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RESEARCH ARTICLE

Not Relational Enough? Towards an Eco-Relational Approach in Robot Ethics

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Abstract

With robots increasingly integrated into various areas of life, the question of relationships with them is gaining prominence. Are friendship and partnership with robots possible? While there is already extensive research on relationships with robots, this article critically examines whether the relationship with non-human entities is sufficiently explored on a deeper level, especially in terms of ethical concepts such as autonomy, agency, and responsibility. In robot ethics, ethical concepts and considerations often presuppose properties such as consciousness, sentience, and intelligence, which are exclusively aligned with humans. I will challenge the understanding of these properties by anchoring them in contexts, bodies, and actions. This approach allows to consider the specific ways of being of various human and non-human entities and to identify these properties in non-human entities as well. My "eco-relational" approach posits that it is crucial to consider the relationality with non-human entities such as animals and technology in central ethical concepts from the beginning. This approach reflects the "eco", the entire house in which we live including animals and robots. To support this, I examine two dominant approaches in robot ethics within the contemporary Western tradition: the "properties approach" and modestly relational approaches. I will develop an eco-relational approach as an alternative. Employing a phenomenological method, I will demonstrate through various examples that our properties and actions are inherently connected with non-human entities. I will show that robots play a central role in our properties and actions, leading to concepts such as hybrid actions and non-human agency. It becomes clear that technology and our relationships with it disrupt traditional ethical concepts.

Keywords Robot Ethics · Social Robots · Relational · Properties · Non-human · Ethical Concepts

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1 Introduction

With the increasing implementation of robots in various areas of life, the question of relationships with robots becomes more significant. Can robots be good colleagues at work? Are friendship and partnership with robots possible? In robot ethics, there is already extensive research on collegial relationships, friendship, partnership, and sex with robots (Frank & Nyholm, 2017; Nyholm & Frank, 2017; Danaher & McArthur, 2017; Danaher, 2019; Dörrenbächer et al., 2022; Haberland et al., 2022; Lin et al., 2017; Nyholm & Smids, 2020). A dominant debate in robot ethics is the robot rights debate, which questions whether robots can and should have rights (Gunkel, 2018a; Gunkel, 2018b; Coeckelbergh 2010; Nyholm, 2023). Thus, it becomes evident that in robot ethics, relationships with robots are being investigated and there is an ethical relevance to relationships with robots.

Although relationality with robots is deemed important in robot ethics, non-human entities like robots and our relationships with them are still inadequately considered on a deeper level, or so I will argue. Environmental ethics, along with long-standing African and East Asian approaches, explore relationships with non-humans on a deeper level, something that has been largely neglected in robot ethics so far. In robot ethics, the way we think about ethical concepts such as autonomy, responsibility, and agency, or how we morally engage with robots, is still based on properties like consciousness and intelligence, which are attributed solely to humans.

For this purpose, I examine two dominant approaches in contemporary Western tradition in robot ethics: the "properties approach" (Coeckelbergh 2012) and modestly relational approaches. Both take human properties as a starting point. I will challenge the perspectives on properties and human–robot interaction. Do we really care about properties like consciousness if we cannot even detect their presence? How can it be that we think of properties independently from the multiplicity of human and non-human bodies and ways of life? Can we still maintain that humans are the only actors in human–robot interaction? Investigating these two approaches, I will demonstrate that our properties and actions are inherently connected with non-human entities and that this has significant implications for our ethics, which have been neglected so far. Taking non-human entities and our relationship with them seriously in our properties and actions, leads to a disruption of traditional ethical concepts, that are based on exclusively human properties.

Therefore, in this article, I will critically challenge whether robot ethics is relational enough. My thesis is that in robot ethics, it is crucial to consider relationality to non-human entities such as animals and technology in central ethical concepts from the outset. I refer to this relational approach as "eco-relational".[1] This approach integrates our relationships with animals, robots, and other non-human entities into robot ethics and reflects in ethics the "eco" (from the Greek οἶκος: house), the entire house in which we live. In contrast to the term "environment" (from the French "environ" in "environnement": to surround), it does not position the human at the

[1] This term is inspired by Mazis (2008), p. 8, 255.

center, with non-humans merely as the surroundings around humans. Although the term "non-human entities" encompasses a wide spectrum of entities, I will primarily focus on animals and robots. Our relationships with animals can provide important insights into our relationships with robots.

After having introduced robot ethics, anthropology of technology, and our relationships with non-human entities in Section 2, I will, in Section 3, present the two dominant approaches in robot ethics that are based on human properties. In Section 4, I will present a relational approach to robot ethics, demonstrating, based on phenomenological research, how deeply our properties, actions, and being are already connected with non-human entities such as animals and robots. In Section 5, I will explore the implications these insights have for robot ethics. Finally, I will end in Section 6 with a conclusion.

2 Anthropology of Technology, Robot Ethics and Our Relationships with Non-Human Entities

2.1 Robot Ethics and Anthropology of Technology

Robot ethics, as a field within the ethics of technology, addresses ethical issues arising from robots. Within this field, ethical concepts like responsibility, autonomy, agency, privacy, safety, and justice are applied to the robotics context, leading to questions such as: Can robots act autonomously? Can robots possess agency? How can equitable access to robots be ensured? There is already a wealth of overview literature on robot ethics (Coeckelbergh, 2022; Lin et al., 2012, 2017; Nyholm, 2020; Nyholm et al., 2023; Van Wynsberghe, 2016). Many of these inquiries focus on the potential capabilities of robots – for example, their capacity for moral judgement, autonomy, and agency – and how humans should behave towards them. A dominant debate in this field concerns whether robots can be both moral agents and moral patients and whether robots can and should have rights (Gunkel, 2018a; Gunkel, 2018b; Coeckelbergh 2010; Nyholm, 2023). In these robot ethics debates, there are two approaches that dominate the current discourse. I will explain these two approaches in Section 3 and refer to them as the "properties approach" and the "as if properties approach".

Another field closely related to the ethics of technology is that of the philosophical *anthropology of technology*. Anthropology of technology reflects on our understanding of humanity within the context of technological advancements. The swift pace of technological progress has rekindled interest in anthropology, sparking numerous inquiries into the understanding of being human (Puzio 2022, 2023). This technological advancement gives rise to several questions: What sets humans apart from technology? What capabilities are unique to humans? Can robots possess consciousness or intelligence? Particularly, humanoid robots prompt us to revisit the foundational question of what it means to be human. Furthermore, the ethics of technology presuppose certain anthropological assumptions, and ethical concepts are based on assumptions about the human condition. This means that, for example, when we speak of autonomy and establish conditions for autonomy, these are inherently shaped by

human characteristics. In the context of robotics, this leads to the conclusion that the conditions for autonomy, as they are currently understood, can be fulfilled only by humans and not by robots. This approach can also be described as "anthropocentric", since it centers on the human.

These anthropological assumptions require more critical engagement. For example, the boundaries between humans, animals, and machines have become increasingly fluid. Donna Haraway (2004a, b) underscores how, towards the end of the twentieth century, the distinctions between humans and animals, living organisms and machines, have become blurred. Abilities such as tool use, intelligence, communication, and social behavior, which were previously considered uniquely human traits, have long been recognised in animals and are now being debated in the context of machines as well. Machines are taking on human tasks, and many human capabilities are being attributed to them.

This fluidity of boundaries between humans, animals, and machines is already exemplified in non-Western approaches such as the sub-Saharan African environmental views of a "web of life" (Behrens 2014; Chemhuru 2019; Dzobo, 2010): All entities are connected and woven into a "web of life". This includes humans and non-humans, and even entities that are not alive themselves, such as rivers (Behrens 2014). These entities are crucial for the life of others and thus are morally considerable (Behrens 2014), or even "are to some extent alive" (Chemhuru 2019). This approach is life-centered and argues "that fullness of life is achieved only in connection, community, the bondedness of all life" (Behrens 2014).

At this juncture, regarding the orientation of ethical concepts exclusively towards humans and thus not towards non-human entities, another aspect comes into play: the relationships we form with non-human entities.

2.2 Relationships with Non-Human Entities

When it comes to relationships with robots, the first thing that often comes to our mind is the lively debate about partnership and intimacy with robots. Will they be our friends? Is love with a robot possible? In fact, there are robots that have been designed specifically for relationships and sex, such as Lovot, Jibo, and Harmony. The conversation is far from superficial: Jecker (2020) argues for sex robots for older people with disabilities, which is related to central human capabilities, and Sparrow (2017) discusses the ethical implications of "rape of robots". Beyond this, there are also "social robots" designed for social interactions in healthcare and education, like DragonBot, NAO, Paro, and Pleo (Ackerman, 2015; Darling, 2021; Leyzberg et al., 2018). For example, the teddy bear-shaped robot Huggable accompanies children during long hospital stays (including times of chemotherapy), playfully assists in administering medications, and makes the hospital experience easier (MIT 2010–2017; Logan et al., 2019; Matheson, 2019). In addition, these social robots have shown promising results in therapy, including cases of autism, enabling interactions that are sometimes unachievable with humans. Kate Darling (2021) demonstrates how individuals with autism, who have not spoken to their psychotherapists even after years of therapy sessions, suddenly begin

to interact with robots. Furthermore, our attachment is not limited to humanoid robots; consider the seemingly impersonal vacuum cleaning robots. They do not bear any human resemblance, yet they are often anthropomorphized and given names as soon as they enter a household, showing the ease with which we form attachments to these non-human helpers (Sung et al., 2007).

The extent to which we can become attached to robots is illustrated by the case of the robotic dog AIBO. When production of spare parts for AIBO was discontinued, the units began to break down over time. Their human owners held funerals for these robotic pets, demonstrating the depth of affection they had developed (Darling, 2021). Similarly, when the company that developed the Jibo robot went bankrupt, it became clear that for many, Jibo had become a companion and family member. Many wrote farewell letters expressing their loss (ibid.). In the military context, despite soldiers recognising packbots as ontologically "just robots", they still mourn their loss as they would fellow soldiers and willingly risk their lives to protect them (Gunkel, 2018b). It has become clear that we form relationships with robots, sometimes even profound ones.

However, the focus of this article will not be on analysing the type of relationship we establish with robots, but rather on challenging whether these relationships are even deeper or more profound than has been previously highlighted in the literature, and on how robots are altering our ethical concepts. As we enter into close relationships with robots, as indicated by the examples above, regardless of how we determine the properties of the entity or classify it ethically, it seems likely that these relationships also affect how we morally engage with these entities. There are already several approaches that consider relationships more heavily in ethics. The trend in research is moving towards "relational approaches". This is first because it is difficult to discern the properties of the various entities and make anthropological assumptions, and second because relationships influence our actions and thus our ethics. Coeckelbergh (2010) talks about a "relational turn" in ethics, and both Coeckelbergh (2010; 2012) and David Gunkel (2012, 2018a, b) point out that it is not merely the properties attributed to robots, such as whether they have consciousness or not, that determine how we interact with them. Rather, it is the relationships we establish with them that are key.

While the deeper consideration of relationships to non-human entities is still in its infancy within anthropology and the ethics of technology, in environmental ethics, the interconnectedness between humans and non-human entities has long been emphasised, and criticism of anthropocentrism has been voiced (Light, 2001). The relationship with animals can be well paralleled to the relationship with robots, as has been done thoroughly in research (Darling, 2021). Firstly, animals belong to non-human entities with which we have established very close relationships, such as with cats, dogs, and other pets. Secondly, relationships with animals are more tangible and easier for us to understand since we have already built more relationships with animals, and thirdly, there are more empirical studies on relationships with animals, while many people have not yet had contact with robots and robots are still in the early stages of development. Darling (2021) has explored the diverse and profound connections that humans can form with social robots. She posits that these

connections will grow even deeper in the future, mirroring our relationships with pets.

Moreover, longstanding Non-Western approaches, which are often neglected in robot ethics, explore relationships with non-humans (including non-living objects, both natural and artificial) in the manner this paper does, i.e., deeply and from the outset. Consider Ubuntu and sub-Saharan African approaches (Jecker et al., 2022, Wareham, 2020), many of which argue that personhood can also apply to robots and that personhood is not possessed but rather achieved, with relationships (including those with non-humans) playing a significant role (Wareham, 2020). For Japanese approaches, consider, for example, Shinto-inspired techno-animism, which does not separate matter and spirit and has much potential to recognise non-human agencies and to view robots as animated (Jecker et al., 2022; Jensen and Blok, 2013; Kasulis, 2019).

Even as we discuss current relationships with robots, we must not forget the historical context from which robots emerged, serving as the backdrop from which present views of robots in the West evolved. Initially, they were imagined as servants and slaves. The word "robot" was coined by Karel Čapek in his 1920 play "R.U.R.: Rossum's Universal Robots" and derives from the Czech word 'robota', which roughly means 'forced labor' (Nyholm et al., 2023). This is related to the view, still prevalent in Western thought, of technology as instrumental tools (Heidegger, 1977).

In the following, I will attempt to integrate the relationship with non-human entities into robot ethics. To this end, I will first introduce the two dominant approaches in robot ethics that are based on, or oriented towards, human characteristics.

3 Approaches in Robot Ethics That Are Based on Human Properties

In robot ethics, much like in other fields of ethics, fundamental questions arise regarding ethical concepts like autonomy, responsibility, and moral agency. The discussion revolves around questions such as: How can autonomy be preserved in the context of robots and can robots act autonomously? Who is responsible to whom or what, and how? Who or what can act morally? Interestingly, in robot ethics, it becomes apparent that for ethical concepts like autonomy, responsibility, moral agency, or moral status, essentialist characterizations and catalogs of properties are presupposed. Whether one can be fundamentally capable of being responsible, autonomous, or a moral agent is determined by whether someone possesses properties such as consciousness, cognitive capabilities, intelligence, or sentience, all of which have traditionally been attributed only to humans.[2] Different types of ethical arguments can be identified, and I categorise them as follows: (1) the properties approach and (2) modest relational approaches such as the as-if properties approach. The distinction between these two approaches is not always clear-cut.

[2] As mentioned above, attitudes towards animals have already changed in animal and environmental ethics. There are discussions about sentience, intelligence, and consciousness in animals.

3.1 The Properties Approach

First, there is the (1) "properties approach" (Coeckelbergh 2012), which explicitly or implicitly considers ontological properties as prerequisites for ethical concepts such as autonomy, responsibility, and moral agency. These properties (e.g. consciousness, intelligence, mental states, rationality, sentience) are genuinely attributed to humans. There is ongoing discussion about whether robots can also possess these properties.

Kenneth Einar Himma (2009) argues that responsibility and moral agency are based on consciousness, and Singer and Sagan (2009) also link moral status to human-like consciousness (2009). Jaworska and Tannenbaum (2018) outline various approaches to the grounds of moral status and highlight cognitive capabilities as a crucial factor. Robert Sparrow posits that moral status depends on sentience, particularly an entity's capacity to experience suffering (2004). Therefore, utilitarians like Singer argue that we must not only maximize the happiness of humans but also that of animals capable of suffering. Since it is about the capacity to suffer and not about rationality or cognitive ability, animals must be considered just as much as humans. Gibert and Martin (2021) and Johnson and Verdicchio (2018) also highlight sentience: Moral status, according to them, depends on whether the entity has sentience. Jaquet and Cova (2018) assert that consciousness is essential, while Bloom and Harris (2018) emphasise both consciousness and sentience as conditions for moral status.

Even if these properties are not explicitly mentioned, they are implicitly assumed for concepts such as responsibility, autonomy, or moral agency. This becomes particularly evident in contributions dedicated to detailed presentations and systematizations of ethical concepts. For instance, when various concepts of responsibility are systematized and discussed, it is implicitly assumed from the outset that the capacity to bear responsibility fundamentally relies on human characteristics – and can, of course, only be attributed to humans. For instance, in these systematizations and discussions about responsibility, "mental capacities" play a significant role (Vincent, 2011; Poel and Fahlquist, 2012; Matthew Talbert, 2022). Similarly, Joanna J. Bryson argues that moral status is linked to the properties of intelligence and sentience. Bryson (2010) justifies her well-known thesis that "robots should be slaves" and, consequently, should not possess moral agency or moral consideration, even if they might gain such capabilities in the future, by emphasising that robots and their intelligence are created by humans. The properties of intelligence and sentience predominantly serve her argument, and she views biological intelligence as unique.

Gunkel (2018b) has thoroughly criticised the properties approach. For example, within philosophy, there is no consensus on the definition of consciousness, and the same ambiguity applies to other properties like sentience (Gunkel, 2018b). Furthermore, even if one could precisely define these properties, identifying them in others becomes challenging. These properties primarily pertain to inner states of mind, making it difficult to unambiguously determine whether an entity (whether human, animal, or machine) possesses these properties (Gunkel, 2018b). The example of animals illustrates how they were once denied properties such as sentience and cognitive capabilities but are now recognised as having them. In the past, women and slaves were also denied the ability of reasoning.

3.2 Modest Relational Approaches

A second type of approaches are what I call "modest relational approaches" that take relationships more into account and recognise their moral significance. Although there are many, I will focus here on one very influential in robot ethics, advocated by Coeckelbergh and Gunkel, which I refer to as the "as-if properties approach" in the sense of an "appearance-based properties approach". Coeckelbergh (2004) suggests that in our daily interactions with other entities, including humans, we often perceive and engage with them based on how they *appear to us*, rather than based on the ontological properties they actually possess. For instance, we tend to treat certain non-human entities, such as animals or robots, *as if* they have certain mental capabilities, and thus, we interact with them as if they were human (2004). Gunkel and Coeckelbergh employ this approach in numerous of their works, which are considered overview literature for robot ethics (Coeckelbergh, 2022; Gunkel, 2012, 2018a), thus making the approach quite established.

Gunkel and Coeckelbergh argue that it is not ontological capabilities or an essence that we determine in advance that determines how we deal with non-human entities such as robots. Instead, we are engaged in relationships with non-human entities and grant them moral consideration within those social relations. Gunkel (2018b) and Coeckelbergh (2010) draw upon the philosophy of Levinas to argue that in our everyday lives, away from philosophical theorizing, we do not start by defining and analysing properties. Rather, it is through the process of encountering and relating to the Other that we determine how to deal with the Other. This leads to the fact that robots become dear to us, and even though we do not attribute consciousness or intelligence to them, we still claim moral consideration for them.

This relational approach, however, is still linked to properties. Although they emphasise the importance of relationships in this approach, Gunkel and Coeckelbergh do not deny that moral decision-making remains influenced by properties. Coeckelbergh acknowledges that properties might have a role in a relational approach to moral consideration, allowing for "properties-as-they-appear-to-us within a social-relational, social-ecological context (Gellers, 2020; cited by Gunkel, 2023; Coeckelbergh 2010)." Similarly, in line with Coeckelbergh's concept of 'as if' and 'appearance', Gunkel (2018a) speaks of a mere "projection" of properties: "[…] we project the morally relevant properties onto or into those others who we have already decided to treat as being socially significant". Gunkel also states that properties do not become unimportant in their approach but rather emerge from relationships attributed to the entities within a social-relational context. These properties are not intrinsic to the entities but are extrinsically attributed to them. This reverses the direction of the properties approach: "In other words, the properties that are determined to belong to an entity are actually a phenomenal effect of the relationship and not an antecedent ontological condition and cause. […] This does not diminish the role of properties, it simply inverts the direction of the derivation." (ibid.)

It has to be acknowledged that the as-if properties approach extends well beyond these authors and in the wider literature, relational approaches are not always linked with properties (Bird-David, 1999; Harvey, 2006, 2014). See here also Shinto-inspired techno-animism, new animism and deep ecology (Jecker, 2021). For

instance, new animism focuses on "how to behave appropriately towards persons, not all of whom are human" with whom we are in a relationship. It is argued that "while it may be important to know whether one is encountering a person or an object, the really significant question for animists of the 'new' kind is how persons are to be treated or acted towards" (Harvey, 2006).[3]

4 An Eco-Relational Approach to Robot Ethics

4.1 Challenging Current Robot Ethics

Both approaches – the properties approach and the modest relational approaches – bring their own challenges. They can be critiqued from various angles: The properties-based approach instigates a competition among properties – asking which characteristic or combination thereof is essential for the ethical categorisation of an entity. Is sentience more critical, or is intelligence? Moreover, creating a universal catalogue of human attributes inevitably leads to discrimination against those who do not exhibit these properties. For example, identifying certain traits as "typically human" involves normative choices, suggesting a hierarchical valuation of certain characteristics over others. Even when relying on vaguely defined human traits, such as mortality or embodiment, these criteria prove too weak to distinctly separate humans from other entities. Furthermore, there has been extensive criticism of the idea of a fixed and determinable "human nature" or "essence" of the human being (Roughley, 2005; Birnbacher, 2006; Puzio, 2022). Additionally, the critique presented by Gunkel against the properties approach can be mentioned – for example, regarding the definition of these properties, such as consciousness, and the difficulty of identifying such properties in others.

In the case of the as-if properties approach, an additional concern is that ethics should not be entirely dependent on subjective perception and relationships. It is problematic to base ethics on how an entity appears to someone. There are concepts like dignity intended to protect the value of every human life, independent of subjective perception and relationships. Moreover, an entity may appear one way to one person and differently to another. Another issue with both approaches is the difficulty in defining what a property actually is. The lines blur regarding what constitutes a property, for example, where do we draw the line between character traits, capabilities, perceptions, and actions? How should we categorise free will, sociability, rationality, emotions, and language?

Given that both approaches have already been criticised by others (Gunkel, 2018b, 2023; Sætra, 2021) this article does not provide a comprehensive evaluation of the approaches, but rather focuses on the role of non-human entities and our relationships with them. As has become clear, the relationship with non-human entities

[3] See also Jecker 2021, p. 263: "Hallowell (1960) relays the vignette of speaking with an Ojibwe elder and asking whether all rocks are alive; the answer the elder gives, according to Hallowell, was that any person can relate to any rock *as if* it is alive, revealing that the important question is not *whether* all rocks are alive but whether specific humans *relate* appropriately (respectfully) with specific rocks."

is neglected in the properties approach. The as-if approach advocates for a relational turn in ethics and argues for a stronger consideration of relationships with robots. In the following, I critically examine whether the as-if approach, which labels itself as relational, is sufficiently relational.

First, I challenge the manner in which properties in robot ethics are presupposed without analysing their contexts and argue that properties are always *contextualised and embodied.* This alters the view of properties, as presupposed in robot ethics. For robot ethics, this implies that properties must be contextualised, meaning that the specific situation, matter, body, and surroundings of the entity must be considered. In robot ethics, we cannot presuppose disembodied, situation-independent properties and then simply apply and test these on robots to see if they can possess them as well. This also leads to a more appropriate understanding of what happens in humans. However, this also changes our perspective, requiring us to attribute similar attributes to animals and robots and identify abilities that often even surpass human ones.

Second, properties are *lived and enacted*, we cannot have or possess them, rather they are actions and processes. Humans and robots do not *have* properties and are not equipped with them; rather, one performs and enacts them. In robot ethics, contexts and actions must be analysed when arguing on the basis of properties. Viewing properties as performed and not possessed also loosens the link between property and a certain ontological constitution: it dispels the idea of a *catalogue of characteristics bound to a certain entity*.

Further, I propose a *relational* understanding of properties, meaning understood in relation to other entities, including non-human ones. Properties should be seen in close connection with non-human entities, which is also is non-anthropocentric and diminishes the special position of humans. The human properties that are considered separate from robots in robot ethics, and taken as a basis from which in the second step it is analysed whether robots can also possess them, are already closely intertwined with robots.

These insights also *broaden the perspective on properties*, thus also encouraging taking *other properties* into account and focusing on processes. Even in humans, the properties approach focuses only on certain properties, especially mental capabilities and dualistic concepts, while the body, as in the example of "body memory", should come more into focus. This could also expand our understanding of properties, e.g., to include non-Western perspectives.

Finally, I would like to stress the *co-being and co-action* of human and non-human entities. We depend on technology, interact with it, and are altered by it. Especially in robot ethics, which fundamentally deals with human–robot interaction, it is crucial to broaden our view beyond considering humans as the sole acting and effective agents. Action is changed through robots as co-actors – that is, both limited and made possible by them – and is different. This suggests a form of non-human agency. Human action is not merely supplemented by robots and human–robot interaction should not be understood in terms of A and B working together, but rather we should understand actions as hybrid, with hybridity not presupposing a mere merging, but a deeper "entanglement" (Barad).

When actions are transformed into hybrid actions or co-actions of human and non-human, this fundamentally shifts traditional ethical concepts that are human-centered. When actions are viewed as "hybrid actions"[4] or co-actions of human and non-human, this fundamentally shifts traditional ethical concepts that are human-centered. Concepts such as autonomy and responsibility change when robots are fundamentally entangled in them.

4.2 How Non-Human Entities Come into Play

In the following, I will elaborate and illustrate the aforementioned aspects. To this end, Sections (1)-(3) will demonstrate how deep the relationships with non-human entities penetrate our properties, actions, and being. In this analysis, I will primarily refer to the phenomenological approach of Glen A. Mazis (2008), which draws upon Animal Studies, as well as the work of Heidegger and Merleau-Ponty. By adopting a phenomenological approach, the argumentation of the as-if approach, which also relies on phenomenology, is ultimately continued.

When referring to non-human entities in this paper, the focus will primarily be on animals and robots. Nonetheless, this always implies the broader diversity of non-human entities, and research should be expanded to encompass the full spectrum of non-human entities. The term "non-human" itself is problematic, as it suggests an anthropocentric perspective that understands the non-human only in a negative distinction from the human. The term "entities" also poses challenges, as it is not always clear what constitutes an entity, or what, on the other hand, might be more accurately described as a phenomenon, process, or event. Especially in the realm of nature, it becomes evident that non-human entities are not always entities with fixed boundaries and characteristics. For instance, what exactly are glaciers, algae, fungi, bacteria, valleys, rivers, and mountains? This can lead to the difficulty where eventually everything becomes a non-human entity. For better illustration, I will focus here on robots and animals.

4.2.1 A Contextual Understanding of Properties: Embodied, Lived, and Enacted

All properties ascribed specifically to human beings are in fact not merely a pure human merit but are deeply interwoven with non-human entities. An important aspect is that these properties can also be identified in non-human entities, as years of studies, for instance in Animal Studies, have already shown. Glen Mazis (2008) demonstrates numerous examples of how animals can also have "intelligence, feelings, morality, capacities for relationship, and recognition of mortality in certain cases" (see also Griffin, 2001; Wohlleben, 2016). Rodney Allen Brooks (2017) demonstrates varying intelligence types, highlighting octopuses' unique abilities, such as operating levers, remembering humans and recognising human sight lines,

[4] This term is inspired by Verbeek's (2014) concepts of "hybrid moral agency" and "hybrid morality", as well as the New Materialism's understanding of "hybridity".

indicating a distinct intelligence. Animal Studies have long shown that chimpanzees possess intelligence nearly akin to humans.

Glen Mazis (2008) urges us to always consider the abilities of various entities in their specificity and contexts, for example, that they have very specific bodies and surroundings in and with which they perform their abilities. Mazis (2007, 2008) refers to Heidegger's (1927) concept of "being-in-the-world" ("In-der-Welt-Sein"). Heidegger uses this term to describe our entwinement with the world, positing that the intertwining of subject and world cannot be separated. For Heidegger, existence ("Dasein") is always in the context of the world (ibid.).

This contextualisation will be illustrated using the example of birds and their mental maps: Many birds are aware of their surroundings by using "mental maps" that enable them to navigate and remember their environments, impressively rediscovering feeding spots or nesting sites (Mazis, 2007, 2008; Page, 1999). Thus, when observing another entity, one must consider it in its environment and examine how it interacts with its specific body, specific matter, and specific surroundings. Then, one can indeed say that birds can possess intelligence, knowledge, and memory. These are not the same as those of humans but are intelligence, nonetheless. This embedding of properties must be acknowledged. It does not make sense, for example, to label a dolphin unintelligent just because it cannot operate a computer (Brooks, 2017).

In this way, we also find in animals the ability to count and language skills. Birds, known as cormorants, notice when they are fed a different number of fish than usual (Mazis, 2008; Page, 1999). The starling can recognise patterns of language syntax and categorise certain acoustic sequences. Furthermore, among animals, various forms of communication are possible (Mazis, 2008). Observing the properties of animals, we see that many of their properties even surpass those of humans, expanding our view on a variety of intelligences, languages, and communications.

Looking at technology, we make the same observations. Recent developments in AI have shown that technologies can exhibit astonishing skills in calculation, language, memory, and intelligence. Learning, memory, or intelligence from technologies differ significantly from humans. Artificial intelligence is not human intelligence. Current AI primarily involves rule-following, pattern recognition, stochastics, and mathematical abilities, whereas societal and public debates on AI frequently point out that emotional intelligence, social intelligence, etc., are crucial for human intelligence. As with animals, technologies must be viewed in their specific ways, contexts, materials, surroundings, and conditions: "Robots have a different way of seeing and processing the world than we do. They can sense things that we can't and be totally oblivious to things that are obvious to us." (Darling, 2021).

Shifting the perspective from a "human-centered paradigm" to acknowledging the "own way of being" of non-human entities also transforms our conception of properties (Mazis, 2008). Instead of viewing them as something someone possesses, they are understood as lived, embodied, and enacted. Heidegger's "being-in-a-world" comes with a familiarity with the world, an immediate sense of our surroundings, meaning "an 'understanding' (verstehen) that is not reflective but rather 'lived'"(ibid.). This enables cognitive capabilities like knowing, often categorised as merely mental, to be understood as lived and embodied. This aligns with birds and

their mental maps, which "do not have a projected, deliberative sense of a map", but an "'understanding' […] through the body's sense of its surround". Instead of "a conscious, deliberative grasp of facts" and an "abstract or a categorical knowing", there is a "felt understanding" (ibid.). In reference to Merleau-Ponty and Heidegger, one can also speak of a "knowing of the hands" or "a 'knowing' of the body" (ibid.). Thomas Fuchs (2020) discusses "body memory" ("Leibgedächtnis"), emphasising how experiences and abilities are embodied, as seen in activities like playing the piano or navigating through space. Nietzsche (1887) similarly contends that experiences and memories are inscribed into the body.

Understanding properties as actions means that we never possess or simply have consciousness, emotions, intelligence, rationality, and sentience. Properties are not static properties we possess but rather dynamic processes, something we actively engage in. They are better understood as verbs than nouns. For example, there is not simply intelligence as a feature, but it pertains to knowing and understanding as actions. Similarly, we do not possess emotions, but are affected by others, feel, and express emotions.

4.2.2 Properties as Collaborations

Understanding beings as beings-in-a-world and considering their embedding in contexts and surroundings also means thinking about them relationally. Heidegger (1927) also stated that "being-in-a-world" always involves "being-with" and "being-with-others" ("Mitsein", "Miteinandersein") (Mazis, 2008). In these properties, human and non-human are already connected and collaborate. There are no human properties that are not shaped by non-human entities.

Taking emotions as an example, emotions are always related to something; they do not stand alone. They are reactions and interactions, or better, "resonance" with their environment (Mazis, 2008). Also, the activities associated with intelligence and mental capabilities, such as thinking, knowing, learning, and memorising, are bound to the conscious experiencing and exploration of the environment (Fuchs, 2020). They are not merely activities of an isolated brain but are produced in interaction with the whole organism and the environment (Fuchs, 2011). Similarly, consciousness implies a "relationship to the world" (Fuchs, 2017, my translation). Moreover, the spheres of thinking and feeling are not separated, and there is no pure thought or pure emotions. They are always embedded in our value system, worldview, experiences, and relationships, which always also involve non-human entities (Mazis, 2008).

The example of computers clearly illustrates how what is understood as human properties should always be regarded as collaboration or "co-accomplishments" with non-human entities (ibid.). What we understand as human intelligence today would not have been achieved without computers and calculating machines. Numerous activities of our daily life build on the performance of computers, which, through their high computing capacities, significantly contribute to what we consider our high level of intelligence (ibid.). The capabilities of technology not only enhance our intelligence but alter it.

4.2.3 Being as Co-Being and Actions as Co-Actions

As has already become evident, human existence cannot be reduced merely to properties, and these are better understood as actions and processes. In the following, the view will be expanded to show that various modes of human being and action are closely intertwined with non-human entities.

The first aspect, trivial but fundamentally the most basic and primary, is that our human existence is inherently dependent on non-human entities. Without non-human entities like bacteria, insects, and plants, we cannot survive. Technologies serve as a fundamental condition for our food production, safety measures, water supply, and energy provisions. Moreover, in the medical field, we largely depend on technology, and many people could not survive without it. The development of robots is still in its early stages, but rescue robots, exploration robots, robots for disaster response, medical purposes, and dangerous tasks are already being developed. Thus, our being is, by the condition of its possibility, always a co-being. If non-humans enable our being, then they also shape it.

Furthermore, our actions are influenced by non-human entities. In the case of robot-assisted surgery in medicine, robots like the da Vinci Surgical System, Versius Surgical Robotic System, and PRECEYES Surgical System are employed to perform interventions on the patient's body (Ficuciello, 2021; Dubey et al., 2020), enabling better visualization and insight into the body, as well as precise and minimally invasive operations (Taylor et al., 2016; Wolf et al., 2023). The surgeon either controls the robot from a console or works directly with it in the procedure, thereby guiding the surgery process. Nonetheless, the interaction changes. It is not only a surgeon undertaking the surgery but ultimately a co-action of robot and surgeon (and the rest of the surgical team). The robot, responds to the surgeon's non-verbal and verbal cues, performs surgical practices, suggests alternate approaches or breaks as needed, and at the same time, it executes its programmed routines. This interaction changes communication forms within the team and enables innovative interventions, that are not possible without the robot. The entire interaction process of the surgery is altered by the robot, leading to a co-action of robots and humans. "Co-action" does not refer to merely A and B working together and being added together, but rather in the sense of a "hybrid action", i.e., something new emerges. Both are adapting to each other and transforming each other.

Similar scenarios can be envisaged in the industry when robots and humans interact to manufacture products, conduct tests, measure, weld, or transport items (Hägele et al., 2016). Especially when things go awry or the robot does not act as the industrial employee expected, it becomes clear that the interaction is not solely dependent on the employee. Even when a robot is controlled by a human (and notwithstanding that not everything is under human control), the human's action is tightly intertwined with the robot's action. They adjust to one another, respond to one another, and the interaction is contingent upon the specific preconditions that both robot and human bring to the table, opening up entirely new possibilities for interaction – the interaction transforms and becomes a co-action.

That our actions and decisions are transformed by technology is not a phenomenon unique to robots, but has long been occurring in everyday technologies such as

wearables, self-tracking apps, visualisation technologies, and medical technologies, where it often goes unnoticed by us (Puzio, 2022). Moreover, there is a broad area that cannot be clearly assigned to either properties or actions, such as perception. Böhme (2008) demonstrates phenomenologically that devices like glasses, contact lenses, microphones, and hearing aids do not merely expand our perception but transform it. With new emerging technologies that are getting closer to our bodies, such as brain-computer interfaces (BCI), these developments are elevated to a new level. People with neurological disorders such as Locked-in syndrome can envision the act of flipping a light switch; the BCI analyses and sends their brain signals, thereby activating the light switch. Similarly, concentrating on particular letters or phrases displayed on a monitor allows the BCI (and the human) to navigate a cursor for selection (Jecker and Ko, 2022a). BCIs facilitate movement and speech; the interaction has to be learned and both parties have to adapt to each other. Consequently, communication and interaction are enabled and changed, thinking and behaviour are restructured.[5] When these brain-computer interfaces become bidirectional, they can provide somatosensory feedback, including perceptions of pressure or warmth, or even disable fear, and could also be used for the enhancement of able-bodied individuals (Jecker and Ko, 2022a, b). Recently, generative AI for the creation of visual and performance art, as well as for multiple medical fields (especially radiology, mental health, and drug development), is being explored (Rajpurkar and Lungren, 2023; Howell et al., 2024; Rengers et al., 2024; Opel et al., 2023). Here, the concepts of non-human agency or "assemblages" of human and non-human (Lupton, 2019) become particularly evident.

5 Consequences for Robot Ethics

The as-if approach has the advantage over the properties approach that it contextualises properties and places them in relation to non-human entities. Gunkel and Coeckelbergh criticise the properties approach for overlooking the significant importance of relationships in ethics and advocate for a relational turn. However, in the as-if properties approach, properties still remain human-centered; the contextualisation of properties stops at a preliminary stage, and the relational level can delve even deeper. The as-if approach recognises that relationships are important and precede ethical categorisation; we make decisions based on them, but relationship is understood as an interaction between separate individuals, whereas here they are already much more connected, namely in their properties.

What do these insights mean for the field of robot ethics? If properties must be contextualised, then robot ethics must also incorporate contexts and reflect on properties instead of merely assuming them. Additionally, a greater variety of properties should be considered, which are not tied to a specific ontological constitution. However, this presents several challenges. If it is not the properties that differentiate

[5] This recalls Michael Chorost's 2001 narrative about his cochlear implant experience (Chorost 2005; Mazis 2008).

us from non-human entities, but the specific contexts and the way we enact them, which are closely linked with non-human entities, the question arises for whether properties can serve as a basis for ethical concepts at all. This is further complicated by the difficulty of identifying properties in other entities. Another question would be whether these properties are indeed relevant for ethical concepts or our everyday actions. As posed by Darling (2021), do we genuinely care about these attributes? Do we elaborate in every situation on whether consciousness and intelligence can be identified in the entity? We should be cautious not to let it be more about the metaphysical interests of philosophers, deeply influenced by Western tradition, rather than about its actual significance in everyday interactions. Or that these properties are merely our anthropological attempts at negotiation that make us feel comfortable to distinguish ourselves from the non-human (in the sense of: we are conscious and intelligent, they are not). I would argue that the elaboration on properties does not advance our understanding of the real problems encountered in human–robot interaction. This also leads to questioning the role of properties, and human properties, as the foundation for ethical concepts. And a more far-reaching question is what happens to our anthropology and understanding of humanity (and ethics) if we can only be defined through relations.

The results – such as contextualised properties, relationality, connectedness, and co-action with non-human entities – bring significant questions to anthropology and ethics within the context of robotics that should not be underestimated. (1) Implications for anthropology: The delineation between human and non-human becomes difficult. How can one then distinguish between human and non-human, which is the foundation for our ethics, laws and politics? (2) Implications for ethics: From a (radical) relational perspective, how is it still possible to act responsibly and make decisions? How can we conceive of a subject from the relational, always connected being, that is capable of action and effect, takes on responsibility, is accountable, and is a political and ethical subject? Here, a "gap" emerges "between the ontological subject" and the acting, "ethical, and political subject" (Buhr, 2019, my translation). Of course, anthropology and ethics cannot be based solely on relationships, because how we deal with an entity cannot only depend on the subjective relationship, we have with it. Moreover, consequences for areas such as law and politics will need further exploration, as these are based on properties and ontological distinctions between entities. Nevertheless, it is suggested that relationships play a role in our actions and must be incorporated into our ethics.

This inevitably comes with transformations of traditional ethical concepts. Elsewhere in research, it has already been shown that with the advent of emerging technologies like robots, our ethical concepts are being disrupted and transformed (Van de Poel et al., 2023a; Van de Poel et al., 2023b; Hopster et al., 2023).

There are two examples in the ethics of technology that attempt to better account for technology in actions. F. Allan Hanson (2009), for instance, discusses "extended agencies", thereby integrating non-human entities such as technology into human moral agency. Through this, Hanson challenges moral individualism, the notion that the moral subject is an autonomous individual – a concept he traces back to the Renaissance (ibid.). Hanson justifies this by indicating that humans are transformed by technology: wielding a gun, for instance, changes a person into a different kind

of subject, and the accountability of a driver varies whether they control a bicycle or a car (ibid.). Nevertheless, he does not advocate for recognising "nonhuman agents in their own right" because such a claim would perpetuate the dichotomy between human and non-human entities. He reshapes the concept of responsibility to include non-human entities, referring to it as "joint responsibility" (ibid.). However, Hanson ultimately ascribes a special role to "will", which resides within humans and renders them essential to the act (ibid.).

Peter-Paul Verbeek, the second example, has developed a "mediation theory" (2005) and considers "technologies as mediators between humans and reality" (2014). Using the example of the ultrasound image, he illustrates that while it does not determine our decision concerning abortion, it informs and influences it. The ultrasound technology does not make decisions for us regarding abortion, but it provides insights into certain health values of the unborn and positions us as decision-makers. Moreover, the fetus is constituted as a person and patient (ibid.). Consequently, Verbeek (2014) considers "moral practices as coproductions of humans and technologies" and attributes "moral significance" to technologies. Verbeek takes it a step further than Hanson by seeking to profoundly rethink the concept of moral agency: "Rather than checking if technologies can meet a pre-given criterion of moral agency, we need to re-conceptualize the phenomenon of moral agency itself in order to understand the roles of technologies in our daily lives." (ibid.) This sets Verbeek apart from Coeckelbergh's approach, as Coeckelbergh (2009) explicitly states that he does not want to alter the concept of moral agency. According to Verbeek (2014), moral agency is not something that one *has* but arises in relationships: "[…] things do not 'have' moral agency – the most crucial point is: neither do humans. Morality is a hybrid affair; it cannot be located exclusively in things, but not in humans either." "It only comes in relations between subjects and objects." (ibid.) Similar to Hanson (2009), he does not dconsider technologies as "moral agents themselves" but rather views their role as the "mediation of morality" (Verbeek, 2014).

Both approaches demonstrate that traditional ethical concepts are being transformed by technology, responding to contemporary challenges. For instance, the advanced automation of robots calls into question ethical notions such as responsibility, autonomy, and moral agency. Furthermore, responsibility is distributed across multiple agents, known as the "problem of many hands" (Doorn and Poel, 2011), which complicates the assignment of responsibility. This diffusion of responsibility is also relevant to other concepts like autonomy, which often presupposes an individualistic framework.

New Materialism, not covered in this article, presents an outlook where tracing relationality to non-human entities could be expanded even further. This is the approach I favour the most, because it best acknowledges the significance of the non-human as well as relationality and processes. Specifically, New Materialism posits that relationships with human and non-human entities precede ontology. In other words, what human, body, animal, or robot mean, is negotiated through interaction and relationship. This represents a radically "relational ontology". Karen Barad, in their New Materialist theory, emphasises the entwined workings of the human and the non-human, granting the non-human a form of agency (Barad, 2007,

2015a, b; Barad 2012). Donna Haraway (2004a, b), another proponent of New Materialism, has crafted the ontological, epistemological, ethical, and political figure of the Cyborg: a hybrid entity merging human, animal, and technology. Within this fluid identity, the boundaries between human, animal, and technology blur, highlighting their interconnectedness. This New Materialist approach highlights more acutely than the aspects above the question of what relations are – whether they are conditions, relationships, and what kind of relationships – and which of these should be deemed relevant and valuable. Moreover, it raises even more pressing questions about the implications for anthropology and ethics if these are solely determined by relations.

6 Conclusion

Our relationships with robots, encompassing love, friendship, and sex, have become a popular topic in research. However, while the consideration of relationships with robots has gained attention, the field of robot ethics remains predominantly individualistic, treating humans and robots as standalone entities. In this article, I have examined dominant approaches in Western robot ethics that are rooted in ethical concepts based on human properties. I have presented an *eco-relational approach*, advocating that in robot ethics, it is crucial to consider relationality to non-human entities such as animals and technology as a central concept from the outset. The insights of this article necessitate a less anthropocentric perspective that foregrounds relational processes. Furthermore, from the results for robot ethics, it can be derived that properties and human properties as a basis for ethical concepts must be questioned. Moreover, through the co-action with non-human entities, ethical concepts are transformed, and a form of non-human agency is suggested. This approach is not without several challenges, which have been outlined, primarily concerning practicability and concrete applicability in practice, ethics, and law.

For future research, the limitations of this approach should be considered. There is a need for more empirical research into our relationships with non-human entities, focusing on specific human–robot interactions. Key questions include: What types of relationships do we form with robots? How do these relationships influence our actions and ethical behavior? What role do certain properties play in ethical judgment? And which properties are relevant or irrelevant for various interactions and ethical concepts?

A key advantage of this approach is that it becomes possible, by moving away from the human-centered paradigm, to consider the "own way of being" of non-human entities. In the case of robot ethics or even technology ethics in general, it is often asked whether robots, AI, and other technologies can be intelligent or have consciousness, or whether they can have autonomy or agency. But in doing so, ideas and concepts are always presupposed that are bound to humans and can only be fulfilled by humans. Therefore, such studies turn out negatively, and the result is clear from the outset: they only show in the end that non-human entities cannot have these properties or capabilities. But if we conceive the concepts from the outset in such a way that they can only fit humans and make this a prerequisite for our investigation,

we will not make progress with today's challenges in robot ethics. Because in today's human–robot interaction, it is not about exclusively human intelligence or exclusively human agency; instead, these concepts are transformed in human–robot interaction.

This interconnectedness and relationality – or in Barad's (2007) terms: "entanglement" – is not just a potential threat but enables us to understand our being and our actions on a deeper level. Darling (2021), who has studied human relationships with both animals and robots, points out that there are not only human–human relationships but a "diversity of relationships" and a diversity among humans, animals, and robots. "The animal world contains a wide variety of different talents, many of which exceed human abilities. Yet when it comes to robots and AI, we're hung up on a very specific type of intelligence and skill: our own." (ibid.) For the future, she suggests leveraging this diversity to enhance what it can do better than human–human interaction, such as the use of animals or robots in certain therapies. "Rather than artificial intelligence being a step on the path to human intelligence, it can and will be something entirely its own, and this means that, just as we've done with animals in the past, we're at our best when we team up." (ibid., referencing Brooks, 2017)

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References

Ackerman, E. *MIT's DragonBot Evolving to Better Teach Kids.* IEEE Spectrum. March 16, 2015. Retrieved July 15, 2023, from https://spectrum.ieee.org/automaton/robotics/artificial-intelligence/mit-dragonbot-evolving-to-better-teach-kids

Barad, K. (2007). *Meeting the universe halfway: quantum physics and the entanglement of matter and meaning*. Duke University Press.

Barad, K. (2012). *Agentieller Realismus*. Suhrkamp Verlag.

Barad, K. (2015a). Dem Universum auf halbem Wege begegnen: Realismus und Sozialkonstruktivismus ohne Widerspruch. In K. Barad (Ed.), *Verschränkungen* (pp. 7–69). Merve.

Barad, K. (2015). Verschränkungen. Merve.

Behrens, K. G. (2014). An african relational environmentalism and moral considerability. *Environmental Ethics, 36*(1), 63–82.

Bird-David, N. (1999). "Animism" revisited. *Current Anthropology, 40*(S1), S67–S91. https://doi.org/10.1086/200061

Birnbacher, D. (2006). Natürlichkeit. *De Gruyter*. https://doi.org/10.1515/9783110193695

Bloom P., Harris S. (2018). *It's Westworld. What's wrong with cruelty to robots?* The New York Times, April 23, 2018. Retrieved July 15, 2023, from https://www.nytimes.com/2018/04/23/opinion/westworld-conscious-robots-morality.html

Böhme, G. (2008). *Invasive Technisierung: Technikphilosophie und Technikkritik* (Bd. 50). Graue Edition.

Brooks, R. A. (2017). *What Is It Like to Be a Robot?* March 18, 2017. Retrieved July 15, 2023, from https://rodneybrooks.com/what-is-it-like-to-be-a-robot/

Bryson, J. J. (2010). Robots should be slaves. In Y. Wilks (Ed.), *Close engagements with artificial companions. Key social, psychological, ethical and design issues* (pp. 63–74). John Benjamins Publishing. https://doi.org/10.1075/nlp.8.11bry

Buhr, L. (2019). Das Subjekt als Werden der Welt. Begriffliche Anmerkungen zur neumaterialistischen Subjektkonzeption von Karen Barad. *Rechtsphilosophie, 5*(1), 75–87. https://doi.org/10.5771/2364-1355-2019-1-79

Chemhuru, M. (2019). The moral status of nature: An African understanding. In M. Chemhuru (Ed.), *African environmental ethics* (pp. 29–46).

Chorost, M. (2005). *Rebuilt: how becoming part computer made me more human*. Houghton Mifflin.

Coeckelbergh, M. (2009). Virtual moral agency, virtual moral responsibility: On the moral significance of the appearance, perception, and performance of artificial agents. *AI & Society, 24*(2), 181–189. https://doi.org/10.1007/s00146-009-0208-3

Coeckelbergh, M. (2010). Robot rights? Towards a social-relational justification of moral consideration. *Ethics and Information Technology, 12*(3), 209–221. https://doi.org/10.1007/s10676-010-9235-5

Coeckelbergh, M. (2012). *Growing moral relations: critique of moral status ascription Palgrave MacMillan*. New York: Springer.

Coeckelbergh, M. (2022). *Robot Ethics*. MIT Press.

Coeckelbergh, M., & Gunkel, D. J. (2014). Facing Animals: A Relational, Other-Oriented Approach to Moral Standing. *Journal of Agricultural and Environmental Ethics, 27*(5), 715–733. https://doi.org/10.1007/s10806-013-9486-3

Danaher, J. (2019). The Philosophical Case for Robot Friendship. *Journal of Posthuman Studies, 3*(1), 5–24. https://doi.org/10.5325/jpoststud.3.1.0005

Danaher, J., & McArthur, N. (2017). *Robot sex: Social and ethical implications: Social and ethical implications*. The MIT Press.

Darling, K. (2021). *The New Breed: What Our History with Animals Reveals about Our Future with Robots*. Henry Holt and Company.

Doorn, N., & van de Poel, I. (2011). Editors' Overview: Moral Responsibility in Technology and Engineering. *Science and Engineering Ethics, 18*(1), 1–11. https://doi.org/10.1007/s11948-011-9285-z

Dörrenbächer, J., Ringfort-Felner, R., Neuhaus, R., & Hassenzahl, M. (Eds.). (2022). *Meaningful futures with robots: Designing a new coexistence*. Routledge. https://doi.org/10.1201/9781003287445

Dubey, S. P., Molumi, C. P., & Swoboda, H. (2020). Robot surgery. In S. Dubey, C. Molumi, & H. Swoboda (Eds.), *Color Atlas of head and neck surgery* (pp. 449–459). Springer. https://doi.org/10.1007/978-3-030-29809-8_13

Dzobo, N. K. (2010). Values in a changing society: Man, ancestors and God. In K. Gyekye & K. Wiredu (Eds.), *Person and community* (pp. 223–240). Ghanaian Philosophical Studies. Council for Research in Values and Philosophy.

Ficuciello, F. (2021). Surgical Robotics. In J. Baillieul, T. Samad (Eds.), *Encyclopedia of Systems and Control* (2253–2261). Springer. https://doi.org/10.1007/978-3-030-44184-5_100031

Frank, L., & Nyholm, S. (2017). Robot sex and consent: Is consent to sex between a robot and a human conceivable, possible, and desirable? *Artificial Intelligence and Law, 25*(3), 305–323. https://doi.org/10.1007/s10506-017-9212-y

Fuchs, T. (2020). *Verteidigung des Menschen*. Grundfragen einer verkörperten Anthropologie. Suhrkamp.

Fuchs, T. (2011). Lebendiger Geist. Wider den Dualismus von »Mentalem« und »Physischem«. In M. Knaup, T. Müller, P. Spät (Eds.), *Post-Physikalismus* (pp. 145–164), Karl Alber.

Fuchs, T. (2017). *Das Gehirn – ein Beziehungsorgan. Eine phänomenologisch-ökologische Konzeption* (5th edition). Kohlhammer.

Gellers, J. C. (2020). *The Rights of Robots: Artificial Intelligence*. Routledge.

Gibert, M., & Martin, D. (2021). In search of the moral status of AI: Why sentience is a strong argument. *AI & Society, 37*(1), 319–330. https://doi.org/10.1007/s00146-021-01179-z

Griffin, D. R. (2001). *Animal Minds: Beyond Cognition to Consciousness* (rev). University of Chicago Press.

Gunkel, D. J. (2012). The Machine Question Critical Perspectives on AI, Robots, and Ethics. *MIT Press*. https://doi.org/10.7551/mitpress/8975.001.0001

Gunkel, D. J. (2018). Robot Rights. *MIT Press*. https://doi.org/10.7551/mitpress/11444.001.0001

Gunkel, D. J. (2018). The other question: can and should robots have rights? *Ethics and Information Technology, 20*(2), 87–99. https://doi.org/10.1007/s10676-017-9442-4

Gunkel, D. J. (2023). The Relational turn. Thinking robots otherwise. In J. Loh, W. Loh (Eds.), *Social robotics and the good life. The normative side of forming emotional bonds with robots* (pp. 55–76). Transcript. https://doi.org/10.14361/9783839462652-003

Haberland, B., Wendland, K., & Loh, J. (2022). Falling in love with a machine – What happens if the only affection a person gets is from machines? In J. Dörrenbächer, R. Ringfort-Felner, R. Neuhaus, & M. Hassenzahl (Eds.), *Meaningful futures with robots: Designing a new coexistence* (pp. 92–100). Chapman and Hall/CRC. https://doi.org/10.1201/9781003287445

Hägele, M., Nilsson, K., Pires, J. N., & Bischoff, R. (2016). Industrial robotics. In B. Siciliano & O. Khatib (Eds.), *Springer handbook of robotics* (pp. 963–986). Springer. https://doi.org/10.1007/978-3-319-32552-1_54

Hanson, F. A. (2009). Beyond the skin bag: on the moral responsibility of extended agencies. *Ethics and Information Technology, 11*(1), 91–99. https://doi.org/10.1007/s10676-009-9184-z

Haraway, D. J. (2004b). *The Haraway reader*. Routledge.

Haraway, D. J. (2004a). A manifesto for cyborgs: Science, technology, and social feminism in the 1980s. In D. Haraway (Ed.), *The Haraway reader* (pp. 7–45). Routledge.

Harvey, G. (2006). *Animism: respecting the living world*. Columbia University Press.

Harvey, G. (2014). *Introduction*. Routledge.

Heidegger, M. (1977). *The Question Concerning Technology*. Harper & Row.

Heidegger, M. (1927). *Sein und Zeit*. Max Niemeyer Verlag.

Himma, K. E. (2009). Artificial agency, consciousness, and the criteria for moral agency: what properties must an artificial agent have to be a moral agent? *Ethics and Information Technology, 11*(1), 19–29. https://doi.org/10.1007/s10676-008-9167-5

Hopster, J., Brey, P., Klenk, M., Löhr, G., Marchiori, S., Lundgren, B., & Scharp, K. (2023). Conceptual disruption and the ethics of technology. In I. Poel, L. E. Frank, J. Hermann, J. Hopster, D. Lenzi, S. Nyholm, B. Taebi, & E. Ziliotti (Eds.), *Ethics of socially disruptive technologies. An introduction* (pp. 141–162). Open Book Publishers. https://doi.org/10.11647/obp.0366.06

Howell, M. D., Corrado, G. S., & DeSalvo, K. B. (2024). Three epochs of artificial intelligence in health care. *JAMA, 331*(3), 242. https://doi.org/10.1001/jama.2023.25057

Jaquet, F., & Cova, F. (2018). Of hosts and men: westworld and speciesism. In J. B. South & K. S. Engels (Eds.), *Westworld and philosophy: if you go looking for the truth, get the whole thing.* Wiley-Blackwell.

Jaworska A., Tannenbaum J. (2018), The grounds of moral status. In E. N. Zalta , U. Nodelman (Eds.), *The Stanford encyclopedia of philosophy.* Retrieved July 15, 2023, from https://plato.stanford.edu/archives/spr2023/entries/grounds-moral-status

Jecker, N. S. (2020). Nothing to be ashamed of: sex robots for older adults with disabilities. *Journal of Medical Ethics, 47*(1), 26–32. https://doi.org/10.1136/medethics-2020-106645

Jecker, N. S. (2021). Can we wrong a robot? *AI & SOCIETY, 38*(1), 259–268. https://doi.org/10.1007/s00146-021-01278-x

Jecker, N. S., & Nakazawa, E. (2022). Bridging East-West differences in ethics guidance for AI and robotics. *AI, 3*(3), 764–777. https://doi.org/10.3390/ai3030045

Jecker, N. S., & Ko, A. (2022a). Brain-computer interfaces could allow soldiers to control weapons with their thoughts and turn off their fear – But the ethics of neurotechnology lags behind the science. *The Conversation.* Retrieved February 21, 2024, from https://theconversation.com/brain-computer-interfaces-could-allow-soldiers-to-control-weapons-with-their-thoughts-and-turn-offtheir-fear-but-the-ethics-of-neurotechnology-lags-behind-the-science-194017

Jecker, N. S., & Ko, A. L. (2022b). The unique and practical advantages of applying a capability approach to brain computer interface. *Philosophy & Technology, 35*(4), 101. https://doi.org/10.1007/s13347-022-00597-1

Jecker, N. S., Atuire, C., & Ajei, M. O. (2022). The moral standing of social robots: Untapped insights from Africa. *Philosophy & Technology, 35*(2), 34. https://doi.org/10.1007/s13347-022-00531-5

Jensen, C. B., & Blok, A. (2013). Techno-animism in Japan: Shinto cosmograms, actor-network theory, and the enabling powers of non-human agencies. *Theory, Culture & Society, 30*(2), 84–115. https://doi.org/10.1177/0263276412456564

Johnson, D. G., & Verdicchio, M. (2018). Why robots should not be treated like animals. *Ethics and Information Technology Arch, 20*(4), 291–301. https://doi.org/10.1007/s10676-018-9481-5

Kasulis, T., (2019). Japanese Philosophy. *The Stanford Encyclopedia of Philosophy (Summer 2019 Edition)*, Edward N. Zalta (ed.). https://plato.stanford.edu/archives/sum2019/entries/japanese-philosophy/

Leyzberg, D., Ramachandran, A., & Scassellati, B. (2018). The Effect of Personalization in Longer-Term Robot Tutoring. *ACM Transactions on Human-Robot Interaction, 7*(3), 1–19. https://doi.org/10.1145/3283453

Light, A. (2001). The Urban Blind Spot in Environmental Ethics. *Environmental Politics, 10*(1), 7–35. https://doi.org/10.1080/714000511

Lin, P., Abney, K., & Bekey, G. A. (2012). *Robot ethics: the ethical and social implications of robotics*. MIT Press.

Lin, P., Abney, K., & Jenkins, R. (2017). *Robot Ethics 2.0: From Autonomous Cars to Artificial Intelligence*. Oxford University Press. https://doi.org/10.1093/oso/9780190652951.001.0001

Logan, D. E., Breazeal, C., Goodwin, M. S., Jeong, S., O'Connell, B., Smith-Freedman, D., Heathers, J. & Weinstock, P. (2019). Social robots for hospitalized children. *Pediatrics*, 144(1). https://doi.org/10.1542/peds.2018-1511

Lupton, D. (2019). 'It's made me a lot more aware': a new materialist analysis of health self-tracking. *Media International Australia, 171*(1), 66–79. https://doi.org/10.1177/1329878x19844042

Matheson, R (2019). Study: Social robots can benefit hospitalized children. In *MIT News*, Massachusetts Institute of Technology, June, 26, 2019. Retrieved July 15, 2023, from https://news.mit.edu/2019/social-robots-benefit-sick-children-0626

Mazis, G. A. (2008). *Humans, animals, machines: Blurring Boundaries*. State University of New York Press.

Mazis, G. A. (2007). Ecospirituality and the blurred boundaries of humans, animals, and machines. In L. Kearns & C. Keller (Eds.), *Ecospirit: Religions and philosophies for the Earth* (pp. 125–155). Fordham University Press. https://doi.org/10.5422/fso/9780823227457.003.0007

MIT (2010–2017), *Project Overview Huggable: A social robot for pediatric care*. In MIT Media Lab. Retrieved May 12, 2023, from https://www.media.mit.edu/projects/huggable-a-social-robot-for-pediatric-care/overview/

Nietzsche, F. (1887). *Zur Genealogie der Moral*. C. G.

Nyholm, S. (2020). *Humans and robots: Ethics, Agency, and Anthropomorphism*. Rowman & Littlefield.

Nyholm, S., & Smids, J. (2020). Can a robot be a good colleague? *Science and Engineering Ethics, 26*(4), 2169–2188. https://doi.org/10.1007/s11948-019-00172-6

Nyholm, S., & Frank, L. (2017). From sex robots to love robots: Is mutual love with a robot possible? In J. Danaher & N. McArthur (Eds.), *Robot sex: Social and ethical implications* (pp. 219–244). MIT Press. https://doi.org/10.7551/mitpress/10718.003.0019

Nyholm, S., Friedman, C., Dale, M. T., Puzio, A., Babushkina, D., Löhr, G., Gwagwa, A., Kamphorst, B. A., Perugia, G., IJsselsteijn,W. (2023). Social Robots and Society. In I. Poel, L. E. Frank, J. Hermann, J. Hopster, D. Lenzi, S. Nyholm, B. Taebi, E. Ziliotti (Eds.), *Ethics of Socially Disruptive Technologies. An Introduction* (pp. 53–82), Open Book Publishers, https://doi.org/10.11647/obp.0366.06

Nyholm, S. (2023). Wie sollen wir mit künstlich-intelligenten humanoiden Robotern umgehen? Drei philosophische Interpretationen dieser Frage. In A. Puzio, N. Kunkel, H. Klinge (Eds.), *Alexa, wie hast du's mit der Religion? Theologische Zugänge zu Technik und Künstlicher Intelligenz. Alexa, How Do You Feel About Religion? Theological Approaches to Technology and Artificial Intelligence* (pp. 73–91). Wbg Publishing, https://doi.org/10.53186/1030373

Opel, D. J., Kious, B. M., & Cohen, I. G. (2023). AI as a Mental Health Therapist for Adolescents. *JAMA Pediatrics, 177*(12), 1253. https://doi.org/10.1001/jamapediatrics.2023.4215

Page, G. (1999). *Inside the Animal Mind*. Broadway Books.

Poel, I, Frank, L. E., Hermann, J., Hopster, J., Lenzi, D., Nyholm, S., Taebi, B. & Ziliotti, E. (2023a) (Eds.), *Ethics of Socially Disruptive Technologies. An Introduction* (pp. 53–82), Open Book Publishers. https://doi.org/10.11647/OBP.0366

Poel, I., Hopster, J., Löhr, G., Ziliotti, E., Buijsman, S., & Brey, P. (2023b). Introduction. In I. Poel, L. E. Frank, J. Hermann, J. Hopster, D. Lenzi, S. Nyholm, B. Taebi, & E. Ziliotti (Eds.), *Ethics of socially disruptive technologies. An introduction* (pp. 11–32). Open Book Publishers. https://doi.org/10.11647/OBP.0366.01

Poel, I., & Fahlquist, J. N. (2012). Risk and responsibility. In S. Roeser, R. Hillerbrand, P. Sandin, & M. Peterson (Eds.), *Handbook of risk theory* (pp. 877–907). Springer. https://doi.org/10.1007/978-94-007-1433-5_35

Puzio, A. (2022), Über-Menschen. Philosophische Auseinandersetzung mit der Anthropologie des Transhumanismus. Transcript. https://doi.org/10.14361/9783839463055

Puzio, A. (2023). eig mir deine Technik und ich sag dir, wer du bist? – Was Technikanthropologie ist und warum wir sie dringend brauchen. In H. Diebel-Fischer, Hermann, N. Kunkel, & J. Zeyher-Quattlender (Eds.), *Mensch und Maschine im Zeitalter Künstlicher Intelligenz. Theologisch-ethische Herausforderungen.* Münster: LIT-Verlag.

Rajpurkar, P., & Lungren, M. P. (2023). The current and future state of AI interpretation of medical images. *The New England Journal of Medicine, 388*(21), 1981–1990. https://doi.org/10.1056/nejmra2301725

Rengers, T. A., Thiels, C. A., & Salehinejad, H. (2024). Academic surgery in the era of large language models. *JAMA Surgery*. https://doi.org/10.1001/jamasurg.2023.6496

Roughley, N. (2005). Was heißt »menschliche Natur«? Begriffliche Differenzierungen und normative Ansatzpunkte. In K. Bayertz (Ed.), Die menschliche Natur. Welchen und wieviel Wert hat sie? (pp. 133–156). Mentis.

Sætra, H. S. (2021). Challenging the neo-anthropocentric relational approach to robot rights. *Frontiers in Robotics and AI*, 8. https://doi.org/10.3389/frobt.2021.744426

Singer, P., & Sagan, A. (2009). *When robots have feelings.* The Guardian. Retrieved July 15, 2023, from https://www.theguardian.com/commentisfree/2009/dec/14/rage-against-machines-robots

Sparrow, R. (2004). The Turing Triage Test. *Ethics and Information Technology, 6*(4), 203–213. https://doi.org/10.1007/s10676-004-6491-2

Sparrow, R. (2017). Robots, rape, and representation. *International Journal of Social Robotics, 9*(4), 465–477. https://doi.org/10.1007/s12369-017-0413-z

Sung, J.-Y., Guo, L., Grinter, R. E., & Christensen, H. I. (2007). 'My Roomba Is Rambo': Intimate home appliances. International conference on ubiquitous computing. In J. Krumm, G. D. Abowd, A. Seneviratne, & T. Strang (Eds.), *UbiComp 2007: Ubiquitous computing. Lecture notes in computer science* (Vol. 4717, pp. 145–162). Springer. https://doi.org/10.1007/978-3-540-74853-3_9

Talbert, M. (2022). Moral Responsibility. In E. N. Zalta, U. Nodelman (Eds.), *The Stanford Encyclopedia of Philosophy*. Retrieved July 15, 2023, from https://plato.stanford.edu/archives/fall2022/entries/moral-responsibility/

Taylor, R. H., Menciassi, A., Fichtinger, G., Fiorini, P., & Dario, P. (2016). Medical Robotics and Computer-Integrated Surgery. In B. Siciliano & O. Khatib (Eds.), *Springer Handbook of Robotics.* Springer. https://doi.org/10.1007/978-3-319-32552-1_63

Van Wynsberghe, A. (2016). *Healthcare robots: Ethics*. Routledge. https://doi.org/10.4324/9781315586397

Verbeek, P. P. (2014). Some misunderstandings about the moral significance of technology. In P. Kroes & P. P. Verbeek (Eds.), *The moral status of technical artefacts* (pp. 75–88). Springer. https://doi.org/10.1007/978-94-007-7914-3_5

Vincent, N. A. (2011). A structured taxonomy of responsibility concepts. In N. Vincent, I. van de Poel, & J. van den Hoven (Eds.), *Moral responsibility* (pp. 15–35). Springer. https://doi.org/10.1007/978-94-007-1878-4_2

Wareham, C. (2020). Artificial intelligence and African conceptions of personhood. *Ethics and Information Technology, 23*(2), 127–136. https://doi.org/10.1007/s10676-020-09541-3

Wohlleben, P. (2016). *Das Seelenleben der Tiere: Liebe, Trauer, Mitgefühl – erstaunliche Einblicke in eine verborgene Welt*. Ludwig.

Wolf, A., Shvalb, N., & Shoham, M. (2023). Medical automation and robotics. In S. Y. Nof (Ed.), *Springer handbook of automation* (pp. 1235–1247). Springer. https://doi.org/10.1007/978-3-030-96729-1_57