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Dr. Doolittle uses AI: Ethical challenges of trying to speak whale

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ABSTRACT

Artificial intelligence (AI) technologies are increasingly used in conservation practices, e.g., to prevent poaching or inventory wildlife. Another area of application is using AI to decode animal vocalisations to understand better—and subsequently better protect—the animals. It has already been applied to different species, including various whale species.

Whales have complex vocalisations that are used for sexual selection, to coo their young, for echolocation, and as a form of communication. Scientists are deploying underwater microphones (hydrophones), robotic fish, and tags to record whale vocalisation. AI is used to identify whale vocalisation patterns, understand their meaning, and digitally recreate these sounds to communicate with them. Understanding and translating whale vocalisations into something humanly understandable aims at helping to identify their movements to protect them from ship strikes and bycatch and prevent or reduce sonar that interferes with their echolocation.

Using AI holds potential benefits, but it also comes with several risks. We describe current projects that use AI to decipher the vocalisations of humpback and sperm whales (Section 3). We introduce six ethical challenges of applying AI to decode whale vocalisations and highlight what needs to be addressed to establish these practices responsibly (Section 4). These challenges are anthropomorphism, privacy rights, cultural and emotional harm to whales, technological solutionism, ineffectiveness for whale conservation, and gender bias.

This paper critically evaluates the use of AI to analyse whale vocalisation, concluding that using AI to decode whale vocalisations holds many benefits for whale conservation; however, using AI to try to speak with whales is ethically problematic because of the potential emotional, physical, and cultural harm caused to whales.

1. Introduction

Artificial intelligence (AI) technologies influence people's everyday lives and social practices in various sectors, such as medical treatment, agriculture, education, and mobility. Nature conservation practices are also increasingly reliant on AI, and many 'conservation AI' technologies are employed by conservation practitioners. AI technologies gather more information about endangered or threatened species, inventory wildlife, and protect wild animals, e.g., prevent poaching or save them from fires. As AI can quickly analyse vast quantities of real-world data, using these technologies promises to make conservation more effective (Thompson, 2023).

Therefore, conservational AI is applied in unsettled, 'wild' areas to protect non-domesticated animals living in urban areas (Fairbrass, 2023).[1] This "technological turn" in biodiversity conservation (Parris-Piper et al., 2023) is also reflected in the increased use of bioacoustics technologies to monitor habitats and animal species using digital recording devices, with the resulting volumes of data being analysed by AI (Andreas et al., 2021, 2022).

Therefore, AI might benefit species protection and animal welfare, potentially being classified as conservation or *animal welfare technology* (Bossert and Hagendorff, 2021, 2023; Coghlan and Parker, 2023;

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[1] For example, the HogWatch project in London uses urban camera traps to collect more information about urban mammals and their use of public green spaces and private gardens to be able to protect them better (Fairbrass, 2023). Examples of projects that use AI to protect animals in the wild include Wildbook, the Elephant Listening Project, TrailGuard AI, or ChimpFace, and conservational AI is strongly promoted by, e.g., the UK-based non-profit organization *Conservation AI*. For a critical examination of such technologies cf. (Parris-Piper et al., 2023).

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Hagendorff et al., 2023; Rutz et al., 2023; Simoneau-Gilbert and Birch, 2024; Singer and Tse, 2023).[2] One example of such conservation and animal welfare technology is using AI to decode animal[3] vocalisation to something humanly understandable – a Google translate for interspecies communication (Rutz et al., 2023). This idea is not science fiction because much research has already been done. For example, recently, researchers have claimed to have had a 20-minute conversation with an Alaskan humpback whale called Twain (McCowan et al., 2023; Ralls, 2024).

In this paper, we focus on such technology and its application to a particular kind of infraorder of mammals, namely cetaceans, and evaluate its promises and pitfalls from an ethical perspective. Altogether, this paper aims to contribute to the discussion of the ethical issues associated with the emergence of conservation and animal welfare technologies, as called for by Natalie York and colleagues (York et al., 2023), who have identified this as a topic needing further investigation.

Section 2 highlights why the protection of cetaceans is essential in the first place and, thus, how AI is needed. Section 3 shows how AI is used to decipher whale vocalisations, such as humpback (3.1) and sperm whales (3.2). Section 4 focuses on six ethical challenges when using AI to decode whale vocalisations: anthropomorphism, privacy rights, cultural and emotional harm to whales, technological solutionism, ineffectiveness for whale conservation, and gender bias.

It must be noted that in this paper, we address conservation and animal ethics equally. Whereas animal ethics focuses on the well-being of individual animals, conservation ethics mainly addresses populations, species, and ecosystems. Whether the two fields might better be characterized by their shared concerns, such as habitat destruction, chemical pollutants, and climate change, or rather by their differences has long been discussed (Callicott, 1980; Singer, 1979), and is still controversially discussed, e.g., within compassionate conservation approaches (Coghlan and Cardilini, 2022). However, for this paper, we do not need to take a position on this question. AI for decoding animal communication is used to protect whales. Animal and conservation ethicists (as well as scientists and practitioners in both fields) agree that this is a valuable goal, whether to protect individual whales or whale species.

2. The history of whaling

The process of whaling involves humans hunting whales and has a history that stems back thousands of years (Thornton and Marrero, 2023).[4] Indigenous groups (e.g., the Inuits in the Arctic Ocean, the Basque in the Atlantic Ocean, and the Japanese in the Pacific Ocean) using whales for subsistence were the first known whalers (ibid.). These groups hunted whales for food (e.g., using the whale's meat, skin, fat, and organs), as a source of material goods (e.g., their baleen was used as roofing material and baskets), for cultural reasons (e.g., 'the Japanese considered whales to be manifestations of the god Ebisu, who brings riches from the seas' (Japan Heritage - Living with Whales, 2023), and for religious purposes (e.g., the whale's bones were used for ceremonial masks) (Thornton and Marrero, 2023).

After whaling's early inception within indigenous communities, it eventually became a booming industry in Northern Europe (from the Middle Ages onwards) and North America (from the 18th Century onwards). Hunting whales was a lucrative business in the 19th Century, with whale oil and baleen being valuable commodities for industrial growth in the West. Because of this, new technologies were developed to stun better, harpoon, and carry whales (ibid.). Whaling witnessed its peak by the middle of the 20th Century and, with it, the sharp decline in global whale numbers, with many species of whale being hunted close to extinction.

The massive drop in whale numbers led to the International Whaling Commission in 1946. It sought to control and curb over-whaling in oceans worldwide but was ineffective because of its high whaling quotas. Whale numbers continued declining; by the 1960s, over 700,000 whales were killed annually (Barkham, 2022; Bromley, 2023). Following the dramatic decline in whale numbers, the United States (US) listed eight whale species as endangered in 1970. Eventually, commercial whaling was banned by the International Whaling Commission in 1986 (Bromley, 2023). 'The move is credited with having rescued several species, including humpbacks and fin whales, from extinction' (Kolbert, 2023). For example, blue whales were hunted from 300,000 in the 18th Century to (approximately) 350 whales when the moratorium on whaling was passed (Mustill, 2022, p. 30). Thanks to the whaling moratorium, the blue whale population is now estimated to be 10,000–25,000 (WWF, 2023a).

However, whaling was not wholly outlawed as several countries did not sign up for the moratorium and continue to allow whaling up to this day, such as Norway (for meat) and Japan (purportedly for scientific purposes). While the number of whales still hunted is relatively low compared to before the whaling moratorium, whaling is still impacting the numbers of whales in our oceans, many of whom are listed as at risk of extinction by the International Union for Conservation of Nature (IUCN), and some of which are still being hunted to this day (IUCN, 2022; McLendon, 2022) (see Table 1).

While this table looks bleak, it does not even capture the complete picture as many species of whales were not on the IUCN list because there was insufficient data on their numbers (e.g., omura's whales), there have not been studies on a particular species of whale (e.g., Hubbs', Shepherd's, and Andrew's, beaked whales), or the IUCN list did not evaluate specific subspecies of whales (e.g., the Salish Sea Orcas, of which, there are only around 75 remaining) (David Suzuki Foundation, 2023). The picture is not optimistic for whales classified as 'least concern' (from the IUCN list) either because some species, such as the bowhead whale, only have 10,000 animals left (IUCN, 2022). While the moratorium and whaling policies after that positively affected whale species, whaling still occurs in many places worldwide (see Table 2 Whaling Numbers by Region in 2022 for the whaling numbers from 2022 (International Whaling Commission, 2023).

As seen in this table, whaling still occurs on whale species that are vulnerable or endangered (highlighted in red). These species are being hunted illegally, or countries are manipulating the reasons why they are catching the whales. For example, Japan claims that it is hunting whales for 'research purposes', but the international community questions the validity of this claim because the bodies are subsequently sold as food

Table 1
List of threatened whale species (IUCN, 2022).

Species	Status
North Atlantic Right Whale	Critically endangered
Rice's Whale	Critically endangered
North Pacific Right Whale	Endangered
Sei Whale	Endangered
Blue Whale	Endangered
Western Gray Whale	Endangered
Perrin's Beaked Whale	Endangered
Sperm Whale	Vulnerable
Fin Whale	Vulnerable

[2] The question how AI technologies impact animals, and how AI can be used to increase individual animal welfare is increasingly addressed within AI and animal ethics, cf. Bossert and Hagendorff, 2021; Coghlan and Parker, 2023; Hagendorff et al., 2023; Simoneau-Gilbert and Birch, 2024; Singer and Tse, 2023.

[3] A biologically correct application of the term animals includes humans. Therefore, it is more accurate to speak of 'nonhuman animals' to refer to all other animals except humans. In this paper, for the sake of readability, we use the term 'animals' to refer only to nonhuman animals while acknowledging that it perpetuates an ethically problematic animal-human dualism.

[4] For example, Norwegians and Japanese have been doing it for the past 4000 years.

Table 2
Whaling numbers by region in 2022.

TYPE[5]	NATION	FIN	SPERM	HUMPBACK	SEI	BRYDE'S	MINKE	GRAY	BOWHEAD	TOTAL
AS	St.Vincent & Grenadines	0	0	1	0	0	0	0	0	1
AS	Russia	0	0	0	0	0	0	124	0	124
AS	USA	0	0	0	0	0	0	0	68	68
AS	Denmark	4	0	1	0	0	149	0	1	155
AS	Denmark	0	0	0	0	0	17	0	0	17
WR	Iceland	148	0	0	0	0	0	0	0	148
N	Canada	0	0	0	0	0	0	0	3	3
WO	Norway	0	0	0	0	0	581	0	0	581
C	Japan	0	0	0	0	0	58	0	0	58
C	Japan	0	0	0	25	187	0	0	0	212
Inf	Korea	0	0	0	0	0	5	0	0	5
U	Indonesia	0	18	0	0	0	0	0	0	18
	Total	**152**	**18**	**2**	**25**	**187**	**810**	**124**	**72**	**1390**

The abbreviations stand for: 'AS: Aboriginal subsistence catches; WR: whaling under reservation; N: Non-commercial catches by non-member nations, reported to the IWC; WO: whaling under objection; C: Commercial whaling by non-member nations, reported to the IWC; Inf: Illegal catches by IWC member nations, reported to the infractions sub-committee; U: Unconfirmed reports of catches by non-member nations' (International Whaling Commission, 2023).
(Data from International Whaling Commission, 2023).

(International Whaling Commission, 2023; WDC, 2018).

While the moratorium on whaling has helped prevent the extinction of several whale species, many other practices have stunted (or reduced) the rebound of whale numbers. Currently, whaling is not the biggest culprit that impacts the numbers and well-being of whales. Nowadays, there are many threats to whales, such as whaling, entanglement in nets (bycatch), climate change, ship strikes, toxic contamination and pollution, oil and gas development, noise, and habitat degradation (Avila et al., 2018; Department of Conservation, New Zealand, 2023; Farmer et al., 2018; Hawaiian Islands Humpback Whale National Marine Sanctuary, 2023; IFAW, 2023; Majestic Whale Encounters, 2021; WWF, 2023b).

Most of these are caused by human practices and can be reverted through more responsible behaviour toward whales and the world's oceans. While many efforts are being put into whale conservation, there is still significant room for improvement. One possible addition to the arsenal of whale conservationists is technologies equipped with artificial intelligence. AI offers a way to provide new insights and recommendations to protect whale species. For example, researchers have been using AI to analyse whale vocalisation to understand better whales, their culture, travel patterns, and well-being.

3. The use of AI to decode whale vocalisation

Scientists have used natural language processing (NLP) to translate *human* languages for decades (Jiang and Lu, 2020). They achieve this by integrating computer programs with bilingual dictionaries, grammar rules, and clear instructions on processing commands. Considerable advancement in the area came in 2017 when researchers developed a way to translate between two human languages without being trained in bilingual texts or using the dictionary-like approach of Google Translate (Bromley, 2023). Instead, these researchers programmed AI to use language as simple geometric shapes and identified where and when these shapes overlapped with a comparable language (Bromley, 2023). Unsupervised machine translation was used to decode human language without any reference point or instructions of what this language means (Jiang and Lu, 2020; Mustill, 2022).

Of course, this opens up the possibility that it could do something similar with animal vocalisation, identifying their sounds, pitches, and patterns to determine what this could mean in human language. However, it worked so well for human language because all human language is essentially structured, perceived, and communicated similarly. The difference between human and animal communication is that there are no direct and comparable semantics in the same way as human speech between languages. Human beings in different parts perceive the world with the same basic technical architecture (through the human senses). Human languages typically have syntax and grammar, and we communicate those differently depending on the language we speak: 'Because the same things are possible in these distant human worlds, their languages have ended up with a similar relational structure, allowing us to translate Swahili to Mongolian' (Mustill, 2022, p. 176).

A significant difference in animal vocalisations (e.g., whales) is that they have very different experiences and life worlds from humans (much more so than differences found between different human cultures) and presumably have very different communication patterns, understandings, and relationships. Despite this, attempting to identify patterns within whale vocalisations may still offer much promise to understanding whales better, providing greater clarity on their lives, and advancing these tools for use with other animals in the future (Andreas et al., 2021, 2022). Within the field of whale vocalisations, there are several small projects around the world looking at different species of whales. The following sub-sections will provide an overview of research on humpback and sperm whales' vocalisations.

3.1. Humpback whale vocalisations research

Even in the early days of humpback whale vocalisation studies, Roger Payne noticed that humpback whales were repeating themselves and had six specific themes in their vocalisation (he classified this as A, B, C, D, E, and F; see (R. S. Payne and McVay, 1971). The whales would go through different cycles in a sequence that resembles a song. Since the early days of humpback whale research, AI has revolutionised researchers' ability to record, listen to, and document whale vocalisations.

For example, a team of conservation scientists (the Sound Science Collective – SSRC)[5] are developing a catalogue of the sounds that humpback whales make (their 'chirps, shrieks, and groans') (Bromley, 2023). SSRC has documented many different sounds that humpbacks make, but there is one sound that is used by all of these whales, which is a kind of belly rumble in a 'whup' sound, which scientists believe is utilised as a way to announce their presence (Bromley, 2023). As a test, scientists used recordings of these whup sounds and played them back to whales in Alaska's Frederick Sound to evaluate their reactions. They received whup sounds back from the whales and interpreted this as a form of two-way communication to announce their presence (Bromley, 2023).

Another project, The Earth Species Project (Rutz et al., 2023), is also researching AI and whale vocalisation (for example, they have already developed a model that can accurately sort beluga whale calls (Bromley, 2023)). They have compiled hundreds of hours of humpback whale recordings (six years of recordings) from the coast of Monterey Bay (Mustill, 2022, p. 170). The project aims to catalogue these whup sounds and, through the help of AI, create a synthetic whup: 'It may soon be possible, for example, to prompt an AI with a whup and have it continue a conversation in Humpback—without human observers knowing what either the machine or the whale is saying' (Bromley, 2023).

Despite this, the Earth Species Project claims that they are more focused on knowledge generation at this point, rather than communicating with whales simply for the sake of it (Bromley, 2023): 'Felix Effenberger, a senior AI research adviser for Earth Species, told me: "I don't believe that we will have an English-Dolphin translator, okay? Where you put English into your smartphone, and then it makes dolphin sounds and the dolphin goes off and fetches you some sea urchin. The goal is to first discover basic patterns of communication."' (Bromley, 2023).

The Earth Species Project use different machine-learning methods to decode animal vocalisations, such as supervised learning to predict human-labelled signal types, unsupervised and self-supervised learning to discover signal language repertoires, and self-supervised deep-learning methods as a basis for foundational models that do not require annotated datasets or predefined features (Rutz et al., 2023). Other projects analysing humpback whale vocalisations, such as Whale-SETI, use similar AI tools trained on vast quantities of whale recordings to identify patterns and sequences in these vocalisations (McCowan et al., 2023; Ralls, 2024).

3.2. Sperm whale vocalisations research

A project that is researching sperm whale vocalisation is the Cetacean Translation Initiative (CETI). CETI aims to have a two-way communication of ideas and experiences with a whale by 2026 (Barkham, 2022). This project focuses on sperm whales, who have the largest brains of all living animals and live in female-dominated groups (Welch, 2021). Sperm whales make clicking sounds used in specific and repeated patterns called 'codas': 'A coda is a sequence of clicks. They [sperm whales] send these out in bursts in many directions. The pattern of the clicks and gaps is thought to carry information in a sort of Morse code fashion. In one sperm whale community studied, over seventy different coda types were found' (Mustill, 2022, p. 66).

These codas are exchanged between whales and are understood to have some communicative purpose (Kolbert, 2023; Oliveira et al., 2013). Different clans of sperm whales have different types of codas (akin to varying dialects in human speech) (Jacobs et al., 2024; Welch, 2021). The whales that CETI is analysing off the coast of Dominica have 25 codas distinct from one another because of the number of their clicks and rhythms:

> The coda known as three regular, or 3R, for example, consists of three clicks issued at equal intervals. The coda 7R consists of seven evenly spaced clicks. In seven increasing, or 7I, by contrast, the interval between the clicks grows longer; it's about five-hundredths of a second between the first two clicks, and between the last two it's twice that long. In four decreasing, or 4D, there's a fifth of a second between the first two clicks and only a tenth of a second between the last two. Then, there are syncopated codas. The coda most frequently issued by members of Unit R, which has been dubbed 1 + 1 + 3, has a cha-cha-esque rhythm and might be rendered in English as click … click … click-click-click'.
>
> (Kolbert, 2023)

However, researchers are still limited in comprehending what these different codas represent. Despite only 25 distinctive coda, there may be undiscovered differences in the pace or pitch of these coda (Kolbert, 2023). There are also notable challenges that different sperm whale pods have different sets of coda, and baby whales communicate coda differently: 'Whales in the eastern Pacific exchange one set of codas, those in the eastern Caribbean another, and those in the South Atlantic yet another. Baby sperm whales pick up the codas exchanged by their relatives, and before they can click them out proficiently they "babble."' (Ibid.).

The CETI team have collected recordings of 100,000 clicks, but they estimate that they need around four billion clicks to meet its target of understanding whale vocalisations (Kolbert, 2023). To achieve this, CETI is also planning to embed three listening stations in the Caribbean Sea, which can capture whale codas 12 miles from the shore (Kolbert, 2023). Some of these listening stations are buoys with several hydrophones attached to the bottom with cables and old train wheels to anchor them to the seabed (Kolbert, 2023). CETI also deploy drones with hydrophones, whale tags, and robotic fish to retrieve the coda data from whales (Barkham, 2022).

After collecting the data, they used several AI-driven methods to decode the sperm whale coda. For example, 'one deep network approach takes random stabs at outlining a system of rules for language. Then it checks to see if "units" of conversation meet those rules. If they don't, it makes tweaks and tries again. Computers perform "this process of tweaking-and-validating rules very quickly, repeating it thousands or millions of times to produce a set of rules that do a good job of explaining data," Andreas says' (Welch, 2021).

Project CETI uses these deep neural networks to uncover patterns in the codas and clicks of sperm whales they are analysing. They also point to progress in NLP (discussed earlier) for unsupervised grammar induction (Kim et al., 2020), which they propose holds significant potential for decoding whale vocalisations (Andreas et al., 2021, 2022). Once their database of whale coda increases, they aim to apply NLP methods to ground minimal units (morphemes) with specific hierarchical structures to identify interpretation rules and meaning in these vocalisations (Andreas et al., 2021, 2022).

4. Challenges of using AI to decode whale vocalisation

Many technical challenges underpin the effectiveness of decoding whale vocalisations, which also has an ethical impact if used in misleading, incorrect, or harmful ways. The following subsections will illustrate this, as many of the discussed ethical challenges are grounded in questionable science.

4.1. Anthropomorphism

While AI is being used to decode whale vocalisations, the accuracy and effectiveness of this decoding are still unclear. Whale vocalisation is used for many reasons, including echolocation, sensation, and

[5] https://soundsciencecollective.org/

communication. For example, sperm whales, which the CETI project is analysing, have snouts and are utilised for sound, perception, and communication. They use sound 'to communicate via vocalizations and to sense its surroundings by firing sonic clicks ahead of it and listening to the returning echoes' (Mustill, 2022, pp. 62–63). Therefore, deciphering these vocalisations' specific meaning or translation to human communication is challenging:

> Machine translation is possible for humans in part because word associations are usually similar across languages; "moon" and "sky" relate to each other the same way as the French words "lune" and "ciel." "With whales, the big question is whether any of this stuff is even present," says Jacob Andreas, a natural language processing expert at MIT and a Project CETI team member. "Are there minimal units inside this communication system that behave like language, and are there rules for putting them together?".
>
> (Welch, 2021)

In addition, whale communication may be done verbally and through gestures and movements (Bromley, 2023). One of the most significant opportunities to untangle what these whale vocalisations could mean is to correlate the vocalisations to the behaviours and actions of the whale (Mustill, 2022). However, the behaviours and movements of whales are even more opaque than their vocalisations. Furthermore, whale vocalisation may not have the same importance for whale communication, interaction, behaviour, and socialisation as we would associate it with human language. Because of these many challenges and inconsistencies, attaching meaning and translation to human language may be a form of anthropomorphising whale vocalisations.

> Anthropomorphism comes in many shapes and forms. It ranges from the naive projection of human experience onto other species to serious attempts to understand animals on their own terms through intimate familiarity with their behaviour and Umwelt.
>
> (De Waal, 1999, pp. 273–274)

This is relevant for scientists decoding whale vocalisations and should be a warning not to fall victim to anthropomorphising their findings. Indeed, their research may conclude that there is no strong correlation between whale vocalisations and human language at all:

> There may be no similarities in the patterns of relationships between the units of humpback whale-speak and those of English, but knowing this would still be illuminating. Discovering rich, complex structures and relationships within nonhuman communication systems that bear no resemblance to those in human language would be a revelation in itself; hinting at parallel animal worldviews that we could explore.
>
> (Mustill, 2022, p. 176)

Therefore, the science in this field may conclude that the differences are so significant that one cannot truly compare whale vocalisations with human language. Researchers may emphasise the importance of not making this comparison, thus effectively reducing inappropriate anthropomorphisms. For example, Michelle Fournet argues that when humans see a humpback whale waving one of their fins, we could anthropomorphise this to mean they are waving or saying hello, when in reality, it may mean they are acting aggressively (Welch, 2021). There is the potential that AI could remove these human biases from understanding what whales may be communicating rather than us inferring similar messages from human communication.

In addition, this field of research is also wholly transforming how scientific research has traditionally been conducted toward animals (which was heavily anthropomorphic and anthropocentric). In the past, scientists would typically try to train animals to speak to humans, use human signs and words, and humanly understandable objects and methods (Pepperberg, 2006, 2012; Pepperberg & Gibson, 2008; Savage-Rumbaugh et al., 1978) rather than trying to understand the animal through their species vocalisations. Through AI, humans are finally trying to comprehend the species-specific language of other animals instead of always trying to make different animals speak human language. Regarding human-animal relations, we are now listening to the other in their language (so to speak) rather than trying to force them to adapt to us or our language.

4.2. *Privacy rights*

Despite the efforts to listen to other species in their language, some claim that we do not have the right to listen in on whales in the first place: 'Still, there are some ethical questions to consider, like do we have the right to eavesdrop on animals without their consent?' (Yalcinkaya, 2023). This question stems from animal ethics concerning individual animals' well-being and potential rights. The question of privacy rights is important for animal ethics but less so for conservation ethics, which is more concerned about species protection than animal welfare. Species cannot be seen as having a meaningful right to privacy.

In law, privacy is considered a fundamental human right (it is protected by the Universal Declaration of Human Rights (Article 12), the European Convention on Human Rights (Article 8), and the European Charter of Fundamental Rights (Article 7)). Privacy for human beings is entrenched in law, and some are critical as to why this right is not extended to animals as well (Mills, 2010). Several researchers claim that animals, like humans, should have a right to privacy (Haratym, 2017; Mills, 2010; Paci et al., 2022; Pepper, 2020).

One of the theoretical bases for privacy law is that (human) individuals should have the right to keep their personal matters and relationships secret and be free from illegitimate observation and disturbance from others. The right to privacy grants individuals control over 'how we present ourselves to others' (Pepper, 2020, p. 629). How we present ourselves to others is often based upon five key areas: 'personal relationships, personal space, tactical deception, eavesdropping and our interest in belongings, homes, and territory', which some claim are also applicable to sentient animals (Pepper, 2020, p. 629). Pepper (2020) engages with empirical research on animal behaviour and psychology to demonstrate that animals' interest in controlling how they present themselves to others is demonstrated through these five key areas, necessitating their need for privacy.

To grant privacy rights to humans while claiming animals should not have such rights amounts to a form of 'speciesism' (Horta, 2010), which is 'a prejudice or attitude of bias in favour of the interests of members of one's own species and against those of members of other species' (Singer, 1990, p. 6). Granting privacy rights to humans but not other animals with similar capacities or needs as those used to justify privacy rights to humans is a case of speciesism. This is a critical claim against AI because it interferes with whales' privacy rights.

However, not enough research has been done on whale species to fundamentally understand how these five reasons underpin the need for human privacy compared to whales; hence, one could argue the need to study them more, which using AI to decode their vocalisations may be a hugely helpful tool for understanding them. In response to the five reasons outlined by Pepper (2020), it would appear that whales' relationships (aspect 1) and habitats (aspect 5) are (relatively) uninterrupted when retrieving and analysing data from their vocalisations (although there may be reasons for challenging this in the case where researchers try to communicate with whales, which will be discussed in the next section). In response to the three other aspects, there is no clear indication that whales hide their vocalisations in the sea for fear of eavesdroppers (aspect 4) or implement tactical deception to ensure their privacy (aspect 3). There is also no forced intimacy or infringement on their personal space when collecting this data (aspect 2), as were the extreme cases of animal farming and zoos (cf. Coghlan et al., 2021; Simoneau-Gilbert and Birch, 2024 for ethical aspects of using AI in these areas).

Therefore, the question of whether and how the use of AI for decoding whale vocalisations conflicts with whales' privacy needs much more investigation, except for the obvious cases where these applications cause some kind of harm to whales, which will be the focus of the following section.

4.3. Emotional and cultural harm

Humpback whales live in around a dozen populations around the globe, and these groups feed and breed in certain seas worldwide (Mustill, 2022, p. 25). At the start of a breeding season, the humpback whales seem to sing different songs, which appear to 'coalesce into a single, coherent song that is quite accurately repeated. These songs evolve continuously, each one changed from that of the previous year, until after a few years it would become entirely different' (Mustill, 2022, p. 25). Some whale populations carry certain songs to different seas where the songs are picked up by, or certain aspects are copied by, other whale populations. Not only are humpback whales' songs changing, but they are influenced and altered by interactions with whales from other seas.

In addition, within a particular ocean basin, many whale species do not communicate in the same manner, with each population possessing their specific dialect (Mustill, 2022, p. 69). Sperm whales also hunt, raise their young, and behave differently from other sperm whale clans (Mustill, 2022, p. 69). These clans do not appear to intermingle very much with other sperm whale clans. They may be unable to communicate with one another, as they have different dialects and codas (Mustill, 2022, p. 69). Many scientists believe other whale clans possess unique cultures to that clan, which adds to the complexity of inferring a general meaning from one particular sample group to sperm whales more generally (Mustill, 2022, p. 69). As a result, playing back whale or AI-whale-generated vocalisations from one clan could dramatically impact the songs, cultures, and way of life of other clans and whale species as a whole (Rutz et al., 2023):

> Rutz cites as an example the new songs composed each year by humpback whales that spread across the world like hit singles. Should these whales pick up on an AI-generated phrase and incorporate that into their routine, humans would be altering a million-year-old culture.
>
> (Bromley, 2023)

Therefore, altering whales' songs may dramatically affect whale culture. We do not know what changes in these songs, mainly caused by an artificially generated sound, could do to individual whales, pods, and whale species (Rutz et al., 2023). 'These sounds are thought to be the glue that holds their cooperative lives together—vital in keeping close, hunting, navigating, mating, and protecting one another' (Mustill, 2022, p. 66). Thus, causing changes to these sounds could impact how they hunt, their culture and relationships, and how they navigate, mate, and protect one another. Human tampering could have dramatic and fundamental consequences on whales.

Adding to this, the desire to randomly send out whale vocalisation playbacks or create AI whale vocalisations into the oceans appears irresponsible. While it may be beneficial for scientific purposes, there is still a lack of understanding of what these vocalisations mean and what kind of repercussions trying to communicate with whales will have. There is the potential that these vocalisations may disturb or disrupt the whale's navigation or cause distress, which could have devastating effects on the health, well-being, and survival of individual whales, their pods, and as a result, the conservation of whale species as a whole. Also, sending out confusing digital whale vocalisations may affect their sonar or even send them to their death (e.g., they swim in a different direction from their pod or stranded).

While these are very worrying concerns, they appear to be attached to this technology's specific application: sending vocalisations to whales for two-way communication. However, there are many uses of AI to analyse whale vocalisations without necessarily trying to communicate back to whales. For example, researchers are using Google's AI TensorFlow and feeding it with large databases of whale sounds to teach it to identify whale calls with an accuracy of 98 % (Google, 2023): 'The model can differentiate between a blue whale and a fin whale, help confirm what time of day each call happened, how loud it was, and how long it lasted' (Google, 2023). This tool can help conservation efforts by identifying and preventing stranding of whales before it occurs, keeping track of whale numbers, and identifying migration patterns, thereby also benefitting individual whales' well-being.

A similar tool is already being used to help save whales' cetacean relative, the dolphin. Dolphins can become stranded, disorientated, swim onto shore, and die. AI offers the potential to predict this before it occurs. Dolphins have specific whistles that are emitted more when they are distressed, and if we can train machines to listen out for these whistles, there is the potential to alert rescuers to reroute dolphins before they end up on shore (Bromley, 2023). In addition, testing is underway in the Salish Sea, where 'there is an alert system, built by Google AI, that listens for resident killer whales and diverts ships out of their way' (Bromley, 2023).

Therefore, the criticism that using AI to decode whale vocalisations will cause harm to whales is mainly directed toward using this technology to communicate with whales (and not so to its use to understand what whales are vocalising). If it is used to decode, understand, and protect whales, then there are strong conservation reasons to adopt such technologies. However, the main issues only arise when scientists attempt to send back whale vocalisations to form some two-way communication or interaction with whales do these issues arise.

4.4. Technological solutionism

There is an ethical concern that using AI to decode whale vocalisation to improve and encourage whale conservation is simply trying to mend a situation caused by humans with more interference and tampering. Using AI to decode whale vocalisations may be just another form of technological solutionism or technofixing (i.e., attempts to solve humanly caused problems with high-tech digital solutions (see Morozov, 2013; Ryan et al., 2019; Ryan and Blok, 2023)). While there is substantial disagreement within the conservation – as well as animal ethics – community on how much human interference should be allowed within conservation practices (Keulartz, 2016; Sandbrook et al., 2019), using AI to decode whale vocalisations to protect them may perpetuate problematic patterns of human behaviour and an attitude that all problems can be solved using technology. Instead of using AI to decode whale vocalisations as an approach to whale conservation, human behaviour should change, and comprehensive policy reform should be implemented to protect whales (even more stringently than the ones currently in place).

We accept that using AI to decode whale vocalisation could be seen as a form of technological solutionism. However, many threats to whales are caused by challenging, intersected, multi-level activities, where no easy solutions are often available. In the past, the most prevalent concern for whale conservation was preventing the hunting and killing of whales. Nowadays, whale threats include bycatch, ship strikes, oil and gas development, noise, and habitat degradation.

While conservationists and animal rights organisations are trying to respond to these threats, there are often no simple solutions because of the deep-rooted economic and political interests in many of these activities. The only way to prevent these threats outright involves dramatic steps such as stopping using fishing nets (bycatch), removing large ships from the sea (ship strikes), eliminating oil and gas development (offshore), and removing all human activity that causes noise and habitat degradation in the oceans.

In an ideal world, we could find alternatives to many of these activities, develop economic systems that were not based and deeply dependent upon globalisation, oil, and gas, and create a deeply respectful relationship with the non-human world. These grand ambitions are admirable and should be encouraged, but they are things that cannot be implemented overnight. In the meantime, whale conservationists are still faced with pragmatically addressing these challenges in the here and now.

Using AI to decode whale vocalisation may improve our scientific understanding of whales and determine their routes and travel patterns. This could help prevent netting and ship collisions, pre-empt when whales are off-course and stop them from washing up on shore, and identify possible distress calls when they are being illegally whaled (and arrest the whalers). Therefore, using AI to decode whale vocalisations is meant as only one (of many) technique and approaches in the arsenal of whale conservationists to protect whales from ship strikes, bycatch, and stranding, and also, at the same time, trying to build awareness, care, and compassion for whales. AI offers a way to provide new insights and recommendations to protect whale species in the here and now while also building and developing conservation efforts and care among citizens and policymakers.

4.5. Ineffectiveness for whale conservation

One of the reasons for using AI to decode whale vocalisations is the aspiration that 'AI will help scientists hear what their ears alone cannot: that animals speak meaningfully, and in more ways than we can imagine', and to demonstrate to the world that 'their abilities, and their lives, are not less than ours' (Bromley, 2023). This research will stir concern, understanding, and empathy toward whales and initiate policy change and action to protect them. However, a criticism against using AI to decode whale vocalisations is that it will be ineffective in convincing humans to change their behaviour or encourage policy change.

One can draw similarities between the work of Roger Payne and his recordings of humpback whale vocalisations. In the 1970s, Roger Payne released an album of humpback whale recordings called *Songs of the Humpback Whale*. This album sold 125,000 copies and was monumental in spawning the 'Save the Whales' movement. Roger played the recordings to the US Department of the Interior, which led to the creation of the Marine Mammal Protection Act in 1972 and the Endangered Species Act in 1973 (Barkham, 2022; Bromley, 2023; Yalcinkaya, 2023).[6]

Payne did not know what the vocalisations meant in the whale recordings (R. S. Payne and McVay, 1971), but the sheer fact that they 'sang' demonstrated enough reason to warrant their protection (Mustill, 2022, p. 29). At the time, Payne thought, '*This will speak to the world as no other voice has ever spoken to the world*' (R. Payne, 2022). Roger Payne used these recordings to communicate the significance of whales to the world and released the album of whale sounds to bring attention to humpback whales and create care for and policy to protect them. His goal was to show the intelligence and beauty of whales in the hope that this would stir global concern for them, leading to their protection.

According to Payne and studies from psychology (Pham, 2007) and philosophy (Lance and Tanesini, 2004), humans do not respond to data alone. They react with their emotions, and it is only through demonstrating such creatures' beautiful and fascinating nature that there would be a public concern and a call for action to protect them (Bromley, 2023). Payne's efforts contributed to the United Nations (UN) Conference on the Human Environment (1972) and a ten-year international moratorium on whaling.

While these recordings helped the 'Save the Whale' movement and increased concern for whales on a global level, a sceptic may point out that it still did not create enough concern in some countries to prohibit whaling outright. There are calls to revert the moratorium and allow for increased levels of whaling again (ABC News, 2000). This has also been reflected in a number of countries: Japan has called for the ban on commercial whaling to be lifted (McCurry and Readfearn, 2018), Iceland has recently declined to ban whaling (again) (Misher, 2023) and the self-imposed whale hunting quota in Norway increased from 1000 in 2023 to 1157 in 2024 (Whale and Dolphin Conservation, 2022).

Therefore, in a similar way that Payne's whale recordings were not wholly successful in preventing all whaling, we should not assume that more knowledge and data retrieved by using AI to decode whale vocalisations will necessarily increase concern or initiate conservation efforts toward them. However, it is unquestionable that Payne's recordings greatly impacted the whale conservation movement – which, one can hope, using AI to decode whale vocalisations will also do. These recordings contributed to the moratorium on whaling. Similarly, AI could be used to decode whale vocalisations to increase concern for whales and improve whale conservation. As David Gruber from Project CETI comments: '"We're also looking into the policy ramifications of understanding what they're saying, [and] we'll be able to hopefully draft better legislation that could protect the sperm whales from our adverse effects"' (Yalcinkaya, 2023).

Like Roger Payne's recordings helped initiate policy change and a moratorium on whaling, using AI to decode whale vocalisations could lead to substantial revisions in whale conservation policy. Apart from the immediate impact on whale conservation, using AI in such a way could lead to an entire paradigm shift in how we view, interact, and respond to the natural world. By using AI to understand other animals and species, we are provided glimpses into their life worlds, building a greater scientific and empathetic understanding of the world around us. While much research has been conducted into animals and their interactions, communications, and social lives, directly understanding vocalisation patterns and what these may mean would be a huge step forward in understanding other species.

4.6. Gender bias

Scientists have traditionally assumed that male humpback whales make the songs they hear in the ocean (Smith et al., 2008). However, this is only an assumption and may not be accurate (Mustill, 2022, p. 151). Furthermore, this has led some to speculate about 'how the loudest whale sounds tended to be made by the males but the most cooperative, long-lasting sociable groups of cetaceans tended to be female' (Mustill, 2022, p. 151).

This point relates to an ethical challenge that broadly refers to research on whale vocalisation and scientific research in general. Conservation science and theory, as every theory, is still in many regards – directly or indirectly – building upon patriarchal thought patterns (Bossert et al., 2024), attributing specific characteristics mainly to male animals (e.g., strength and aggressiveness) and others predominantly to female animals (e.g., care and softness). While the scientific validity of such attributions needs to be clarified from case to case, in some cases it may not reveal valid scientific results but a gendered stereotype researchers have internalized (Bossert et al., 2024).

In the case of studying whale vocalisation, this could lead to a biased perspective on which whale gender performs what kind of vocalisation, thereby potentially distorting research results. If, on the other side, AI-enabled research on whale vocalisation reveals that, e.g., male whales do not sing louder or more intense than females, such research is accompanied by the potential to overcome internalized gender biases in conservation or animal welfare research (which is reasonable to strive for, cf. Bossert et al., 2024). However, as with the call for privacy rights for animals, this issue plays a more important role within animal agriculture than for whale conservation, as there are many gendered applications for farmed animals (Eaton et al., 1996). In the context we focus on here, the most important aspects are a) scientific accuracy, including the avoidance of transferring internalized gender biases to

[6] Parts of the album were also printed as a flexi disk in 1979 and given away free with copies of National Geographic to raise further awareness about whales and the need to end whaling. In 1977, Payne released a follow-up album, Deep Voices - The Second Whale Record, containing recordings from blue and right whales.

animals. This is closely related to anthropomorphism, as discussed above (4.1).

5. Conclusion

This paper highlights that developing and using AI to decode whale vocalisations presents several ethical challenges. We addressed six challenges: anthropomorphism, privacy rights, emotional and cultural harm, technological solutionism, ineffectiveness as a means for whale conservation, and the risk of projecting biases onto other species.

We support the idea that anthropomorphism can be harmful and that, in many instances, it should be avoided and prevented. However, we establish that AI may be used to find patterns and ways to decode whale vocalisations in a way that avoids many of the biases and anthropomorphisms inflected by humans. However, we also emphasised a need to implement stringent scientific procedures to avoid anthropomorphic interpretations when analysing findings using AI to decode whale vocalisations.

We concluded that advocating for whales' privacy rights is not (yet) a strong argument in the context of using AI to decode whale vocalisations. There is insufficient evidence that retrieving and analysing whale vocalisations harms individuals or whale species. The comparisons often used (farm animals and zoo animals) are laden with many ethical issues, and privacy harms are much more evident than those caused to whales by using such technologies. However, further evidence may be provided to justify how using AI to decode whale vocalisations can harm privacy.

Thirdly, we propose that there is an evident concern about how AI is used to decode whale vocalisations in the context of the cultural and emotional harm it causes. However, this is only potentially problematic if scientists attempt to communicate with whales through whale vocalisation recordings or AI-generated whale vocalisations. It is currently unclear what type of impact this will have on whales' navigation abilities, well-being, culture, and movements, so this is a somewhat dubious use of AI without any clear benefits to whale conservation (apart from being scientifically exciting and potentially useful in the future).

Fourthly, technological solutionism may be applicable if AI's ability to decode whale vocalisation is the best and most effective way to solve whale conservation issues. This is not the case. Most people using AI for this purpose treat AI as another way to help them address many of the welfare and conservation challenges. However, other measures also need to be applied, such as increasing public concern for whales, developing nets so that whales will not become entangled, and identifying ways for ships to avoid hitting whales. AI will help to avoid many of the current harms toward whales, but it is not the only or most important solution.

Lastly, we demonstrated that Roger Payne's research and demonstrations of whale vocalisations previously caused enough concern for the protection of whales; the use of AI to decode whale vocalisations may offer some of the same benefits to encouraging public concern and policy to protect whales. However, we believe that a bigger obstacle is the lack of resources available to develop AI whale decoding projects, with many being funded by independent philanthropists or individuals interested in animal conservation causes. In a world where there is so much money being pumped into developing AI algorithms for increasing profits, growing businesses, and optimising advertising (Brevini, 2021) More money should be dedicated to helping us better understand the non-human world and the care and conservation of (individuals of) other species. Unfortunately, this lack of investment in decoding whale vocalisations is due to the lack of profitability/payoff for such investments. Using AI to decode whale vocalisations will remain dependent upon governmental funding and investments from philanthropists and conservation agencies despite the scientific importance and potential for breakthroughs of such research.

So, while using these technologies offers benefits and drawbacks, we should remain open to the potential and possibilities that AI will bring while being stringent to ensure it reconnects us with other animals, improves species conservation, and improves our relationship with nature. Regarding this, we share a hope with Tom Mustill (2022). We hope that 'people will learn that there are still many things we don't understand about how animals communicate, that technology is not always bad for nature and that some of these tools can help us heal our broken relationship with other living creatures'. While many research gaps need to be filled, we call for the accompaniment of such investigations by ethical research so that the challenges discussed in this paper are addressed and 'conservation AI' and 'animal welfare AI' happen responsibly.

Author statement

We the undersigned declare that this manuscript is original, has not been published before and is not currently being considered for publication elsewhere. We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us. We understand that the Corresponding Author is the sole contact for the Editorial process. He/she is responsible for communicating with the other authors about progress, submissions of revisions and final approval of proofs Signed by all authors as follows:

Mark Ryan and Leonie Bossert

CRediT authorship contribution statement

Mark Ryan: Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Leonie N. Bossert:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis.

Declaration of competing interest

N/A

Data availability

No data was used for the research described in the article.

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