms that flow directly or indirectly from their use of a NACT. Those who fund, design, assemble, or use NACTs are accountable for their conduct, including any harms to nonhuman animals and the environment. NACT actors should not avoid accountability by resorting to claims of marginal intervening cause, technical error, or foreseeable misappropriation or misuse of NACTs or information collected using NACTs.

COMPLIANCE WITH EXISTING LAW

reminds individuals and organizations involved in the design, construction, or deployment of NACTs to comply with applicable international, regional, and national laws, standards, and regulations at all times.[100] Particular attention should be paid to animal welfare, biodiversity, and environmental laws; laws governing artificial intelligence, machine learning, large language models, and other technical means that enable interspecies communication; the protection of intellectual property rights and personal data; and fundamental human rights and freedoms.[101] NACT actors must also comply at all times with all existing international, regional, and domestic laws governing human communities, particularly with the body of law concerning Indigenous and traditional communities.[102]

Examples:

- A nonprofit scientific collective is formed to study and decipher the communications of bonobos. During their first week of operation, the collective designates a PEPP implementation officer, whose dedicated responsibility is to ensure compliance with these Framework Principles.

- An organization headquartered in the United States and conducting research in Germany identifies that European Union animal welfare and research laws are more protective than those in the United States and chooses to act in compliance with the standards established under EU law.

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12

PRINCIPLE 12

Remediation of Harms

NACT actors should urgently and thoroughly remediate any harms resulting from the construction or use of NACTs. This obligation to remediate extends to harms arising from the foreseeable misuse of the technology.

12. Remediation of Harms

Operative elements of this Principle include:

DEVELOPMENT AND IMPLEMENTATION OF HARM REMEDIATION MEASURES

I. Timely and comprehensive investigation of all harms and instances of noncompliance with these Principles, professional standards of conduct, or applicable laws and regulations.[103]

II. Remediation, through the implementation of concrete and effective measures, of any material harm to an individual nonhuman animal, a group of nonhuman animals, a species, or an ecosystem that results from the application of a NACT.

III. Efforts to strengthen institutional capacities to assess risks and prevent harm in order to prevent the recurrence of harm.[104]

IV. Where harm has accrued to a human community, provision of an absolute remedy to the maximum extent possible; implementation of measures to prevent the recurrence of such harms; and, in all cases, provision of a minimum adequate remedy as determined by national and international law.

TRANSPARENCY & COMPLAINT PROCEDURES

V. Implementation of processes whereby individuals may lodge complaints and identify defects in harm remediation processes to internal supervisory bodies or an external, centralized monitoring entity.[105]

VI. Reporting and publication of any psychological, physical, or relational harms to any individual, community, or ecosystem that have resulted from the construction or application of NACTs.[106] This includes those harms related to breaches of or defects in data governance and security protocols.[107]

"Bavarian Forest National Park - Wolves 3" by MrT HK is licensed under CC BY 2.0. To view a copy of this license, visit https://creativecommons.org/licenses/by/2.0/?ref=openverse.

Commentary:

This Principle aims to promote accountability for any harms resulting from NACTs across the entire lifecycle of a given NACT, reduce harms resulting from NACTs to the fullest extent possible, and incentivize the prevention of harms by making NACT actors responsible for those harms that do materialize.

It provides that NACT actors should, through the implementation of concrete and effective measures, remediate any material harm to an individual nonhuman animal, a group of nonhuman animals, a species, or an ecosystem that results from the application of a NACT.[108] Such measures should be implemented in a timely manner and to the fullest extent possible, with the ultimate objective of reducing and reversing harms, to the extent feasible, and preventing the repetition of such harms. NACT actors should remediate harms even if such harms are generated indirectly or result from the foreseeable intervention of a non-intended actor or use.

The responsibility to remediate harms does not, however, relieve NACT actors of their responsibility to prevent harm to the maximum possible extent.

Where harm has accrued to a human community, it will be necessary but not sufficient for NACT actors to provide a minimum adequate remedy as determined by national and international law. NACT actors should strive, to the maximum extent possible, to provide an absolute remedy (i.e., one that places the relevant human community in the position they would have occupied had the harm never transpired) and to implement measures to prevent the recurrence of such harms.

Examples:

- A scientific collective using NACTs to study wild wolves discovers that their research accidentally shared data that poachers used to locate and hunt the rare species. The collective immediately implemented enhanced data security measures, worked with conservation organizers to protect the affected areas, and established new protocols to prevent misuse of location data. They also published a report detailing the harm, the remedial measures taken, and the relative success of those measures.

- In studying the communications of a small group of mallard ducks, a researcher from a scientific collective accidentally turned the NACT to a frequency that injured a few of the ducks. The scientific collective followed their remediation measures, which included taking the affected ducks to a veterinarian for care. Afterwards, the collective bought new frequency dials for the NACT, which maxed out at a lower frequency level to prevent a similar accident from recurring in the future.

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Endnotes

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INTRODUCTION

1 This report's focus on risks is not meant to imply that NACTs do not offer considerable opportunities for the protection of nonhuman animals and for human reconnection with the more-than-human world. The MOTH Program undertook a distinct research inquiry into those opportunities in collaboration with Project CETI (Cetacean Translation Initiative). This resulted in a co-authored paper, "What If We Understood What Animals Are Saying? The Legal Impact of AI-Assisted Studies of Animal Communication," in *Ecology Law Quarterly*, which can be found here. César Rodríguez-Garavito et al., "What If We Understood What Animals Are Saying? The Legal Impact of AI-Assisted Studies of Animal Communication," *Ecology Law Quarterly* 52 (2025): 123.

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