Chapter 10

Ethical and Societal Implications of AI in Human–Animal Communication:

Towards Responsible Interspecies Technology

Chika Lilian Onyagu
https://orcid.org/0009-0004-1845-2432
Margaret Lawrence University, Ika North East, Nigeria

Etaoghene Paul Polo
https://orcid.org/0009-0001-1606-0273
University of Delta, Agbor, Nigeria

ABSTRACT

This chapter explores the implications of AI technologies used in decoding animal vocalisations, emotion recognition, behavioural prediction, and robotic interaction. Employing a qualitative, interdisciplinary methodology that draws on philosophical analysis, ethical theory, including animal ethics and AI ethics, and empirical case studies, the work critically examines the impact of AI design choices on animal agency, consent, and welfare. Attention is also paid to broader societal issues, such as anthropomorphism, data bias, and the unequal effects of AI adoption in contexts like conservation and industrial farming. Furthermore, the chapter situates these interspecies technologies within the wider discourse on AI ethics, addressing concerns around fairness, transparency, accountability, data privacy, and digital

DOI: 10.4018/979-8-3373-5483-5.ch010

inequality. It advocates for an ethics-by-design approach and participatory governance frameworks that incorporate the perspectives of ethicists, technologists, affected communities, and policymakers.

1. INTRODUCTION

Background to Human-Animal Communication

Human-animal communication has long fascinated philosophers, linguists, ethologists, and cognitive scientists, reflecting deep questions about what it means to be human and how humans relate to other living beings. Historically, communication with animals was largely symbolic, ritualistic, or based on intuitive interpretation of behaviour, such as shepherds understanding the calls of their herds or hunters interpreting the tracks and sounds of wildlife (Bradshaw, 2021).

Over time, domestication led to a more structured interaction between species, where certain animals, such as dogs and horses, were trained to respond to human signals, creating a rudimentary form of two-way communication (Miklósi, 2015). Advances in animal cognition research demonstrated that many non-human animals possess sophisticated communicative abilities. Primates such as chimpanzees and bonobos have been taught to use sign language or lexigrams, while dolphins and parrots have shown capacity for symbolic understanding and mimicry (Pepperberg, 2019; Savage-Rumbaugh *et al*., 1993). These studies disrupted anthropocentric assumptions about the uniqueness of human language and opened debates on interspecies understanding. However, such communication remains limited, requiring human mediation and training.

The advent of Artificial Intelligence (AI) introduces a transformative shift, as AI offers the possibility of "decoding" animal vocalisations, gestures, and emotional states without intensive training or conditioning. This development holds profound implications for human-animal relations, ranging from conservation and agriculture to companionship and even philosophical conceptions of animal personhood (Crist, 2019).

The Rise of AI in Interspecies Interaction

Artificial Intelligence is increasingly employed to analyse vast datasets of animal sounds, behaviours, and biological signals. Machine learning and natural language processing (NLP) techniques are applied to detect patterns in whale songs, elephant rumbles, and bird calls, while computer vision is used to monitor behavioural cues in livestock and wildlife (Kershenbaum *et al*., 2016; Stowell, 2022). Robotic technologies have also been developed to interact with animals in controlled settings, such as drones guiding herds or robotic fish influencing schools of live fish (Kovac *et al.*, 2021).

While such applications promise to enhance conservation, farming efficiency, and companionship, they also raise questions of ethics and governance. Should animals' "voices" be interpreted through human-designed AI systems? Can animals give consent to being surveilled or having their communications decoded? These questions strike at the intersection of AI ethics and animal ethics.

Statement of the Problem

Despite the promise of AI in improving interspecies understanding, its integration into human-animal communication generates critical ethical and societal concerns. On the one hand, these technologies can promote animal welfare, aid conservation, and deepen empathy. On the other hand, they risk reinforcing anthropocentrism, perpetuating data biases, and reducing animals to instrumental objects for human use (Fitzpatrick *et al.*, 2022). Moreover, AI systems may impose technological determinism, where the algorithmic interpretation of animal communication is taken as objective truth, even though these systems are shaped by human assumptions and limitations (Cave & Dihal, 2020).

Purpose and Significance of the Chapter

The aim of this chapter is to critically examine the ethical and societal implications of AI in human-animal communication, emphasising the need for responsible design, participatory governance, and sensitivity to animal agency. The chapter situates these debates within broader discourses in philosophy of technology, animal ethics, and AI governance. It seeks to contribute to emerging interspecies ethics by highlighting the risks, opportunities, and responsibilities of integrating AI into contexts that directly involve non-human lives.

Methodology and Theoretical Orientation

The chapter employs a qualitative, interdisciplinary methodology, drawing on philosophical analysis, ethical theory, and empirical case studies. Philosophical inquiry provides the normative framework for assessing issues of animal agency, consent, and dignity, while empirical studies supply real-world grounding for technological developments in conservation, farming, and research. The theoretical orientation is informed by animal ethics (Singer, 1975; Regan, 2004), AI ethics (Floridi *et al.*, 2018; Jobin *et al.*, 2019), and the philosophy of technology (Ihde, 1990; Verbeek, 2011). These perspectives allow a layered exploration of both ethical concepts and technological realities.

Chapter Structure Overview

The chapter contains 8 sections, with the first section being introduction. Section 2 clarifies the core concepts underpinning the debate, such as AI, human-animal communication, interspecies technology, and ethics-by-design. Section 3 outlines the technological landscape, surveying current AI applications in animal vocalisation decoding, behavioural prediction, and robotic interaction. Section 4 delves into ethical implications, focusing on questions of agency, anthropomorphism, data bias, and transparency. Section 5 examines societal implications, such as socioeconomic impact in conservation and farming, digital inequality, and technological access. Section 6 discusses governance, policy, and ethical frameworks. Section 7 establishes future directions towards responsible interspecies technology. Section 8 concludes the chapter with a call for responsible stewardship of interspecies AI.

2. CONCEPTUAL CLARIFICATIONS

Artificial Intelligence (AI): Meaning and Scope

Artificial intelligence (AI) refers to the ability of machines, particularly computer systems and computer-controlled robots, to simulate human intelligence by performing tasks that typically require human-like thinking, reasoning, and behaviour (Polo, Emmanuel & Obeka, 2024). This means that AI is not merely about machines carrying out instructions, but about their capacity to process information in ways that demonstrate a form of rationality comparable to human cognitive processes. For example, when a machine solves a mathematical problem, interprets a sentence, or navigates through a city using sensors, it is engaging in activities that mimic aspects of human reasoning and adaptation. In practical terms, AI technologies are designed to bridge the gap between human mental capabilities and machine efficiency, thereby making it possible for machines to undertake complex functions that would otherwise require significant human involvement.

In other words, artificial intelligence refers to computational systems capable of performing tasks that typically require human intelligence, such as perception, reasoning, learning, and decision-making (Russell & Norvig, 2020). Perception in this sense involves a machine's ability to interpret sensory data, such as recognising faces in images or detecting objects in a video stream. Reasoning refers to the logical processes through which AI systems can evaluate alternatives and make rational choices. Learning, particularly through machine learning and deep learning, allows AI systems to improve performance over time without explicit reprogramming, by identifying patterns and adjusting behaviour accordingly. Decision-making, perhaps one of the most critical aspects, enables machines to weigh multiple factors and select actions that are most likely to lead to desired outcomes. Hence, AI can be understood as a multidisciplinary field of study and application, integrating computer science, mathematics, cognitive science, and even philosophy, to build systems that extend human problem-solving capacities (Russell & Norvig, 2020).

From the foregoing, we can surmise that artificial intelligence is intelligence displayed by machines, devices, or apparatuses, usually imitating natural human intelligence. It performs tasks or exhibits attributes (traits) ordinarily typical of humans (Olojede & Polo, 2025). Such traits include creativity, adaptability, and problem-solving. For instance, an AI-powered chess engine demonstrates strategic planning comparable to that of a human grandmaster, while AI-driven translation systems can interpret and reproduce linguistic nuances with increasing accuracy. Beyond technical definitions, AI also carries a symbolic dimension: it reflects humanity's attempt to recreate its own intelligence in external forms. This imitation is not absolute, machines do not "think" in the human sense, but the resemblance is sufficient for them to replicate results traditionally achieved by humans.

In the context of interspecies communication, AI encompasses machine learning algorithms that analyse animal vocalisations, neural networks that model behavioural patterns, and robotics that enable physical interaction with animals. These applications illustrate AI's capacity to move beyond human-centred problem-solving into areas where communication and interaction across species becomes possible. For example, researchers use AI to decode the complex calls of whales, enabling a deeper understanding of their social structures and behaviours. Similarly, neural networks have been employed to model the migratory and feeding patterns of birds, which helps ecologists in both conservation and the prediction of environmental changes. Robotics powered by AI allow for safe and non-intrusive interaction with animals in laboratory or field settings, making it possible to study behaviour in ways that would be impractical or harmful if humans were directly involved. Thus, AI broadens the horizons of communication, research, and understanding not only among humans but also across the natural world.

Importantly, AI is not neutral, it reflects the assumptions of its designers, the biases in its training data, and the socio-economic contexts in which it is deployed (Crawford, 2021). This means that AI systems are shaped by the cultural, political, and historical conditions under which they are created. For instance, an AI model trained predominantly on data from Western societies may fail to adequately recognise or interpret information from non-Western contexts, thereby reproducing global inequalities. Moreover, the developers' perspectives, whether consciously or unconsciously, are embedded in the algorithms, influencing how fairness, accuracy, and efficiency are prioritised. On a socio-economic level, AI can reinforce existing disparities, as powerful corporations and governments often control access to the most advanced AI systems, potentially marginalising those without the same resources. Therefore, while AI appears as a neutral, technical tool on the surface, it is in fact deeply value-laden, and its outcomes cannot be divorced from the human contexts that shape its creation and application (Crawford, 2021).

Human-Animal Communication: Definitions and Modalities

Human-animal communication refers to the processes by which humans and non-human animals exchange signals, information, or affective states. At its core, this communication enables two-way interaction, where humans attempt to interpret animal expressions, sounds, or behaviours, and animals, in turn, respond to human cues. This process is not restricted to vocal interaction but encompasses a wide spectrum of modalities that allow cross-species understanding. For humans, decoding these communicative acts is fundamental for strengthening the human-animal bond, enhancing domestication practices, and advancing scientific research on animal cognition and behaviour (Miklósi, 2015).

Modalities include vocalisation (e.g., bird calls, dolphin whistles), body language (e.g., tail wagging in dogs, trunk gestures in elephants), chemical signals (pheromones), and technologically mediated channels (such as collars with AI sensors) (Miklósi, 2015). Vocalisation is perhaps the most immediately recognisable form of animal communication, where sounds serve diverse functions such as warning others of danger, attracting mates, or coordinating group activities. Body language is equally important; for instance, a dog's wagging tail may express excitement, submission, or agitation depending on the context, while elephants' trunk gestures can communicate comfort, threat, or invitation. Chemical signals like pheromones demonstrate a deeper layer of communication, particularly among insects and mammals, by conveying messages related to reproduction, territory, or social hierarchy. In recent years, technologically mediated channels have added a new dimension, with innovations such as smart collars embedded with AI sensors that track physiological signals, interpret stress levels, and translate them into forms comprehensible to human caretakers. These modalities illustrate that communication is not bound by speech alone but can manifest through multiple channels, each uniquely adapted to the ecological and social needs of species (Miklósi, 2015).

Unlike human language, animal communication systems are often specific to survival functions, mating, alarm, food discovery, but research increasingly shows cognitive and emotional depth across species (Sebeok, 1990; Bradshaw, 2021). For example, alarm calls among primates are not mere instinctive reactions but can carry specific information about the type of predator, prompting different responses depending on the threat. Similarly, mating calls in birds often involve complex songs that not only signal reproductive readiness but also display learning and creativity. Food discovery signals, such as the "waggle dance" of honeybees, demonstrate remarkable precision in conveying spatial information to hive members. Despite these survival-oriented functions, scholars argue that animal communication is richer than once assumed. Studies reveal that elephants exhibit mourning behaviours, dolphins recognise themselves in mirrors (an indication of self-awareness), and dogs respond to human emotional states, suggesting that animal communication extends beyond immediate utility to encompass affective and cognitive dimensions (Sebeok, 1990; Bradshaw, 2021).

Interspecies Technology: Emerging Trends

"Interspecies technology" refers to technological systems explicitly designed to mediate or facilitate communication and interaction between humans and non-human animals. This concept highlights the ways in which digital innovations and engineering are being harnessed not simply to observe animals but to actively engage with them. At its core, interspecies technology recognises that humans and animals share communicative capacities, albeit through different channels, and therefore attempts to bridge these channels through artificial means. It is rooted in both scientific curiosity, understanding how animals think, behave, and interact, and practical applications, such as conservation, veterinary care, and companion animal welfare (Kershenbaum *et al*., 2016).

These range from AI collars that interpret dog emotions, to drones that monitor elephant movements, to machine learning models attempting to decode whale songs (Kershenbaum *et al.*, 2016). AI collars are designed with sensors that can track a dog's heart rate, stress levels, and vocalisations, and then translate these biological and behavioural signals into human-readable data. This allows pet owners not only to understand their animals' needs more accurately but also to respond to signs of discomfort or illness earlier than they otherwise might. Drones used in conservation settings play a different role: they provide a bird's-eye view of elephant herds, monitoring their movements across vast landscapes, which helps prevent human-elephant conflict and allows conservationists to respond swiftly to threats such as poaching. Machine learning models designed to decode whale songs push the boundaries even further, as they attempt to penetrate the complexities of cetacean communication, potentially uncovering social structures, mating rituals, and even cultural behaviours within pods. These examples demonstrate that interspecies technology does not simply observe but actively translates, mediates, and, in some cases, transforms the communicative possibilities between species (Kershenbaum *et al*., 2016).

Interspecies technology also extends to robotic interfaces, such as robotic bees assisting pollination, or robotic fish guiding marine populations (Kovac *et al.*, 2021). Robotic bees have been developed as a response to the global decline in natural bee populations, aiming to sustain pollination processes that are vital for agricultural productivity. By mimicking the flight patterns and pollinating behaviours of bees, these robots interact with plants in a way that substitutes or supplements the role of living pollinators. Similarly, robotic fish are designed to integrate into marine environments, either to guide schools of fish away from hazardous areas such as oil spills or to encourage sustainable migration patterns in changing climates. Both examples illustrate that robotic interfaces are not merely imitations of animals but active agents within ecosystems, interacting with and influencing animal behaviour in real time. These technologies therefore raise profound questions about the boundaries between natural and artificial systems, and the extent to which machines can act as ecological participants (Kovac *et al.*, 2021).

The rise of such technologies challenges existing categories of "tool use" and raises questions about co-agency between humans, animals, and machines. Traditionally, tools have been regarded as objects wielded by humans to manipulate their environment, with animals occasionally noted as tool users in exceptional cases, such as primates using sticks to extract termites. However, interspecies technology does not fit neatly into this paradigm. Rather than being a static object of use, these technologies often operate autonomously, gather their own data, and respond dynamically to both human and animal inputs. This complicates the notion of agency: if a robotic fish alters the movement of a school, is it acting on behalf of humans, or has it become a co-agent within the ecological system? Similarly, if an AI collar allows a dog to express emotions in ways that shape human behaviour, does the animal, through the technology, gain a new form of communicative power? Such questions push the boundaries of philosophy, ethics, and technology studies, suggesting that interspecies technologies are not neutral tools but mediators that create hybrid forms of interaction in which humans, animals, and machines share influence and agency.

Ethics-by-Design and Participatory Governance: Key Concepts

"Ethics-by-design" refers to embedding ethical principles, such as transparency, fairness, and accountability, into technological systems from the outset, rather than retrofitting them after deployment (Floridi *et al.*, 2018). The essence of this approach is that ethical reflection is not treated as an afterthought once potential harms have already emerged, but rather as a guiding principle at every stage of technological innovation. Transparency ensures that both developers and users understand how systems operate, what data they process, and the limitations of their outputs. Fairness demands that systems are designed in ways that avoid bias, whether against particular human communities or against the interests of non-human animals. Accountability requires that individuals and organisations remain answerable for the consequences of the technologies they create, ensuring that responsibility cannot be deferred to "the machine" itself. In the interspecies context, this requires accounting for animal welfare and dignity alongside human values. It means recognising animals not merely as passive subjects of technology but as beings with needs, preferences, and vulnerabilities that deserve to be respected. For example, the design of AI collars for dogs should not only prioritise human convenience but also consider whether continuous monitoring causes stress or whether feedback mechanisms align with the animal's natural behavioural patterns (Floridi *et al*., 2018).

"Participatory governance" refers to involving a wide range of stakeholders, including ethicists, technologists, animal welfare organisations, indigenous communities, and policymakers, in shaping how technologies are designed and regulated (Stahl *et al*., 2022). This approach emphasises inclusivity and democratic decision-making, recognising that technology has wide-reaching effects and therefore should not be controlled solely by corporations or small groups of experts. Ethicists contribute philosophical and moral perspectives, ensuring that questions of justice and dignity are foregrounded. Technologists provide practical knowledge about what systems are capable of achieving, as well as limitations that need to be acknowledged. Animal welfare organisations bring insights into the lived realities of animals, ensuring that welfare standards are not compromised in the pursuit of technological novelty. Indigenous communities often contribute traditional ecological knowledge, which can guide responsible and sustainable interaction with non-human species. Policymakers play a vital role in establishing regulations and frameworks that formalise ethical practices into enforceable standards. By bringing these diverse groups together, participatory governance fosters a collective sense of responsibility, balancing competing interests, and enabling more socially and ecologically sustainable outcomes (Stahl *et al*., 2022).

Both concepts are crucial for ensuring that interspecies technologies are developed responsibly. Without ethics-by-design, technologies risk perpetuating hidden biases or causing unintentional harm to both humans and animals. Without participatory governance, decisions about such technologies may be driven by narrow commercial interests, sidelining ethical, ecological, and cultural considerations. Together, they establish a framework that integrates moral foresight with democratic inclusivity, ensuring that technological progress does not occur at the expense of justice, sustainability, or respect for non-human life. By embedding ethical principles early and ensuring a plurality of voices in governance, societies can cultivate innovations that genuinely benefit humans, animals, and the ecosystems they share.

Distinguishing Anthropocentrism From Interspecies Ethics

Anthropocentrism privileges human interests and perspectives, often at the expense of non-human life. It assumes that human needs, values, and modes of understanding are central and superior, relegating animals and other species to secondary or instrumental roles. Within this orientation, animals are frequently viewed primarily in terms of their usefulness to humans, whether as sources of food, labour, companionship, or research subjects. This approach tends to obscure the intrinsic worth of non-human life, reducing animals to objects of utility or scientific curiosity rather than recognising them as beings with their own inherent value. As a result, anthropocentrism reinforces hierarchical distinctions between humans and animals, making it difficult to conceptualise genuine moral obligations toward non-human beings (Donaldson & Kymlicka, 2011).

In contrast, interspecies ethics seeks to recognise the moral considerability of animals as sentient beings with their own forms of agency and value (Donaldson & Kymlicka, 2011). The central premise is that animals are not mere background entities in human-centred worlds, but participants in shared ecological and social systems. By acknowledging their sentience, their capacity to feel, perceive, and experience, this ethical perspective accords animals a moral status that obliges humans to treat them with respect and care. Agency, in this context, refers to animals' ability to make choices, exhibit preferences, and influence their environments in ways that are meaningful to their lives. For example, migratory birds demonstrate agency in selecting routes that respond to climate shifts, while domesticated animals express preferences for social interaction or solitude. Interspecies ethics therefore encourages humans to move beyond anthropocentric assumptions and cultivate relationships based on mutual respect, recognising animals as co-inhabitants of a shared moral community rather than as resources to be managed or exploited (Donaldson & Kymlicka, 2011).

While anthropocentrism risks interpreting animal communication solely in human terms, interspecies ethics advocates for humility, recognising the limits of human understanding and the need to avoid projecting human categories onto non-human communicative systems (Crist, 2019). Anthropocentric interpretations often seek to translate animal communication into human linguistic or behavioural frameworks, which can distort or oversimplify the complexity of non-human interactions. For instance, describing dolphin whistles purely as "language" risks neglecting unique acoustic structures that may not conform to human grammar or semantics but nonetheless carry profound social meaning within dolphin communities. Interspecies ethics, by contrast, calls for caution and humility: it urges humans to approach animal communication with an openness that acknowledges both the richness of non-human forms of expression and the epistemic limits of human interpretation.

This humility prevents overconfident projections of human categories, such as assuming that all communication must resemble speech, and instead supports a more careful and respectful study of the ways animals interact with each other and with humans (Crist, 2019).

Distinguishing these orientations is critical to developing ethical frameworks for AI in interspecies communication. If AI technologies are designed from an anthropocentric standpoint, they risk instrumentalising animals further, treating communicative signals as data points to be translated solely for human benefit. Such an approach could perpetuate the reduction of animals to tools in human projects rather than recognising them as communicative partners. On the other hand, grounding AI design in interspecies ethics would prioritise technologies that respect animal welfare, preserve ecological balance, and foster genuine cross-species understanding. This distinction matters because it shapes not only how technologies are built but also how humans conceive of their relationships with non-human life. By moving away from anthropocentrism and embracing interspecies ethics, researchers and designers can create frameworks that encourage co-agency, respect, and moral responsibility across species boundaries.

3. TECHNOLOGICAL LANDSCAPE OF AI IN HUMAN-ANIMAL COMMUNICATION

Overview of Current AI Tools and Applications

AI technologies are increasingly used to decode animal communication, predict behaviour, and mediate human-animal interactions. These developments represent a growing convergence between computer science, ethology, and conservation studies, where advanced computational models are applied to questions that were once confined to traditional zoology or behavioural science. By processing large amounts of data far beyond human cognitive capacity, AI allows researchers to identify patterns and correlations that shed light on how animals communicate, interact, and respond to their environments. This not only broadens scientific understanding but also opens up possibilities for improving human-animal relationships, enhancing conservation strategies, and supporting animal welfare initiatives. In this sense, AI serves as a powerful mediator between human and non-human systems, transforming the scope of interspecies communication research (Stowell, 2022).

These include deep learning models that classify animal sounds, wearable devices that track physiological states, and robotic platforms that interact with animals in controlled ways. Deep learning models, which rely on artificial neural networks, are particularly well suited to the analysis of bioacoustic data because they can detect subtle variations in pitch, frequency, and rhythm that are difficult for humans to discern. This enables the classification of vocalisations not only by species but also by context, for example, distinguishing between alarm calls, mating calls, and social calls within the same species. Wearable devices, on the other hand, extend the study of animal communication into the physiological domain. Equipped with sensors that monitor heart rate, body temperature, and movement, these devices provide real-time data that help researchers and caretakers to understand how animals experience stress, excitement, or relaxation. Robotic platforms introduce yet another dimension by enabling controlled interaction; robots designed to mimic animal movement or behaviour can be used to study group dynamics, predator-prey interactions, or the social responses of animals to new stimuli. Collectively, these tools demonstrate the versatility of AI in bridging the gap between observation and interaction, allowing for a more nuanced appreciation of animal lives.

For example, the Earth Species Project uses machine learning to analyse bioacoustic data in an effort to uncover the structures of animal communication systems (Stowell, 2022). This initiative exemplifies how AI can be harnessed for large-scale, non-invasive research. By compiling vast libraries of sound recordings from diverse species, ranging from birds and whales to primates, the project applies computational models to search for recurring structures and syntactic rules, much like linguists would in the study of human languages. The ambition is not merely to catalogue sounds but to uncover whether they represent structured communicative systems that convey complex meanings. If successful, such work could revolutionise our understanding of non-human intelligence and open the possibility of deeper cross-species dialogue. Beyond pure research, these findings also have practical applications, including informing conservation strategies by providing insights into animal social organisation, reproductive behaviour, and responses to ecological pressures (Stowell, 2022).

Similarly, AI-enabled collars for pets claim to translate barks into categories of emotions such as hunger, playfulness, or distress. While these devices are sometimes marketed with a degree of exaggeration, they nonetheless represent a broader trend of integrating AI into everyday human-animal relationships. The underlying principle is that by analysing the acoustic qualities of a dog's bark alongside physiological and behavioural indicators, AI systems can generate interpretations that help owners respond more effectively to their pets' needs. For instance, distinguishing between a bark signalling distress and one indicating excitement could improve welfare by allowing timelier interventions. Such tools also raise intriguing questions about the extent to which technology can make animal inner states more accessible to humans, and whether this represents a genuine enhancement of empathy or a simplified projection of human categories onto animal behaviour. Either way, these consumeroriented applications demonstrate that AI's role in interspecies communication is not limited to the research lab but is increasingly entering the realm of everyday life.

Animal Vocalisation Decoding Technologies

One of the most promising applications is the decoding of animal vocalisations. AI models are used to identify patterns in whale songs, bird calls, and elephant rumbles that may correspond to specific meanings or functions (Kershenbaum et al., 2016). Bioacoustics combined with machine learning allows the classification of calls at a scale and precision not possible through traditional human observation. For example, researchers have used convolutional neural networks to automatically detect bat echolocation calls, aiding in biodiversity monitoring (Stowell, 2022). While promising, such decoding remains probabilistic and may risk anthropomorphic over-interpretation.

Behavioural Prediction and Emotion Recognition Systems

AI systems are also being developed to predict animal behaviour and recognise emotional states. This area of innovation is grounded in the understanding that animals, like humans, display behavioural patterns and physiological cues that can be systematically observed, measured, and analysed. By capturing these signals through digital sensors, video analysis, and algorithmic modelling, AI offers the possibility of identifying not only what animals are doing at a given moment but also what they are likely to do next. Such predictive and interpretative capacities can be applied across multiple domains, from farming and veterinary medicine to wildlife conservation and companion animal care, making them a rapidly expanding field of research and application. Importantly, these systems are not limited to observation; they actively process large datasets, learn from repeated patterns, and generate insights that humans alone might overlook, thereby transforming the study of animal behaviour into a more data-driven and proactive enterprise.

Computer vision can monitor livestock for signs of stress, illness, or discomfort, enabling early intervention in farming (Tullo *et al*., 2019). Cameras installed in barns, fields, or enclosures continuously record the movements and postures of animals, while AI models process the footage to identify subtle deviations from normal behaviour. For instance, reduced feeding, altered gait, or increased restlessness can be early indicators of illness or injury. By detecting such changes at an early stage, farmers and veterinarians are able to intervene more swiftly, potentially reducing animal suffering and improving productivity in agricultural systems. This technology also assists in monitoring environmental factors, such as overcrowding or poor ventilation, that may contribute to stress. In this way, AI not only benefits animal health but also supports more sustainable farming practices by minimising losses and reducing reliance on routine antibiotics. Thus, behavioural prediction through computer vision is becoming an essential tool for advancing both welfare and efficiency in animal husbandry (Tullo *et al*., 2019).

Similarly, algorithms trained on video data of dogs or horses can detect tail and ear positions associated with mood. These algorithms rely on machine learning techniques that map specific body postures to particular emotional states, such as contentment, agitation, fear, or excitement. In dogs, for example, the speed and angle of a tail wag may signal different intentions, while in horses, the movement of ears can indicate attentiveness, irritation, or anxiety. By automating the detection of these signals, AI systems provide caretakers with objective feedback that supplements human interpretation, which can sometimes be inconsistent or influenced by anthropocentric bias. Such technologies are increasingly being integrated into smart collars, wearable sensors, or stable-monitoring platforms, thereby providing continuous, real-time assessments of animals' emotional wellbeing. This can be particularly valuable in contexts such as equestrian sports or therapy animals, where monitoring stress and comfort levels is essential for ethical practice.

These tools have potential to improve animal welfare, but they also raise ethical questions about surveillance and the reduction of complex behaviours into simplistic categories. Continuous monitoring may enhance safety and wellbeing, but it simultaneously introduces a level of surveillance that could alter the naturalness of animal lives, particularly in captive or farmed contexts. There is also the risk that the rich and multifaceted nature of animal behaviour might be oversimplified when reduced to a set of algorithmic labels. For example, categorising a dog's bark or a horse's ear flick exclusively as "stress" could overlook contextual factors such as playfulness, curiosity, or environmental disturbances. Moreover, reliance on automated systems could encourage humans to defer to technological interpretations, potentially sidelining empathetic engagement and nuanced observation. Ethical concerns therefore centre on striking a balance: harnessing the benefits of AI for welfare without allowing technology to dominate or distort our understanding of animal lives. In this regard, behavioural prediction and emotion recognition systems exemplify both the promise and the challenge of interspecies AI, ffering opportunities for care and insight while demanding careful reflection on their broader implications.

Robotic Interfaces and Animal-Responsive Machines

Robotics offers another frontier for interspecies communication, one that pushes the boundaries of how technology can mediate and shape interactions between humans, animals, and machines. Unlike traditional tools that merely extend human control or observational power, robotic systems are increasingly designed to interact with animals directly, responding to their behaviours and even influencing their choices in ways that bypass human mediation. This makes robotics a particularly fascinating domain, as it does not simply involve interpreting or predicting animal signals but actively creating new forms of embodied, dynamic interaction between species. Such developments open up innovative possibilities for improving animal management, welfare, and companionship, while simultaneously generating profound philosophical and ethical questions about what it means to engage with non-human beings through artificial agents.

Robotic fish have been designed to integrate into schools of live fish, influencing group movements without direct human intervention (Kovac *et al.*, 2021). These biomimetic machines are programmed to replicate the movement patterns, shapes, and even colouring of real fish, thereby gaining acceptance within a shoal. By adjusting their swimming behaviour, they can steer or reorganise groups of live fish, subtly altering patterns of migration, feeding, or avoidance of predators. This demonstrates that animals may perceive and respond to artificial agents as if they were members of their own species, illustrating the capacity of robotics to operate not just as external observers but as active participants in animal societies. Such experiments reveal both the technical sophistication of modern robotics and the complexity of animal perceptual worlds, while also highlighting the possibility of unintended manipulation, since the fish, unaware of the machine's artificial nature, may be influenced in ways that serve human objectives rather than their own natural inclinations (Kovac *et al.*, 2021).

In agriculture, robotic herders and drones are used to guide livestock, providing a practical alternative to traditional labour-intensive methods. These machines can be programmed to maintain optimal distances, generate specific sounds, or use movement cues that encourage animals to move towards grazing areas or enclosures. The advantage lies in efficiency and safety: robotic herders can reduce the need for constant human presence in potentially dangerous situations, such as moving large cattle herds, while drones offer aerial perspectives that allow farmers to oversee wide pastures. By integrating with animal behavioural tendencies, these systems reduce stress compared to harsher manual herding techniques, as they can employ gentler, more consistent signals that animals come to recognise over time. At the same time, their adoption reflects a broader trend in agriculture towards automation, where the management of animal life becomes increasingly mediated by machines rather than by direct human-animal relationships. This shift raises questions about whether such technologically mediated interactions diminish opportunities for empathy and attentiveness in human caretaking.

Robotic pets offer companionship for elderly people, further expanding the scope of animal-responsive machines beyond agriculture and scientific research into the domain of social and emotional care. These artificial companions are designed to mimic the behaviours of real animals, such as purring, wagging, or responding to touch, thereby providing comfort, reducing loneliness, and even improving mental health in individuals who may be unable to care for live animals. For instance, robotic cats or dogs can offer a sense of presence and routine without the practical challenges of feeding, grooming, or veterinary care. While these machines cannot replicate the full richness of genuine animal companionship, they demonstrate how robotics can be designed to engage with human needs by simulating interspecies interaction. Their use highlights both the therapeutic potential of robotics and the philosophical dilemma of authenticity: does simulated companionship diminish or replace the meaningfulness of real relationships with living beings, or does it represent an acceptable substitute in contexts where real pets are impractical?

Such technologies blur the boundaries between biological and artificial agents, raising questions about authenticity, manipulation, and co-agency. On one hand, the ability of animals to treat machines as fellow agents suggests that robotics can create new forms of interspecies communication, enriching our capacity to understand and interact with non-human life. On the other hand, it also reveals the risk of manipulation, where animals are influenced by artificial entities without the possibility of recognising them as such, thereby undermining the autonomy and natural agency of non-human beings. The issue of authenticity further complicates matters: if relationships with robotic pets or animal-responsive machines come to substitute for relationships with living beings, we may inadvertently cultivate a culture where simulations are valued over genuine interspecies bonds. Finally, the question of co-agency arises, if animals respond meaningfully to robotic agents, can these interactions be considered genuine forms of collaboration, or are they always asymmetrical, with machines ultimately programmed to serve human goals? These questions show that while robotic interfaces expand the horizons of interspecies communication, they also demand critical reflection on the ethical and philosophical implications of merging life with artificiality in increasingly intimate ways.

Case Studies: Wildlife Monitoring, Smart Farming, and Wearable AI

Several case studies illustrate the diversity of applications of artificial intelligence in human-animal relations, each showing how technological innovation can be harnessed to address pressing practical needs while simultaneously raising deeper philosophical and ethical concerns about the nature of our engagement with non-human life. These examples help to demonstrate not only the potential of AI to improve welfare and conservation outcomes, but also the risks of overreliance on technological mediation in contexts that traditionally required closer, more organic human-animal relationships.

- **Wildlife monitoring:** AI-powered drones are used to track elephant populations in Africa, assisting in anti-poaching efforts (Puri *et al*., 2019). These drones are equipped with advanced cameras and machine learning algorithms that can identify elephants from the air, often in vast and difficult terrains where traditional human patrols would be less effective. By continuously gathering visual data, the drones can detect unusual patterns such as rapid herd movements, signs of distress, or the presence of human intruders. This information is transmitted in real time to conservationists and law enforcement, enabling faster and more targeted interventions against poaching activities. Beyond surveillance, these systems also provide valuable long-term ecological data on migration routes, feeding patterns, and reproductive cycles, which can inform sustainable conservation strategies. At the same time, the use of AI in this domain raises critical questions about technological dependency: will conservation efforts become overly reliant on machines, potentially reducing the importance of fostering community-based stewardship of wildlife? Furthermore, there is an underlying tension between the protective function of drones and their intrusive nature, as continuous aerial monitoring could be seen as a form of surveillance that intrudes upon the natural lives of elephants, whose movements are now constantly under watch (Puri *et al*., 2019).
- **Smart farming:** AI sensors in barns monitor cows' movements and health, optimising feeding and reducing disease spread (Tullo *et al*., 2019). These systems typically use accelerometers, thermal cameras, and behavioural tracking tools to monitor subtle changes in posture, feeding habits, or levels of activity that may signal illness, discomfort, or reproductive readiness. Farmers benefit from receiving automated alerts that allow them to intervene before diseases spread or before productivity losses occur. For instance, early detection of lameness or mastitis can significantly reduce suffering for the animals while also ensuring economic efficiency for the farm. By tailoring feed distribution and identifying specific nutritional needs, AI can also help to improve overall herd health, reduce waste, and make farming practices more environmentally sustainable. Yet, while such systems can be justified on welfare grounds, they also risk reframing animals primarily as units of productivity to be optimised. The very act of constantly measuring, categorising, and predicting their behaviour may reduce the richness of their lived experience into quantifiable data points, thereby reinforcing a view of livestock as biological machines rather than sentient beings with intrinsic value. This dual role of AI—as both a tool for welfare and a tool for commodification—reveals the ambivalence at the heart of smart farming technologies (Tullo *et al*., 2019).

- **Wearable AI:** Collars fitted with accelerometers and machine learning models can track pets' activity levels and emotional states (Brugarolas *et al.*, 2020). These devices are marketed to pet owners as tools for monitoring health, ensuring adequate exercise, and even gaining insight into the emotional wellbeing of their animals. For example, sudden reductions in activity can alert owners to potential illness, while patterns of movement or tail positioning may be interpreted as indicators of stress or excitement. In this way, wearable AI promises to deepen the bond between humans and their companion animals by providing continuous feedback about their condition. Such technologies, however, come with their own set of ethical complexities. On the one hand, they may help to prevent neglect by giving owners more information to act responsibly. On the other hand, they risk creating a culture in which pet care is reduced to data interpretation, potentially displacing the attentiveness and empathy that arise from lived, embodied interaction with the animal. Moreover, questions arise about accuracy and interpretation: can an algorithm truly capture the emotional states of pets, or does it simplify complex behaviours into categories that may mislead owners and generate misplaced responses (Brugarolas *et al.*, 2020)?

Model Interpretability and Transparency in Animal-Centred AI

One emerging challenge in deploying AI for decoding animal vocalisations or predicting behaviour is model interpretability. Deep learning systems, especially those trained on acoustic spectrograms or multimodal behavioural datasets, often operate as "black boxes." This presents two concerns.

First, opaque models risk misclassification due to biases in training data (e.g., overrepresentation of a single species, environment, or context). Second, lack of interpretability makes it difficult for researchers, conservationists, and animal welfare experts to validate whether model outputs align with species-specific ethological knowledge.

Explainable AI (XAI) tools, such as feature attribution maps, interpretable decision trees, or rule-based classifiers, are increasingly recommended when working with animal datasets. These methods help uncover what aspects of a vocalisation, gesture, or physiological pattern a model is using to make predictions, enabling more responsible, scientifically grounded analysis.

4. ETHICAL IMPLICATIONS

The integration of Artificial Intelligence (AI) into human-animal communication systems is unfolding with unprecedented speed, ushering in a series of profound ethical challenges that extend far beyond conventional animal welfare concerns. These challenges delve into complex questions of animal agency, their representation within technologically mediated interfaces, and the very essence of interspecies relationships in a rapidly digitising world. Understanding and proactively addressing these ethical dimensions is crucial for ensuring a responsible and sustainable future for human-animal interactions.

Animal Agency and Consent in AI-Mediated Interactions

A fundamental ethical concern revolves around the concept of animal agency and the intricate question of consent in contexts where AI is deployed. When AI systems are utilised to predict, influence, or even manipulate animal behavior, for instance, in optimised smart farming operations or sophisticated wildlife conservation strategies, it fundamentally raises questions about whether animals are genuinely treated as autonomous beings capable of expressing preferences, or merely as data-generating entities whose behaviors are optimised for human benefit (Kim *et al.*, 2024). This instrumental view risks reducing sentient life to programmable inputs and outputs, diminishing their intrinsic value in the process. While AI can undoubtedly decode complex animal emotional states or vocalisation patterns, offering unprecedented insights into their physiological needs and psychological well-being, this technological capability does not readily translate into a straightforward system of true consent, which remains a deeply complex, often human-centric, construct (Cowie *et al.*, 2023).

The inherent asymmetrical power dynamic between human designers and animal subjects underscores the urgent need for a thorough re-evaluation of existing ethical frameworks. These frameworks must be robust enough to genuinely account for animal interests, a critical topic frequently explored within the burgeoning and increasingly vital field of AI ethics that explicitly recognizes the profound impact of technology on non-human entities (Potluri *et al.*, 2025).

Emerging research, however, indicates a potential silver lining: thoughtfully designed animal-computer interactions have the capacity to enhance animal agency by providing them with greater control over their immediate environment (Martínez-Vega & García-Martínez, 2025). Yet, this potential can only be realised if the design considerations are meticulously aligned with authentic animal preferences and ethological requirements, rather than solely serving human operational goals. The ethical imperative here is to move beyond mere efficiency and towards a symbiotic partnership where AI tools empower animals, rather than just manage them.

The Perils of Anthropomorphism and Ethical Misrepresentation

The increasing sophistication of AI in interpreting animal signals also presents a significant ethical dilemma related to anthropomorphism and the subsequent risk of ethical misrepresentation. While AI systems are engineered to bridge the communication gap between species, they frequently achieve this by inadvertently projecting human-like cognitive abilities, emotional states, or social paradigms onto animals. This projective process, while seemingly benign, can inadvertently create a false sense of understanding, leading to interventions that are not genuinely in the animal's best interest (Miranda-de la Lama & Mota-Rojas, 2020). For instance, an AI interpreting a specific animal vocalisation as "sadness" might trigger a response based on a human emotional paradigm, such as attempting to comfort, rather than a more nuanced, species-specific behavioral or physiological context. The animal's distress might stem from a completely different, non-human-like cause, rendering the AI's "empathetic" response ineffective or even detrimental. This ethical pitfall highlights the critical need for a critical, interdisciplinary approach that synergistically combines cutting-edge technological expertise with profound ethological insights into animal behavior, psychology, and species-specific communication, complemented by robust philosophical grounding in animal ethics. Without such a holistic perspective, AI runs the risk of creating "communication" systems that are more reflective of human preconceptions than of genuine animal realities, potentially leading to misdirected efforts in welfare, conservation, and management.

Data Bias, Technological Determinism, and Accountability

The deployment of AI in interspecies contexts is inextricably linked with the significant risks of data bias and technological determinism. AI models, by their very nature, are trained on vast datasets, and if these foundational datasets are inherently biased, for example, by overrepresenting certain species, geographical environments, or specific human-animal interaction types, the resultant technologies will inevitably reflect, and consequently perpetuate, these ingrained biases (Bazarganu et al., 2024). This phenomenon can lead to a form of technological determinism, where the AI's pre-programmed logic and biased operational parameters dictate outcomes, effectively overriding more context-sensitive, ethically informed, and humane approaches.

Consider an AI designed to maximise agricultural output: if its training data disproportionately emphasizes production metrics over animal well-being indicators, it might recommend practices that, while deemed "efficient" by its biased algorithms, are demonstrably detrimental to animal welfare. This underscores why the issues of transparency, fairness, and accountability are paramount in the development of interspecies AI. When an AI system makes a critical decision, such as recommending the culling of a herd based on predictive health analytics or altering the habitat of a wildlife population, the lack of transparency inherent in its decision-making process, often referred to as the "black box" problem, makes it exceedingly difficult to ascertain accountability or ensure that the decision was fair and justifiable from the animals' perspective (Cambraia & Pyrrho, 2025). This "black box" problem is a central, long-standing concern in broader AI ethics and applies with equal, if not greater, force to interspecies technologies. The ethical imperative demands the development and implementation of Explainable AI (XAI), systems capable of providing clear, human-understandable justifications for their decisions, thereby allowing for critical ethical oversight and the assignment of responsibility when adverse outcomes occur.

Surveillance, Privacy, and the Instrumental Value Dilemma

Finally, the pervasive use of surveillance and the erosion of privacy in animal monitoring systems represent a significant and rapidly expanding ethical frontier. While AI-driven monitoring can offer profoundly beneficial applications for crucial conservation efforts, such as tracking endangered species or detecting poaching activities, and for optimising animal health management in controlled environments, it simultaneously raises profound questions about the animals' fundamental "right to be left alone" and the potential for ubiquitous, intrusive, and continuous surveillance.

The constant collection of detailed data, even when motivated by benevolent intentions, can inadvertently infringe upon the natural behaviors, social structures, and private lives of animals, potentially altering their fundamental existence without their "consent" or even human awareness of the full impact. This continuous digital gaze transforms natural environments into data farms, raising questions about whether such pervasive monitoring is merely a tool for observation or a subtle form of control. The core of these intricate ethical dilemmas lies in the ongoing philosophical debate between instrumentalisation versus the intrinsic value of animals.

AI systems, by their very design, are frequently developed and deployed for instrumental purposes: to increase efficiency, enhance human productivity, or simplify human tasks. This instrumental lens can inadvertently devalue animals, systematically reducing them to mere objects of data collection, algorithmic analysis, and human manipulation, rather than respecting their inherent worth as sentient beings with lives, experiences, and purposes of their own (Potluri *et al.*, 2025). A truly responsible approach mandates that the relentless pursuit of technological advancement does not overshadow, but rather actively reinforces, the fundamental ethical imperative to recognize, protect, and uphold animal dignity in all its forms.

5. SOCIETAL IMPLICATIONS

The integration of artificial intelligence (AI) into human-animal communication systems heralds a transformative era, bringing with it a complex tapestry of societal ramifications. These consequences span from profound economic restructuring within key industries to subtle yet significant shifts in cultural perspectives and established power dynamics. The economic implications, particularly within the interconnected realms of conservation and agriculture, warrant meticulous examination.

Economic Transformations and the Widening Digital Divide

In contemporary agricultural practices, AI-driven automation is poised to significantly enhance productivity. This is achieved through sophisticated systems that optimise feeding regimens, implement continuous animal health monitoring, and streamline various operational processes, thereby promising a substantial elevation in profitability for large-scale operations (Potluri *et al.*, 2025). For instance, AI algorithms can analyse real-time data from sensors attached to livestock, enabling individualized feed adjustments based on an animal's age, weight, activity, and even genetic predisposition, minimising waste and maximising growth efficiency.

Furthermore, computer vision and acoustic monitoring systems can detect early signs of illness or distress in animals, allowing for timely intervention and reducing losses due to disease outbreaks. Precision farming techniques, facilitated by AI, can also optimize resource allocation for pasture management, ensuring sustainable land use and improved animal nutrition. This technological surge offers unprecedented levels of efficiency and control, presenting a compelling economic incentive for adoption.

However, this rapid technological advancement simultaneously carries the inherent risk of exacerbating existing disparities within the agricultural sector. The substantial capital outlay required for AI-driven systems, including specialised sensors, robotics, advanced software subscriptions, and the necessary digital infrastructure, can be prohibitively expensive for small-scale farmers (Martínez-Vega & García-Martínez, 2025). This creates a burgeoning digital divide, where larger, well-capitalised enterprises can leverage AI to gain a competitive edge, while smaller farms, often operating on tighter margins and with limited access to credit or technical expertise, risk economic marginalisation. The consequence is a potential consolidation of power and wealth within the agricultural landscape, threatening the viability of traditional family farms and the diversity of food production systems.

Similarly, in conservation efforts, AI-powered surveillance tools offer transformative potential for safeguarding endangered species and monitoring biodiversity. Technologies such as drone surveillance, automated acoustic monitoring for detecting poacher activity or specific animal calls, and even AI-driven facial recognition for individual animals, can provide unprecedented data for protection and population tracking (Damián-Rodríguez & Gómez-Gómez, 2024). These capabilities can significantly bolster anti-poaching initiatives and provide crucial data for habitat management.

Yet, the considerable expenses associated with acquiring and maintaining these sophisticated systems, coupled with the demand for highly specialized technical expertise (e.g., data scientists, AI engineers, drone pilots), often lead to an increased reliance on affluent nations, large international non-governmental organisations, or well-resourced academic institutions. This dependence can inadvertently sideline local communities and indigenous populations who traditionally coexist with these animal populations and often possess invaluable traditional ecological knowledge (TEK). Their deep-rooted understanding of local ecosystems and species behavior, accrued over generations, risks being devalued or overlooked in favor of technologically driven, external solutions, fostering a new form of conservation inequality.

Digital Inequality and the Specter of Techno-Colonialism

The emerging scenario profoundly underscores pervasive concerns regarding digital inequality and the equitable access to advanced AI technology. The benefits generated by AI in interspecies communication are demonstrably not distributed uniformly across the global landscape. Instead, global AI adoption frequently mirrors and reinforces existing power asymmetries, where industrially developed nations and dominant multinational corporations largely dictate the trajectory of technological development, deployment strategies, and the very ethical frameworks governing these technologies (Cohen & Galily, 2024). This often transpires with insufficient meaningful input from marginalised communities or indigenous populations, many of whom possess profound, intergenerational relationships with animals and unique cultural practices concerning interspecies interactions.

Such dynamics risk ushering in a contemporary manifestation of techno-colonialism, where technologically advanced solutions, frequently imbued with Western-centric epistemologies and values, are imposed upon diverse local contexts (Cambraia & Pyrrho, 2025). This imposition can lead to the erosion of traditional ecological knowledge systems, which are often holistic, adaptive, and deeply integrated with local socio-cultural structures. For example, AI-driven systems designed for wildlife management, while effective in their technical scope, might overlook or actively disrupt indigenous hunting practices, sacred land-use patterns, or traditional methods of animal husbandry that are intrinsically linked to cultural identity and sustainable coexistence. This is not merely a matter of technology transfer; it is a process by which specific technological solutions and their underlying rationales become dominant, potentially leading to new forms of dependence on foreign expertise and proprietary systems, thereby undermining local self-determination and cultural sovereignty in environmental and animal management. The extraction of vast datasets from biodiversity hotspots by external entities, without equitable benefit-sharing or genuine community participation in data governance, exemplifies a modern form of resource extraction, reminiscent of historical colonial practices.

Labor Displacement and the Reshaping of the Human-Animal Bond

A critical concern emanating from the widespread adoption of interspecies AI revolves around the potential for labor displacement and pervasive automation within industries traditionally reliant on animal interaction. As AI and robotics progressively assume a wider array of tasks, such as automated milking, precision feeding, robotic cleaning of enclosures, sophisticated health diagnostics, and even complex herding operations, the human workforce in these sectors confronts a future demanding extensive reskilling or facing significant redundancy (Bazarganu et al., 2024).

The economic consequences for these workers, often in rural and agricultural communities, can be severe, leading to job losses, increased economic insecurity, and potentially forced migration. The challenges of reskilling an often-traditional workforce, potentially with limited access to advanced education or training programs, are substantial and require proactive policy interventions.

Beyond the purely economic shifts, this transformative process fundamentally reshapes the traditional human-animal bond. The direct, hands-on care, observation, and intuitive understanding that historically characterized human interaction with animals are increasingly substituted with mediated, data-centric management protocols (Kim *et al*., 2024). When an AI system monitors an animal's health through sensors and algorithms, the human caregiver's role shifts from direct physical interaction and empathetic observation to interpreting data dashboards and responding to algorithmic alerts. This qualitative alteration in human engagement means that the nuanced, often unspoken communication and the empathetic connection forged through physical presence and shared labor may diminish.

The psychological and ethical implications for both humans and animals are profound: humans may experience a sense of detachment, while animals might be managed as mere data points rather than sentient beings with individual needs and personalities. This reductionist approach risks eroding the very foundation of reciprocal relationships that have defined human-animal coexistence for millennia.

Cultural Attitudes and the Dilemma of Perception

Finally, the widespread integration of interspecies AI is poised to significantly influence cultural attitudes toward animals, presenting a dual-edged sword of potential enlightenment and potential dehumanisation. On one hand, the capacity to "converse" with animals via sophisticated AI interfaces, for example, through AI-driven translation of animal vocalisations, interpretation of subtle behavioral cues, or the generation of insights into their cognitive states and emotional experiences, could foster a heightened sense of empathy and compel a profound re-evaluation of their cognitive capabilities (Cowie *et al*., 2023).

By providing what appears to be a window into the inner lives of animals, AI might cultivate more respectful and compassionate interspecies relationships, challenging anthropocentric biases and fostering a deeper appreciation for animal sentience and subjective experience. This could lead to a societal shift where animals are increasingly seen as subjects rather than mere objects.

Conversely, there is an inherent risk that this very capacity could lead to a more clinical, utilitarian perception of animals. An over-reliance on algorithmic outputs might inadvertently reduce animals to quantifiable data points, de-emphasising their individual subjectivity, unique personalities, and complex emotional lives (Miranda-de la Lama & Mota-Rojas, 2020). When an animal's "well-being" is reduced to a set of sensor readings and algorithmic scores, the direct, empathetic understanding gained through lived experience and shared interaction can be diminished. This could reinforce an instrumental view, where animals are primarily valued for their utility, productivity, or the data they generate, rather than for their intrinsic worth. Such a perspective could inadvertently normalise or even optimise their instrumental use within human systems, potentially entrenching existing exploitative practices by making them more efficient and less visible, rather than challenging the fundamental ethical questions surrounding animal use.

Consequently, the societal reception and integration of these transformative technologies will play a pivotal role in determining whether they ultimately serve to elevate the status of animals within human moral consideration or primarily function to render their exploitation more scientifically efficient and culturally palatable. Public discourse, ethical education, and media representation will be crucial in shaping how these powerful technologies are perceived and integrated into our evolving societal norms regarding our non-human companions on this planet.

6. GOVERNANCE, POLICY, AND ETHICAL FRAMEWORKS

Establishing robust governance for artificial intelligence (AI) applications in human-animal interactions is paramount to fostering a responsible and ethically sound future. A thorough review of existing policies and identified regulatory gaps underscores that the current frameworks are largely inadequate to address the unique and intricate challenges presented by interspecies AI (Martínez-Vega & García-Martínez, 2025). Predominantly, AI regulations have been human-centric, primarily concentrating on aspects like data privacy, algorithmic bias, and accountability as they pertain to human subjects. This narrow focus leaves a significant void in the provision of explicit protections for animals within AI systems. Consequently, there is an urgent need for a novel methodological approach that effectively integrates comparative ethical frameworks. This necessitates drawing comprehensively from well-established animal ethics,which typically foregrounds concepts such as animal sentience, intrinsic value, and welfare, and contemporary AI ethics, with its emphasis on principles of fairness, transparency, and accountability in algorithmic decision-making.

A particularly promising avenue for responsible development lies in the adoption of an ethics-by-design approach within interspecies AI contexts (Bazarganu et al., 2024). This philosophical stance advocates for the proactive embedding of ethical considerations into the foundational core of AI system development, from the initial conceptualisation phase through to deployment and ongoing operation. Practically, this implies that animal welfare, the preservation of animal autonomy where applicable, and the systematic minimisation of potential harm must be prioritized as central design constraints. These considerations should be integrated at the outset, rather than being treated as reactive afterthoughts or mere compliance-based add-ons. For example, an AI system engineered for precision livestock management ought to be programmed with sophisticated welfare metrics that are afforded equitable weighting alongside traditional productivity metrics, ensuring that technological advancements do not inadvertently compromise animal well-being (Kim *et al.*, 2024). Such an approach moves beyond simply avoiding harm to actively promoting positive animal outcomes.

The inherent complexity of these ethical and governance issues necessitates a robust model of participatory governance, which deliberately includes a diverse array of stakeholders beyond the conventional spheres of technologists and policymakers. An effective governance structure must actively incorporate the perspectives and voices of ethicists, conservationists, dedicated animal welfare advocates, indigenous communities (who often possess deep traditional knowledge of human-animal relationships), and farmers themselves. This inclusive approach ensures that emerging technologies are developed with a profound, on-the-ground understanding of their practical impact, cultural resonance, and local ecological contexts (Miranda-de la Lama & Mota-Rojas, 2020). By fostering this multi-stakeholder engagement, the governance model can help to mitigate existing power asymmetries and work towards a more equitable distribution of the benefits derived from interspecies AI technologies, preventing the concentration of technological advantage in a few hands.

Finally, the development of comprehensive global regulatory considerations and best practices is not merely advisable but essential. Given the intrinsically global nature of both AI development and the transboundary realities of many animal populations (e.g., migratory species, global agricultural supply chains), a fragmented patchwork of national regulations will inevitably prove insufficient. International collaboration is therefore imperative to establish shared ethical principles and universally applicable regulatory guidelines. These guidelines must be sufficiently flexible to be adapted effectively to diverse local contexts, while simultaneously upholding a universal and unwavering commitment to animal dignity and welfare (Potluri *et al*., 2025). Such international frameworks could encompass shared data protocols designed to protect both animal privacy and the integrity of scientific research, alongside standardized requirements for algorithmic transparency that seamlessly traverse national borders, fostering a unified approach to responsible interspecies AI.

7. TOWARDS RESPONSIBLE INTERSPECIES TECHNOLOGY

The trajectory toward the development and deployment of truly responsible interspecies technology necessitates a unified and deliberate effort to translate abstract ethical principles into concrete, actionable practices that span the entire technological development lifecycle. At the core of this imperative lies the establishment of robust ethical design principles specifically tailored for AI applications within human-animal contexts. These foundational principles must be deeply rooted in a profound respect for animal agency, an unwavering commitment to minimising all forms of harm, and an active pursuit of promoting positive welfare outcomes for animals (Kim *et al*., 2024). Moving beyond a reactive stance of merely preventing harm, ethical design in this domain should proactively strive to enhance the lives of animals, for instance, by conceptualising and creating technologies that significantly enrich their natural or captive environments, facilitate more nuanced and positive interspecies interactions, or even empower animals with greater choice and control over their immediate surroundings. This proactive approach demands a fundamental shift from human-centric utility to animal-centric well-being, acknowledging that technological advancement should not solely serve human interests but also contribute meaningfully to the flourishing of non-human life. Designing for animal agency, for example, could involve developing AI systems that detect and respond to animal preferences, allowing them to choose feeding times, activity levels, or social groupings within defined parameters. Such systems would move beyond simple automation to a more interactive and respectful coexistence, fostering a sense of control for the animals themselves. The integration of complex biometric and behavioral data, processed by advanced AI models, allows for unprecedented insights into animal states, yet these insights must be ethically managed to ensure they empower, rather than merely surveil or control.

Building upon these critical ethical design principles, a comprehensive series of recommendations for policy and practice can be meticulously formulated to guide stakeholders across various levels. At the macro policy level, this involves actively advocating for and implementing progressive legislation that specifically addresses the nuanced complexities of AI utilisation within animal-based industries, such as intensive agriculture and aquaculture, as well as crucial conservation initiatives. A central tenet of such legislation should be the mandated requirement for transparency and stringent accountability mechanisms for all AI systems impacting animals (Bazarganu et al., 2024). For example, regulatory bodies could establish explicit requirements for any AI system slated for deployment in an agricultural setting to undergo a rigorous, independent ethical impact assessment prior to its implementation. This assessment would scrutinise potential negative impacts on animal welfare, behavioral patterns, and environmental sustainability, ensuring a holistic evaluation. Furthermore, international cooperation is paramount, given the transboundary nature of many animal populations (e.g., migratory species) and the globalized supply chains of animal products. Harmonised international policies could prevent regulatory arbitrage and ensure a consistent standard of animal protection regardless of geographical location. This necessitates frameworks for shared data protocols that respect both animal privacy, by anonymising individual data where possible and aggregating for population-level insights,and the integrity of research, alongside international standards for algorithmic transparency that transcend national borders, fostering a unified and responsible approach (Potluri *et al.*, 2025). At the micro practice level, there is an urgent need to develop clear, unambiguous, and implementable guidelines for developers, researchers, and institutions actively engaged in building and deploying these transformative technologies. These guidelines should precisely specify robust requirements for data collection,ensuring data is ethically sourced and representative,rigorous algorithm training that minimises bias against certain animal characteristics or breeds, and comprehensive system validation protocols where animal welfare is not merely an afterthought but a central, quantifiable metric of success (Martínez-Vega & García-Martínez, 2025). Moreover, these practical guidelines should mandate thorough and accessible documentation of all AI systems, enabling independent external audits, ethical reviews, and public scrutiny to ensure ongoing adherence to established ethical standards and best practices.

It is unequivocally clear that addressing the intricate challenges of interspecies AI is not a task for a single discipline; rather, it necessitates fostering profound cross-disciplinary collaboration. The future trajectory of interspecies AI cannot, and must not, be solely entrusted to the purview of computer scientists and engineers. It demands a sustained, dynamic, and iterative dialogue among a diverse consortium of experts: technologists who can articulate the capabilities and limitations of AI; ethicists who can provide normative guidance and identify potential moral pitfalls; animal behaviorists and ethologists who possess deep understanding of species-specific needs and cognitive capacities; sociologists and anthropologists who can shed light on the societal impacts and cultural contexts of human-animal interactions; and policymakers and legal experts who can translate ethical aspirations into enforceable legal frameworks. This institutionalised collaboration should manifest in the form of interdisciplinary research grants, dedicated academic centers focused on interspecies AI ethics, and, crucially, ethical review boards for AI projects that actively include a diverse range of expertise. These boards would serve as critical junctures for scrutinizing design choices, data practices, and deployment strategies from multiple ethical, scientific, and societal vantage points. The challenges in such collaborations, such as differing terminologies and methodologies, can be overcome through concerted efforts to establish a common language, shared objectives, and a mutual appreciation for each discipline's invaluable contribution. This integrated approach ensures that technological innovation is consistently guided by a holistic understanding of its multifaceted implications, moving beyond purely technical efficacy to encompass moral rectitude and societal benefit.

Ultimately, the overarching goal of these concerted efforts is to establish a comprehensive framework that extends beyond the mere mitigation of risks. Instead, it aims to embed animal dignity and welfare as foundational tenets within every stage of AI development and application. This pivotal shift entails moving decisively beyond a purely utilitarian calculus, which traditionally assesses value based on usefulness or economic output. It demands a paradigm where animals are recognised not merely as resources to be managed or instruments to be optimized, but as inherently sentient beings deserving of profound respect and moral consideration (Miranda-de la Lama & Mota-Rojas, 2020). As AI continues to dramatically deepen our scientific and public understanding of non-human life, revealing new facets of animal cognition, emotion, and social complexity, we bear an profound ethical responsibility to ensure that these powerful technologies are not only designed to be smart and efficient but also to be inherently kind, just, and respectful of the incredibly diverse forms of life with whom we share this planet. This future vision of interspecies technology is one where ethical consciousness is as integral to its architecture as its algorithms, fostering a profound re-evaluation of humanity's role as stewards of the animal kingdom and pioneering new frontiers of respectful coexistence.

Table 1. Ethical Challenges and Mitigation Strategies in Interspecies AI

Ethical Issue	Description	Recommended Mitigation Strategy
Anthropomorphism	Risk of projecting human categories onto animal signals	Use species-specific ethological baselines; incorporate expert review
Data Bias	Training datasets overrepresent certain species/contexts	Diversify data collection; apply bias-detection tools
Loss of Agency	Animals affected by AI-guided behavioural interventions	Design for optionality, preference-testing, low intrusiveness
Surveillance	Excessive monitoring of wildlife or livestock	Establish monitoring thresholds; require welfare justification
Lack of Transparency	Users cannot interpret how models make decisions	Incorporate XAI; document model decision pathways

Practical Design Frameworks for Responsible Interspecies AI

Building on ethics-by-design, practical frameworks can guide developers and practitioners:

a. **Species-Sensitive Data Standards:** Data collection must follow ethological evidence, ensuring recordings and behavioural observations reflect natural rather than stressed or artificial states.
b. **Tiered Transparency Protocols:** Models should include documented assumptions, training conditions, and known limitations.
c. **Animal Preference Testing:** Interfaces (e.g., robotic agents, collars) should be validated through voluntary interaction patterns rather than enforced exposure.
d. **Context-Adaptive Deployment:** Technologies should respond to ecological, cultural, and cross-species differences rather than applying one-size-fits-all standards.
e. **Welfare-Centred Key Performance Indicators (KPIs):** Success metrics must include reduced stress, increased autonomy, and behavioural normalcy.

Cross-Cultural Ethical Considerations

Human–animal relations vary widely across cultures. Technologies designed in Western contexts may misalign with the animal ethics frameworks of indigenous, pastoral, or agrarian communities. Integrating cross-cultural ethical analysis ensures that interspecies AI does not universalise narrow values or impose external priorities.

This includes recognising:

- Indigenous ecological knowledge and traditional modes of reading animal signals.
- Non-Western relational ontologies, which may conceptualise animals as kin, spiritual entities, or cohabitants.
- Context-specific welfare concepts (e.g., communal grazing norms, ritual significance).

This cross-cultural lens ensures culturally responsive and globally responsible interspecies technologies.

8. CONCLUSION

Recap of Key Insights

This chapter has traced the emergence of AI as a transformative force in human-animal communication. Computational bioacoustics, multimodal machine learning, passive acoustic monitoring, and robotic interfaces together form a dynamic technological ecosystem that can potentially revolutionise how we perceive and interact with non-human minds.

Yet, these technological advancements cannot be considered value-neutral. Issues of animal agency, anonymity, anthropomorphism, misinterpretation and unequal access permeate the field. Without deliberate ethical frameworks, AI may reproduce or worsen existing asymmetries, even as it promises new forms of interspecies connection.

Emphasis on the Need for Caution and Responsibility

Progress in interspecies AI must proceed with caution. Key ethical concerns include:

- **Agency and Consent:** Animals cannot grant informed consent, but designers must strive to minimise intrusiveness and maximise welfare.
- **Anthropomorphism:** Interpreting animal signals through a human lens risks distortion. Critical anthropomorphism, grounded in species-specific understanding, is essential.

- **Transparency and Accountability:** AI systems should be explainable; users should understand model limitations and potential biases.
- **Bias and Misrepresentation:** Data imbalances, e.g., over-representation of certain species or contexts, can produce skewed outputs. Bias mitigation must be proactive.
- **Surveillance and Instrumentalisation:** Passive data gathering can morph into control or exploitation. Governance must safeguard against misuse.

Final Reflections on the Future of Interspecies AI

If pursued ethically, interspecies AI may reshape our relationship with animals, from viewing them as data points to recognising them as communicative agents. Legal scholars speculate that AI-mediated insight into animal communication could catalyse transformations in animal rights law, potentially altering animals' legal status (Rodríguez-Garavito, 2025).

Conservation strategies may become more responsive and nuanced-guided by real-time communication cues. Agriculture could shift toward welfare-centric systems. Public empathy may grow through direct, AI-facilitated glimpses into animal experience.

However, the path forward demands collaboration across disciplines: ethicists, technologists, biologists, animal care professionals, policy makers and communities must co-design ethical and effective systems.

Call to Action for Ethical Stewardship and Inclusive Innovation

To ensure responsible interspecies AI, stakeholders must commit to:

- **Ethics-by-Design:** Embed welfare, fairness, transparency and minimal intrusiveness from the earliest design stages.
- **Participatory Governance:** Include diverse voices, especially animal advocates, ethicists and local communities, in policy formation and oversight.
- **Regulatory Frameworks:** Develop legal standards to govern data use, surveillance thresholds, interpretative limits and the rights of non-human communicators.
- **Cross-disciplinary Collaboration:** Leverage insights from AI, animal ethics, behavioural ecology, law and public policy to shape humane innovation.
- **Public Advocacy and Education:** Promote critical anthropomorphism and informed discourse, avoiding sensationalism while fostering empathy and awareness.

In embracing these principles, interspecies AI can evolve responsibly, fostering deeper understanding across species without undermining the dignity of those we seek to listen to.

REFERENCES

American Bar Association. (2025). Bridging species: Legal and ethical implications of AI- assisted animal communication. *Tort Trial & Insurance Practice Law Journal*. https://www.americanbar.org/groups/tort_trial_insurance_practice/resources/brief/202 5-winter/legal-ethical-implications-ai-assisted-animal-communication/

Bradshaw, G. A. (2021). *Elephants on the edge: What animals teach us about humanity*. Yale University Press.

Brugarolas, R., Lee, J., & Martins, N. R. B. (2020). Wearable devices for animal health monitoring. *Frontiers in Veterinary Science*, *7*(63), 1–11. DOI: 10.3389/fvets.2020.00063

Cambraia, A., & Pyrrho, S. (2025). Generative artificial intelligence and the risk of technodigital colonialism. *Frontiers in Political Science*, *7*, 1628139. DOI: 10.3389/fpos.2025.1628139

Cave, S., & Dihal, K. (2020). *AI narratives: A history of imaginative thinking about intelligent machines*. Oxford University Press.

Cohen, A., & Galily, Y. (2024). Behavioral and Psychosocial Dynamics of Engagement: The Digital Divide in Artificial Intelligence [AI]-Driven Sports Podcasts. *Technologies*, *14*(10), 911. DOI: 10.3390/technologies14100911

Cowie, J., Cowie, S., & Gentry, K. (2023). Artificial intelligence technologies and compassion in healthcare: A systematic scoping review. *Journal of Medical Systems*, *47*(1), 1–17. DOI: 10.1007/s10916-023-01931-1

Crawford, K. (2021). *Atlas of AI: Power, politics, and the planetary costs of artificial intelligence*. Yale University Press.

Crist, E. (2019). *Abundant earth: Toward an ecological civilization*. University of Chicago Press.

Damián-Rodríguez, M., & Gómez-Gómez, A. (2024). Artificial Intelligence Alone Will Not Democratise Education: On Educational Inequality, Techno-Solutionism and Inclusive Tools. *Sustainability*, *16*(2), 781. DOI: 10.3390/su16020781

Donaldson, S., & Kymlicka, W. (2011). *Zoopolis: A political theory of animal rights*. Oxford University Press.

Fitzpatrick, J., Browning, H., & Brakel, S. (2022). Ethical challenges in precision livestock farming. *Journal of Agricultural & Environmental Ethics*, *35*(2), 1–19. DOI: 10.1007/s10806-022-09898-3

Floridi, L., Cowls, J., Beltrametti, M., Chatila, R., Chazerand, P., Dignum, V., & Vayena, E. (2018). AI4People—An ethical framework for a good AI society: Opportunities, risks, principles, and recommendations. *Minds and Machines*, *28*(4), 689–707. DOI: 10.1007/s11023-018-9482-5

Ihde, D. (1990). *Technology and the lifeworld: From garden to earth*. Indiana University Press.

Jobin, A., Ienca, M., & Vayena, E. (2019). The global landscape of AI ethics guidelines. *Nature Machine Intelligence*, *1*(9), 389–399. DOI: 10.1038/s42256-019-0088-2

Kershenbaum, A., Blumstein, D. T., Roch, M. A., Akçay, Ç., Backus, G., Bee, M. A., & Yuan, C. (2016). Acoustic sequences in non-human animals: A tutorial review and prospectus. *Biological Reviews of the Cambridge Philosophical Society*, *91*(1), 13–52. DOI: 10.1111/brv.12160

Kim, S., Park, J., & Lee, J. (2024). AI-Based Smart Monitoring Framework for Livestock Farms. *Applied Sciences (Basel, Switzerland)*, *15*(10), 5638. DOI: 10.3390/app151005638

Kovac, M., Bonnet, F., & Floreano, D. (2021). Robotic animals for scientific research and conservation. *Annual Review of Control, Robotics, and Autonomous Systems*, *4*(1), 185–209. DOI: 10.1146/annurev-control-062220-092241

Martínez-Vega, J., & García-Martínez, A. (2025). AI Algorithms in the Agrifood Industry: Application Potential in the Spanish Agrifood Context. *Applied Sciences (Basel, Switzerland)*, *15*(4), 2096. DOI: 10.3390/app15042096

Miklósi, Á. (2015). *Dog behaviour, evolution, and cognition*. Oxford University Press.

Miranda-de la Lama, G. C., & Mota-Rojas, D. (2020). Association between Attitude and Empathy with the Quality of Human-Livestock Interactions. *Animals (Basel)*, *10*(8), 1304. DOI: 10.3390/ani10081304

Olojede, H. T., & Polo, E. P. (2025). "In Praise of Normative Science: Arts and Humanities in the Age of Artificial Intelligence," pages 1-9. In *International Journal ofSocial Sciences and Humanities: Africa Research Corps Network (ARCN) Journals*. ISSN: 2360-9877. Volume 11, Issue 2, (January, 2025). DOI: . Available at https://arcnjournals.org/images/27265774111101121-1.pdfDOI: 27265774111101121-1

Pepperberg, I. M. (2019). *The Alex studies: Cognitive and communicative abilities of grey parrots*. Harvard University Press.

Polo, E. P., Emmanuel, H., & Obeka, O. B. (2024). Examining the epistemological status of AI-aided research in the information age: Research integrity of Margaret Lawrence University in Delta State. *International Journal of Social Sciences and Humanities: Africa Research Corps Network (ARCN)*. *Journals*, *11*(1), 197–207. https://www.arcnjournals.org/images/27265774111101125.pdf

Potluri, S., Satpathy, S., & Basa, S. S. (Eds.). (2025). *AI in Agriculture for Sustainable and Economic Management*. Taylor & Francis., DOI: 10.1201/9781003451648

Puri, V., Nayyar, A., & Raja, L. (2019). Agriculture drones in India: A review. *Computers and Electronics in Agriculture*, *162*, 164–177. DOI: 10.1016/j.compag.2019.04.001

Regan, T. (2004). *The case for animal rights*. University of California Press.

Russell, S., & Norvig, P. (2020). *Artificial intelligence: A modern approach* (4th ed.). Pearson.

Savage-Rumbaugh, S., Shanker, S. G., & Taylor, T. J. (1993). *Apes, language, and the human mind*. Oxford University Press.

Sebeok, T. A. (1990). *Essays in zoosemiotics*. Springer.

Singer, P. (1975). *Animal liberation*. HarperCollins.

Stahl, B. C., Timmermans, J., & Mittelstadt, B. (2022). The ethics of computing: A survey of professional bodies and academic institutions. *Computer*, *55*(6), 65–75. DOI: 10.1109/MC.2022.3164232

Stowell, D. (2022). *Computational bioacoustics with deep learning.*

ADDITIONAL READING

Anderson, D. J., & Adolphs, R. (2014). A framework for studying emotions across species. *Cell*, *157*(1), 187–200. DOI: 10.1016/j.cell.2014.03.003

Beer, J. M., & Takayama, L. (2011). Mobile remote presence systems for older adults: Acceptance, benefits, and concerns. In Proceedings of the 6th ACM/IEEE International Conference on Human-Robot Interaction (pp. 19–26). *Association for Computing Machinery*. https://doi.org/DOI: 10.1145/1957656.1957665

Bensky, M. K., Gosling, S. D., & Sinn, D. L. (2013). The world from a dog's point of view: A review and synthesis of dog cognition research. In H. J. Brockmann, T. J. Roper, M. Naguib, J. C. Mitani, L. W. Simmons, & L. Barrett (Eds.), Advances in the study of behavior (Vol. 45, pp. 209–406). Academic Press., 407186-5.00005-7.DOI: 10.1016/B978-0-12-

Coeckelbergh, M. (2021). *AI ethics*. MIT Press.

Dell, A. I., Bender, J. A., Branson, K., Couzin, I. D., de Polavieja, G. G., Noldus, L. P., & Straw, A. D. (2014). Automated image-based tracking and its application in ecology. *Trends in Ecology & Evolution*, *29*(7), 417–428. DOI: 10.1016/j.tree.2014.05.004

Despret, V. (2016). *What would animals say if we asked the right questions?* University of Minnesota Press.

Haraway, D. J. (2008). *When species meet*. University of Minnesota Press.

Mancini, C. (2011). Animal–computer interaction: A manifesto. *Interaction*, *18*(4), 69–73. DOI: 10.1145/1978822.1978836

Marconi, F. (2020). *Newsmakers: Artificial intelligence and the future of journalism*. Columbia University Press.

Meijer, E. (2019). *When animals speak: Toward an interspecies democracy*. New York University Press.

KEY TERMS AND DEFINITIONS

Anthropocentrism: An ethical perspective that prioritises human interests and interpretations, often at the expense of recognising animals' intrinsic moral status.

Artificial Intelligence (AI): Computational systems capable of performing tasks that typically require human intelligence, such as pattern recognition, prediction, language processing, applied here to decoding animal communication.

Bioacoustics: The study of sound production, dispersion, and reception in animals, often used with AI to analyse communication signals.

Critical Anthropomorphism: A nuanced interpretive approach that uses informed empathy to understand animal behaviour, while avoiding inaccurate projection of human emotions or motivations.

Ethics-by-Design: The principle of embedding ethical reflection, such as welfare considerations, transparency, accountability and fairness, throughout the life cycle of a technological tool.

Human–Animal Communication: The exchange of signals, vocal, gestural, behavioural or physiological, between humans and animals, interpreted or facilitated through AI systems.

Interspecies Ethics: An ethical stance aiming to acknowledge animals' capacity for experience and value, promoting respect for their autonomy, welfare and modes of existence.

Interspecies Technology: Tools and systems developed to enable or enhance interaction between humans and other species, such as bioacoustic decoders, robotic interfaces, emotion-recognition systems, and animal wearables.

Participatory Governance: A policy-making approach that includes diverse stakeholders, scientists, ethicists, technologists, welfare advocates, local communities, in designing, supervising, and regulating AI applications.

Robotic Interface (Interspecies): A technological system capable of engaging with animals through responsive behaviour, such as playing sounds or enabling the animal to trigger responses (e.g., CHAT for dolphins).