



Rethinking Sentience: Invertebrates as Worthy of Moral Consideration

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Abstract

The ethical debate on the moral consideration of non-human animals (hereafter animals) is currently centred on the evidence of sentience in these individuals. Legal protection for vertebrates and cephalopods (and decapods in the UK) has resulted from the recognition of sentience in these animals. Although one should celebrate the significant advances in the legal protection of animals in recent decades, current animal legislation is modulated by an instrumental viewpoint, remaining speciesist and anthropocentric. A sentient being is here understood as one who has the phenomenological experience of awareness, which is the most basic sense of phenomenal consciousness that implies the existence of a subject who is not indifferent to what happens to itself. This paper demonstrates, with reasonable assumptions, that this concept of sentience would apply to many invertebrate species, thus deeming them worthy of increased moral consideration and legal protection. In cases in which sentience cannot be demonstrated clearly, one should assume the precautionary principle and consider the intrinsic value of each animal to designate moral consideration. In considering sentience as the primary condition for moral consideration, science must expand who is recognized as sentient rather than being reductionist. Animal ethics must review to whom the moral consideration should be given. Animal legislation must include legislative innovations and invertebrates in its protective scope. Thereby, a significant improvement in the current political and legislative decisions would be rooted in animal ethics. Opening the ethical perception and broadening the debate are urgent, as moral consideration should be given to all animals.

Keywords Animal ethics · Animal legislation · Animal rights · Ethical concerns · Invertebrates' sentience

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Introduction

The ethical debate on the moral consideration of non-human animals (hereafter animals) currently centres on the evidence of sentience in these beings. The recognition of sentience in vertebrates and cephalopods (and decapod crustaceans in the UK) has led to their legal protection (Birch et al., 2021). Part of the scientific community recognizes the sentience of a few invertebrates, including cephalopods, decapod crustaceans, and some insects, such as bees. Invertebrates comprise 97% to 99% of all known fauna on Earth (CBD, 2023; Lydeard et al., 2004); thereby, almost all animals are excluded from the sentience umbrella and legal protection. Regulations for their protection are still limited and vary between countries.¹ When invertebrates are included in animal protective legislation, most jurisdictions do so based on the scientific description of invertebrate sentience, thus legally recognizing it and including sentient animals under their protective umbrella. Historically, most invertebrates are understood as unable to think and are considered insentient beings within the scientific discourse (Magalhães-Sant'Ana, 2009).

Numerous definitions have been proposed regarding what exactly sentience is. Cunha (2021) asserts the ability to have any and all experience denotes sentience, which stimuli have an external (e.g., perceived with sensory organs) or internal origin (e.g., dreams). DeGrazia (2020) states having subjective experience (i.e., phenomenal consciousness) does not necessarily imply having sentience, but the capacity for affect made possible by conscious experience is necessary to be considered sentient. Mallatt and Feinberg (2020) propose sentience as the most basic form of consciousness, i.e., the phenomenal, primary consciousness understood as the ability to have sensorial (e.g., images) and affective experiences (e.g., emotions and moods). Broom (2020) understands sentience as the ability to have feelings, including some memory and analysis of actions, assessment of risks and benefits, and some degree of awareness. Marino (2010) considers that sentient individuals have the phenomenological experience of awareness, both self and about others, raising the possibility that animals might have different sentience properties that might be lacking in humans.

¹ Animal legislations from Tanzania (Animal Welfare Act 2008), Finland (Animal Welfare Act 2006), Estonia (Animal Protection Act 2000), Hong Kong (Prevention of Cruelty to Animals Ordinance 2018), India (Prevention of Cruelty to Animals Act 1960), and Malta (Animal Welfare Act 2002) include all animals; the first four cite invertebrates in their scope. The Swiss animal protective law includes invertebrates deemed sensitive by the Federal Council (Animal Welfare Act 2005). The Norwegian law (Animal Welfare Act 2009) covers cephalopods, decapods, and honeybees. The protective law of New Zealand (Animal Welfare Act 1999) includes cephalopods and decapods. Cooking live lobsters is prohibited in New Zealand, Switzerland, and Italy. It is a crime of maltreatment to store live lobsters on ice in Italian restaurants (Conte et al. 2021; Mills 2018). The UK legislation protects cephalopods and decapods (Animal Welfare Sentience Bill 2022). Australian law (Prevention of Cruelty to Animals Act 1986) protects adult decapods. The European Directive (2010/63/EU) includes cephalopods; the European Ethics Committee recommended the inclusion of decapods; however, they were excluded from the final text of the Directive (AHAW 2005).

Conte, F., Voslarova, E., Vecerek, V., Elwood, R. W., Coluccio, P., Pugliese, M., & Passantino, A. (2021). Humane slaughter of edible decapod crustaceans. *Animals*, 11(4), 1089.

Mills, G. (2018). Decapod crustaceans have feelings too. *Vet Record*, 182(6), 155.

Using these definitions as a semantic foundation, a sentient being is here understood as one who has the phenomenological experience of awareness, which is the most basic sense of phenomenal consciousness that implies the existence of a subject. Sentience enables a being to understand her/himself as oneself, have interests that matter to her/himself, be able to experience positive and/or negative states and be affected, whether positively or negatively. Understanding the subject as oneself is necessary because it is the self, i.e., the subject of the individual being, who experiences. Sentience endows affect, the experience of information, awareness about others, social communication, analytical abilities, decision making, and learning abilities, among others (Broom, 2019; Cunha, 2021; Marino, 2010; Mellor, 2019; Powell & Mikhalevich, 2020). Even if the isolated observation of some of these experiential capacities might not necessarily be definitive proof of sentience, they are strong indicators that there is a self, potentially sentient, experiencing them, rather than just an automata entity. Further, the absence of one type of experiential capacity does not nullify sentience. A being that does not have reasoning capacity but presents sensory experience is experiencing. Consciousness is what enables one to “perceive and respond to sensory stimuli” (Broom, 2014), acknowledging “the external world or one’s own mental state (Gennaro, 2017); it is required for sentience, although not all conscious beings are necessarily sentient. Awareness is the experience and reflection on “concepts of environment, of self, and of self in relation to environment”, resulting from “sensory stimuli or [...] memory” (Broom, 2014). Experience is the personal phenomenon of perceiving an information or event in a sensorial, cognitive, or affective way and results from a modulation of the nervous system; this information or event originates internally (in the body of the individual) or externally (on the environment) (Johnson, 2019).

This conception of sentience considers the possibility of different levels of sentience. Sentience is a complex and pluralistic personal phenomenon that can present itself in different varieties, richness, and degrees (Veit, 2023). Thus, sentience can manifest in different forms among different animal species and even within species (Kaufmann, 2023). Depending on the capacity level for self-consciousness and, therefore, self-understanding, there is a different capacity level to experience sensorial stimuli and affect. Even if an animal is incapable of feeling pain if she/he is capable of some type of conscious experience *and* not indifferent to what happens to her/himself, this is already evidence of sentience. The cognitive ability of a given species is not imperative for its capacity for sentience (Proctor, 2012). The nervous system does not produce sentience; rather, it only promotes it (Engelsted, 2017). Sentience expressions, e.g., through behaviour, may differ among animal species due to dissimilar neural biology (Kaufmann, 2023). Animals with simple nervous systems (e.g., bivalves’ ganglia), though lacking conclusive evidence of pain experience, have sensory organs (Kotsyuba et al., 2020), suggestive of experiencing sensory information. Nociception is the activation of sensory receptors (nociceptors) by noxious stimuli (potentially tissue damaging); it is an unconscious experience that does not denote sentience by itself. Pain is a perception, not a stimulus, thus it denotes sentience.

A morally considerable being is one with moral status, that is, a being with “interests in their experiential well-being” (Todorović, 2021), and with “moral reasons or

requirements, for one's own sake, for how one is to be treated" (Jaworska & Tannenbaum, 2023). A morally considerable being is one who can be harmed or wronged (Gruen, 2021) and whose interests (e.g., not suffering, experiencing pleasure) matter morally. The moral consideration of such being's interests results in the recognition that she/he has certain moral rights that can be legally protected although which legal rights they have is still subject of debate (Fasel & Butler, 2023). In sentiocentric ethics, the criterion of sentience indicates who should receive moral consideration, and sentience, in this criterion, is necessary and sufficient to determine who is benefited or harmed by one's acts and omissions (Cunha, 2021). With ethical significance, harm is what impairs the interests of someone, both in physical and emotional terms²; it encompasses the harm of death and the infliction or failure to avoid suffering³ (e.g., pain, distress, terror) leading to the decrease or suppression of welfare. Intrinsic value is the ultimate value a being has in itself, i.e., a value of inherent worth, not extrinsically imposed, and with an end in itself, regardless of the instrumental or utilitarian value this being can have (Himes et al., 2024). The intrinsic value concept maintains that "each animal has a good of its own", thus it expands who can be deemed morally considerable (Verhoog, 1992).

This paper challenges the current understanding of which animals can be considered sentient by demonstrating, with reasonable assumptions, that many invertebrates exhibit the capacity for conscious experience. Therefore, they should be considered sentient beings and one should acknowledge them as worthy of moral consideration. In cases where sentience cannot be demonstrated clearly, one should assume the precautionary principle and consider not only sentience should count for moral consideration, but also the intrinsic value of each individual animal.

Evidence of Sentience in Invertebrates

Cephalopods

Cephalopods are a class of marine molluscs that includes cuttlefish, squids, octopus, and nautilus. Due to their sophisticated behaviour, cephalopods are considered honorary vertebrates.⁴ They have a complex and highly cephalized nervous system, with cerebral lateralization suggesting specialization of cognitive processes (Cascon &

² Not all and any negative feelings or unpleasant sensations necessarily amount to harm. Animals (inc. humans) experience negative emotions and sensations in certain situations that are part of their lives and contribute to protection and survival. For instance, the pain that leads to the learning behaviour that avoids the source of pain or the protective fear that leads to precaution and escape from predators.

³ Suffering is "the internal subjective state experienced when [occurs] an involuntary exposure to a painful or injurious [or distressful] situation over which the subject has no control and which the subject is hindered to alleviate". Baumans V et al. (2007). Making lives easier for animals in research labs. Animal Welfare Institute, p.35.

⁴ The perception of cephalopods as "honorary vertebrates" contains in its essence the bias of intelligence, in which hierarchical degrees are created based on the taxonomic classification. This reflects the Aristotelian *scala naturae*, which considers beings deemed as having superior intelligence as more worthy of moral consideration.

Rocha-Barreira, 2016; Mather, 2008). Cephalopods have sensory cells that perceive the environment, as well as tactile and chemoreceptor cells and olfactory organs (Cascon & Rocha-Barreira, 2016). They have the five senses: sight, taste, touch, smell, and hearing-like (sensitive to vibrational stimuli and low-frequency sound) (Hanlon & Shashar, 2003; Hanlon et al., 2018). The presence of sensory cells and the five senses denote sensory information experience. They experience pain and suffering; when they are injured, they protect the injured body area for long periods (Alupay et al., 2014). Many cephalopods use tools, have task-solving abilities and spatial memory and locate in space; these qualities demonstrate analytical ability and memory. Cephalopods form concepts, learn, and have sophisticated and playful behaviours, controlling minds, and different personalities, in addition to social relations, numerical abilities, decision-making and a sophisticated system of signalling and communication (Alupay et al., 2014; Authority, 2005; Bortot et al., 2021; Hanlon et al., 2018; Mather, 2019; Mather, 2008).

Crustaceans

The class of crustaceans is composed of 42,000 described species, including decapods, barnacles, sea lice, and small crustaceans such as brine shrimp, copepods, and water fleas. Decapods (shrimp, prawns, crabs, crayfish, lobsters) demonstrate being sentient. There is strong evidence indicating the ability of these animals to experience pain, particularly crabs, lobsters, and crayfish (Crump et al., 2022). They experience suffering and are aware of the location of pain (Barr et al., 2008; de Souza Valente, 2022b; Elwood et al., 2009; Gherardi, 2009). Most decapods exhibit decision-based behaviour (denoting reasoning capacity), respond to analgesics and anaesthetics, protect injured body parts (protective response), and present prolonged behaviour modification when subjected to painful stimuli (de Souza Valente, 2022a; Sneddon et al., 2014). Some decapods (e.g., European shore crab *Carcinus maenas*) exhibit memory and spatial learning capacity (Davies et al., 2019). Most of them have a developed visual system, with colour discrimination or polarisation sensitivity, depending on the species (Cronin & Feller, 2014; Marshall & Cronin, 2014), denoting information experience. Decapods produce and perceive sound, including aquatic or terrestrial species, and present acoustic signalling (Budelmann, 1992), indicating information experience and social communication. Many decapod species exhibit parental care behaviour, commonly performed by females though biparental care occurs; caring complexity depends on the species and habitat (Fernández et al., 2020; Palaoro et al., 2020). This raises the possibility of the existence of parental feelings in decapods. Shrimp exhibit play behaviour (author's personal observations) suggestive of pleasure experience. On the other hand, what is currently understood about the cognition and possible sentience of crustaceans other than decapods is minimal; most studies on their well-being are focused on biology and behaviour (e.g., feeding, breeding), not on their potential sentience. Nevertheless, practices that harm the welfare of crustaceans persist. One can find commercial establishments offering their customers the service of cooking live decapods. Crustaceans are

commonly sold alive and wrapped and often crowded and immobilized, and aquatic species are exposed to open air.

Insects

Three-quarters of all animals described thus far are insects (Katayama et al., 2008), with approx. 5.5 million estimated species. This means 200 million individual insects for every human being or the equivalent biomass of ants and humans (Tavares, 2016). There are strong suggestions many insect species have subjective experiences, are sentient beings, and have interests that matter morally (DeGrazia, 2020). Honey bees, ants, beetles, and ladybirds exhibit information processing and categorisation, attention to and recognition capacity of individuals and objects, communication and causal reasoning, mental representation of space and time, and numerical cognition (Baracchi & Baciadonna, 2020; Bortot et al., 2021). There is strong evidence that adult flies, mosquitos, cockroaches, termites, and bees have the capacity to feel pain (Gibbons et al., 2022, 2024). Ants, social bees, and wasps have complex social interactions where communication socially modulates community life (George & Brockmann, 2019), denoting social relationships, awareness about others, and communication systems. Individual bees have distinct personalities and preferences (Chittka, 2022), indicative of animal personality. Social bees detect chemical signals in their olfactory chemoreceptors (sensillum) located in the antennae and feet; each chemoreceptor contains one or more sensory neurons that connect to the brain region (Wittwer et al., 2017), suggesting sensory information experience. Some insects from Blattodea, Coleoptera, Hemiptera, and Hymenoptera Orders present parental care⁵ (Siefert et al., 2021; Steiger & Stökl, 2017; Suzuki, 2013), suggestive of possible parental feelings. Insects, particularly large ones (e.g., Orthoptera Order; moths), produce and perceive sounds (hearing capacity), and use acoustical signs for social communication and detection of predators (Michelsen, 1992; Römer, 1992), connoting information experience and social communication. Bumblebees learn tasks and make efforts to be rewarded, and the task is learned by observing cohorts (learning abilities); they work together in a collective effort to achieve the reward (social communication, awareness of others) (Alem et al., 2016), have play behaviour (potential pleasure experience) (Dona et al., 2022), and learn from unpleasant experiences (Ings & Chittka, 2008). Bees avoid making uncertain decisions about what to do when facing difficult situations (reasoning capacity) (Perry & Barron, 2013), and bees and wasps recognize faces and patterns (awareness of others, analytical abilities) (Avargues-Weber et al., 2010).

Nevertheless, insects are largely excluded from moral consideration or animal protective legislation. Many insects are used as model organisms for conservation, ecotoxicology, and biotechnology studies (Muhammad et al., 2021; Vilcinskas, 2010), but most regulations for animal experimentation do not include them. Severe and invasive procedures (e.g., lobotomy) are practised on insects such as

⁵ Parental care refers to any parental (maternal, paternal, biparental) characteristic or contribution that increases the fitness of the offspring. In insects, it can be pre- and post-oviposition.

fruit flies (*Drosophila melanogaster*) without any legal protection for these individuals (Magalhães-Sant'Ana, 2009). Insects are exploited in different industries (e.g., honey, silk, insect meat). In anthro-po-entomophagy, approximately 2200 species of insects are used for human consumption, including beetles, ants, crickets, and grasshoppers, in addition to arachnids such as spiders and scorpions (Lucas et al., 2020). Noticeable is the death of a huge number of individual insects necessary to produce one kilogram of insect meat. Annually, 1.2 *trillion* individual insects, from larvae to adults, are farmed to serve the entomophagy and feed markets (Rowe, 2020), a quantity 15 times greater than the number of farmed individual birds and mammals that are annually killed for food (i.e., approx. 79 billion) (Šimčikas, 2020). In addition, the insect meat industry faces an inherent difficulty: designing welfare measurements that contemplate the needs of multiple insect species, including the coverage of inter-population and inter-individual variability (Barrett & Fischer, 2023). Last, most current animal ethical theories, including sentiocentric ethics, aim to protect the sentient individual. In those theories, the sentient individual is the one who directly matters and can be harmed or benefitted. Therefore, if the sentience of most, if not all, insects is granted, the welfare of an enormous number of individual insects is widely disregarded, and this constitutes a serious, neglected ethical issue.

Arachnids

Arachnids comprise more than 74,000 described species, among which approximately 50% are spiders, 40% mites and ticks, and 10% scorpions. Most spiders and scorpions have eyes; the quantity and presence of them vary among species (Locket, 2001; Pechenik, 2015); they identify luminous intensity but are less able to distinguish shapes, especially those located at long distances (Bost & Gaffin, 2004). Most of them are therefore sighted animals (sensory information experience). The sense of touch is well developed in many arachnids; spiders and scorpions have sensory hairs that are sensitive to air current, movement, and vibration and are used in prey detection (Pizzi, 2011). Moreover, spiders have moisture receptors, photosensitive neurons throughout the body, and numerous nerve vibrations exposed to the external environment (Pechenik, 2015). With the tips of their legs, spiders taste food and test the substrate where they are (Pizzi, 2011). The capacity of sense (sight, touch, taste, vibration perception) denotes sensory information experience. In scorpions, the chemosensory appendage (pectines) contains mechanoreceptors and chemoreceptors capable of recognizing the type of substrate where the individual is and perceiving vibrations in the soil, as well as a function of location and detection of prey and partners (Avery et al., 2016; Brazil & Porto, 2016; Frye, 2011); these denote sensory information experience and analytical abilities. Although most arachnids live alone, many others live socially, such as social web-building spiders, who cooperate and work in groups to capture prey and take care of their offspring. They include spiders from the Agelenidae, Eresidae, Theridiidae, and Dictynidae families and the non-web-building but also social spiders *Delena cancerides* and *Tanpinullus* sp. (Pizzi, 2011). This indicates social relationships and connotes awareness about others. Jumping spiders plot their routes, plan multifaceted detours, have elaborate hunting

and ambush strategies, and adapt their hunting techniques to unknown defences of new prey (Harland & Jackson, 2000), denoting planning and analytical ability. These spiders are numerically competent, meaning they understand the number of prey, distinguishing between the numbers one and two and categorizing above the number three as “many” (Cross & Jackson, 2017). The gold silk spider (*Trichonephila clavipes*) adjusts the hunting time according to the success of the hunting (Bortot et al., 2021). These aptitudes denote reasoning capacity, learning, prediction, numerosity, and analytical abilities. Scorpions orient themselves in space and use vision to aid navigation, identification of relief, and following footprints; moreover, their directional choices are non-random, showing intentionality to return to the burrow they are familiarized with (Bost & Gaffin, 2004). It is suggested that scorpions use tactile information for navigation and store memories of substrate textures (Avery et al., 2016). These indicate spatial learning, information experience, analytical ability, and decision-making. Nevertheless, despite the suggestive evidence of sentience, only a few legislations include arachnids, namely, the ones that collectively protect invertebrates.

Bivalves

More than 20,000 species of bivalve molluscs have been described, the main representatives being oysters, mussels, clams, scallops, and cockles. Bivalves have a simple nervous system, with three pairs of ganglia. They have sensory filaments in the mantle region. Some species of the Pectinidae and Spondilidae families have eyes, which are in the mantle and structured with the cornea, lens, retina, and pigment layer (Cascon & Rocha-Barreira, 2016; Wilkens, 2008). Scallops use their vision to perform tasks like detecting predators, finding food, and choosing a habitat (Sumner-Rooney, 2023). Therefore, these species are sighted invertebrates; this denotes sensory information experience. When they perceive a threat, clams and scallops perform an escape swimming movement, which is a motor response mediated by the cerebral ganglion (Wilkens, 1981). The escape behaviour occurs after chemical-sensory detection or by contact with predators, which are potential noxious stimuli. This fact is highly suggestive of nociception, and even in a basic way, there is information processing (Crook & Walters, 2011). In a stress test, the cardiac activity of scallops (*Aequipecten opercularis*) was significantly higher when the scallop was threatened by a predator (i.e., starfish) and unable to find refuge than when the refuge was available or when the predator was absent (Kamenos et al., 2006). This physiological alteration is highly suggestive of negative affect. Therefore, although not conclusive, it is suggested that some bivalves experience stress and can be sentient.

The use and market of bivalves include production for human consumption, food supplements, jewellery, and medicinal properties (e.g., stone shellfish *Anomalocardia brasiliensis*, source of heparin and histamine) (Cascon & Rocha-Barreira, 2016). Nonetheless, bivalves’ potential suffering and welfare have received very little attention. There is no protective legislation on bivalves’ production in different industries, when used in research (e.g., ecotoxicological studies), or when they are commercially prepared as food. Like animals such as fish, snakes, annelids, and

coelenterates, bivalves are highly susceptible to the bias of the degree of empathy as they do not have a face, fur, or make sounds, and they do not commonly live in proximity to humans as pets. Although this does not affect their capacity for sentience, a lack of empathy hinders the perception of animal sentience, especially by non-specialists, leading, for instance, to less social activism on animal rights and contributing to the absence of more comprehensive legal protection. In addition, there are almost no studies on their sentience. Consequently, their protective legislation and welfare concerns are practically absent.

Other Invertebrates

Animals such as gastropod molluscs (e.g., snails, slugs, freshwater limpets, whelks) and annelids exhibit sensory abilities that include defensive responses to noxious stimuli, escape behaviour, and pain perception. Pain response as well as escape and avoidance behaviour are observed in leeches and sea slugs (Broom, 2013), snails (Kavaliers & Hirst, 1986), sea anemones, earthworms, and other annelids (Smith & Boyd, 1991; Stefano et al., 2002). Porifera (e.g., sponges), coelenterates (e.g., cnidarians, jellyfish, anemones, caravels, corals, hydras) and echinoderms (e.g., starfish, sea urchins, sea cucumbers) are perhaps the animals for which science is furthest from recognizing sentience.

Limitations of Advancing Animal Sentience Studies

The legislation and guidelines for animal protection greatly rely on the recognition of sentience in animals to include them in the legal scope and moral consideration, thereby excluding animals whose sentience is not recognized. Nevertheless, numerous invertebrate species are excluded from the sentience umbrella due to knowledge constraints, bias, and reductionism. Science, ethics, and legislation are limited by the current knowledge about the capacity of animals to experience, whether positive (inc. happiness, social values) or negative (inc. pain, fear) experiences in the short or long term. This impacts what humans can infer about animals' well-being and sentience (Berry et al., 2015). Consequently, several animals are excluded from moral consideration.

Potential Harm on Sentience Studies and the Low Priority to Positive Experiences

To designate moral consideration, traditionally it would be necessary to consider whether a being is sentient or not. Acquiring this knowledge requires studies to test the sentience hypothesis. Nonetheless, as most invertebrates are deemed insentient beings by science, there is a critical lack of regulations or ethical considerations when conducting animal research with them. One should consider that these studies potentially involve animal experimentation that could lead to discomfort, deprivation, pain and/or suffering. Relying on the principle of the 3 Rs, several animal legislations recommend, when possible, the replacement of “superior” sentient animals

by invertebrates or other “lower organisms”.⁶ Procedures in most invertebrates, including use in research, surgeries, mutilations, vivisection, and euthanasia, commonly do not need to be reviewed and approved by ethics committees; the use of analgesia or anaesthesia is commonly not mandatory; and the numbers of individuals used are not necessarily controlled. Tom Regan highlights that.

“In non-therapeutic research [such as animal experimentation], subjects are harmed in the absence of any intended benefit from them; instead, the intention is to obtain information that might ultimately lead to benefits for others” (Regan, 2004) p.249).

Notably, sentience is not limited to pain or other negative experiences; it also encompasses the possibility of having positive experiences (de Souza Valente, 2022b). Even though the current legislation strongly relies on the experience of pain for legal decisions and animal welfare protection, positive experiences must also be considered by science and policymakers. Positive experiences have moral significance. When denying pleasure and rewards to a sentient being (e.g., privation of freedom, harm of death), it is also being denied a pleasurable life worthy to be lived (Balcombe, 2009). This proposal concurs with the Five Freedoms and the fifth of the Five Provisions, i.e., the freedom from fear and distress, prevention of mental suffering, and promotion of positive mental experiences (Mellor, 2016). Studies on animal sentience should consider prioritizing positive experiences.⁷

Technology Limitations, Personal Subjective Affect, Anti-Anthropomorphism, and Conclusive Proof

Some experiences (e.g., suffering, happiness) can be inferred based on the behaviour repertoire understood as the expression of subjective experiences, i.e., there is a meaning to the observed proactive behaviour rather than a mere passive response to the environment (Gomez-Marin & Ghazanfar, 2019). Nevertheless, one should consider science may not recognize animal sentience in a particular species due to current limitations in technology. For instance, the present difficulty in distinguishing between conscious and unconscious affect in animals and the need to develop new methodologies to study animal subjective feelings and emotions (Browning & Birch, 2022). Moreover, it is inherently impossible to acquire objective knowledge

⁶ The idea of inferior organisms, still present today, is perhaps a reflection and has its origins in Antiquity, when animals such as worms, due to the absence of ears, nose, distinct head, eyes, and limbs, were understood as imperfect animals. Pie, M. R. (2016). Evolução, classificação, sistemática e filogenia. In A. Fransozo & M. L. Negreiros-Fransozo (Eds.), *Zoologia dos Invertebrados* (pp. 132–145). Guanabara Koogan. (Pie 2016).

⁷ The study of positive welfare of invertebrates is still incipient and requires practical considerations on the biology and requirements of each species. It can be oriented by the study of positive welfare of vertebrates, including the assessment of physiological (e.g., heart rate, endorphin release), neurobiological (e.g., sensory systems), and behavioural (e.g., playful behaviour) indicators of animal welfare and the experience of positive affect. Boissy, A., et al. (2007). Assessment of positive emotions in animals to improve their welfare. *Physiology & behavior*, 92(3), 375-397.

of the personal phenomena of subjective emotions, feelings, and thoughts. Additionally, the anti-anthropomorphism⁸ of science limits natural heuristics and thus restricts the empathy that could facilitate the recognition of animal sentience (Bruni et al., 2018). Finally, the obsessive need for science to present definite proof about the sentience of an animal to give them moral consideration and protection is shown to be incongruous and paralyzing. Griffin (2000) calls this inability (or denial) to deal with incomplete evidence “paralytic perfectionism”, i.e., the quest for perfection, which often paralyzes advances in knowledge and practical changes. Due to the many subjective aspects of animal studies, there is no requirement for a high degree of certainty about animal sentience and cognition to include them in the practical ethical debate and legal protection (Jones, 2013). Although science should constantly search for evidence, uncertainty and limitations should not prevent advances in animal ethics and protection.

Reductionist Science and the Error of Using Science as Ethical Guidance

Similarly, current science is still reductionist when mechanizing and instrumentalizing animals. Reductionism⁹ here is discussed as an epistemological limitation, i.e., a limitation in the development of the sentience concept, constraining related-knowledge evolution, with direct implications for animal rights and welfare. Welfarism is taken to stand for normative guidance, hence regulating practices based on this instrumental viewpoint, a posture that resembles Thomas Aquinas’s theory of indirect duties that sustains one should treat animals the best as possible, not because they have the right to, but for the sake of one own morality since animals would be non-rational creatures devoid of ethical value (Benzoni, 2007). Most current animal protective legislation (e.g., Brazilian Arouca Law; Canadian Council on Animal Care; European Directive 2010/63/EU; USA Federal Rural Law), despite significant advances in animal legal protection, remains speciesist and anthropocentric when providing indirect protection to (some) animals and having at its core the objective anthropocentric model, whereby animals are seen as objects and human interests have greater weight (Cunha, 2021). Along with environmentalism, moulded culture, and unfamiliarity, a misconception that contributes to this scenario is the use of science as the final voice to formulate political-legislative decisions. Notably, the purpose of science is to investigate and describe what happens in nature.

⁸ Anthropomorphism is “an attitude to attribute human psychological features, more than physical ones, to other entities [including animals, which] may work as a natural and frugal heuristics” (Bruni et al., 2018, p. 2). The scientific community often rejects anthropomorphism (the anti-anthropomorphism of science cited in this article) due to concerns regarding unbiased data interpretation. On the other hand, some thinkers suggest anthropomorphism has benefits (e.g., recognition of animal emotions, facilitation of empathy towards animals), and not only negative aspects; anthropomorphism can be accepted in scientific studies with a mindful attitude to its positive and negative aspects (Chan, 2012, Safina 2016, Bruni et al., 2018, Williams et al., 2020).

⁹ Reductionism also encompasses other philosophical viewpoints such as methodological aspects (e.g., the rigid accuracy of the analytical method resulting from scientific rationalism) and ontological arguments (e.g., the metaphysical concept that understands that a given being can be simplified to small entities (like Descartes’ automata animal, as opposed to the holistic concept of unity).

The role of ethics and value theory is to, with this description, guide ethically and prescribe what should be done in this given situation (Cunha, 2021). Thus, ethics should assess what is right or wrong, not science. Political and legislative decisions shall refer to the scientific description of nature, and animal welfare policies should be guided by the best science; however, those decisions and advancements must be based on the prescription of (animal) ethics. Scientists, philosophers, and stakeholders should incorporate protective measures in cooperative decision-making. Most, if not all, invertebrates demonstrate to be sentient and worthy of moral consideration, making it urgent to review and update animal law aiming at including all invertebrates under proper protective legislation.

Moral Consideration Beyond Sentience

Although animal sentience is remarkably ethically relevant, the intrinsic value of each individual animal should also count when considering who is worthy of moral consideration. Sentience should not be the only limiting factor when giving moral consideration to a being. Sentience would be sufficient to determine whether a being is worthy of moral consideration only if it were possible to be certain about its sentience; however, this certainty does not exist in absolute for all animal species. In addition to sentience, the intrinsic value of each individual animal should also count when deeming moral consideration towards animals.¹⁰

Suffering can occur without subjective or phenomenal consciousness (Carruthers, 2004). In such a case, a being can suffer but shows no subjective indication of conscious suffering. Additionally, animal well-being can be granted without certainty of their conscious experience by ensuring animal physical health and respecting what they want¹¹ (Dawkins, 2017), both integral parts of their own interests. Similarly, the precautionary principle should be adopted in cases in which sentience cannot be proved. One can assume all animals are sentient because, if they are not, they will not suffer any harm from being treated as if they were.¹² Furthermore, giving moral consideration to a being who may not be sentient does not diminish the moral consideration given to beings known to be sentient. Withal, there is no need to classify animals as sentient or not to recognize their own quest for a life with dignity and freedom. Even if the sentience of some animals cannot be demonstrated, their well-being should be considered, as they respond to environmental influences and have intrinsic and social value to other living beings. Although one may argue that more effort should be placed into preventing negative affect on proven sentient beings,

¹⁰ In this regard, Verhoog (1992, p. 151) argued that “animals have a value independent of their utility value for human beings, then the emphasis is no longer on the sentience of the animals, although this may, under some circumstances, be an extra reason for respecting these animals”.

¹¹ Humans can recognize what animals want by, for example, observing that animal’s behaviour, which indicates whether an animal wants to remain in a certain situation or wants it to cease (Dawkins, 2017).

¹² This argument should not be understood as an evasive commitment; on the contrary, it implies a significant responsibility when calling to consider (potentially) all animals as sentient. When considering all animals as sentient, human’s ethical responsibility extends to all of them.

the welfare of all animals can and should be the subject of ethical debate (Broom, 2022). One should remember “absence of evidence is not evidence of absence”¹³—Martin Rees. Therefore, well-being must be considered both for sentient individuals and for individuals whose sentience may not be possible to prove (Broom, 2020).

Prehistoric society believed animals have a soul (Phillips, 2022). The soul, as presented in the Aristotelian work *De Anima*, is the vital principle or manifestation of life present in all living beings, which have their dignity associated with the soul itself (McInerny, 1996). Despite his rigid *Scala Naturae* and controversial position on the animal mind, Aristotle (384–322 BCE) thought animals “have sensory of perception, desires, memory, imagination and even emotion”, with a sensitive soul capable of awareness (Mesaros, 2014), p. 186). According to this pre-modern conception of sentience, animals not only have a nutritive soul (the most fundamental power of life also present in plants and related to nutrition and reproduction) but also a sensitive soul that is endowed with sensory powers (Bennett & Hacker, 2022).¹⁴ Note that the soul is not the inner subject who experiences (necessary for sentience) “but is the essential, defining powers of a living thing” (Bennett & Hacker, 2022), p. 15). The notion that animals possess a sensitive soul aids in supporting the intrinsic value of each individual animal with their own interests that include a life worth living and fulfilled with sensory powers. Likewise, the term “soul” comes from the Latin *animus* or *anima*, meaning animus, which animates. The word “animal” displays an etymological recognition of the soul in animals, beings endowed with a soul. Notably, Western philosophy, early in its history, recognized the presence of the soul in animals. Nevertheless, to justify animals being used and exploited by humans, it was no longer necessary or possible to recognize the presence of their soul; hence, the soul was (theoretically) removed from them; now, only humans possess a soul (Cragolini, 2015). This anthropocentric speciesist view is observed in different modern dictionaries when the word “soul” is defined as a human attribute, excluding other animals from the definition. Humans lose their *anima* when they no longer see themselves as animals. Disregarding that humans are also animals (and with *anima*) puts them in a superior category that hampers the recognition of sentience, consciousness, and soul in the different animal species.

Animals should be given moral consideration, dignity, and protection, regardless of their biological characteristics or what is known or can be known about their potential sentience. Deeming animals worthy of moral consideration should not only be based on what is established about their cognition, biology, and sentience but

¹³ Note that the burden of proof is not excluded by the axiom; it considers potential limitations to obtaining definitive proof of a given hypothesis or the impossibility of obtaining it. The axiom should not be understood as an ode to ignorance or acceptance of low-quality science. Nevertheless, one should avoid the mistake of hastily concluding that something does not exist due to the absence of proof. For instance, Sneddon, L. U., & Leach, M. C. (2016). Anthropomorphic denial of fish pain. *Animal Sentience*, 1(3), 28. when discussing the capability of fish to feel pain, address “the incompleteness of current knowledge certainly does not constitute evidence for inferring that fish in particular do not feel pain.”

¹⁴ According to this Aristotelian perspective, humans have the nutritive, the sensitive and the rational soul. The last one would be exclusive to humans and would provide the powers of thought and will (Bennett & Hacker, 2022).

also on their rights and dignity as living beings. Hierarchical scales and anthropocentric classifications should not be the exclusive guide. A precautionary concept of sentience would include all experiencing animals in the sentience umbrella. Additionally, an understanding of animal value beyond sentience can also be considered. The current ethical perception should include and respect animals for who they are: beings with a soul and inner movements that support their own individual purposes and values, with morally significant lives and an end in themselves. As addressed by Broom (2020), p.1, p.1, p.3):

“Invertebrates deserve moral consideration too. [...] All animals have welfare but humans accord more protection to sentient animals. Humans should be less human-centred. [...] All individuals of any animal species can have moral actions addressed to them.”

Final Considerations

Presenting and debating the ethical distinctions humans make raise questions about the dignity of animals and the moral consideration they are granted. One asks how much distress vertebrates and invertebrates are subjected to based on reasons that are not possible to sustain on ethical grounds. Many animals, including invertebrates, experience intense physical and emotional suffering. Several invertebrates are sentient animals, with the expression of emotion and pain, are capable of suffering, experience positive and negative emotions, and are capable of perceiving themselves as a self. A revision of the traditional understanding of which animals are sentience is crucial; an extended understanding would include numerous invertebrate species (Broom, 2014). Likewise, changes in the attitudes towards invertebrates' welfare can be and should be taken. Honest and genuine debate on animal ethics will lead to moral consideration without distinctions between any individual or animal species. Browning and Veit (2020) suggest combining invertebrate welfare and sentience sciences to achieve, for example, humane methods of killing (e.g., substituting the use of neurotoxins that cause prolonged death for fast humane slaughter), the use of analgesia during painful procedures, the revision of the 3Rs recommendation for the replacement of vertebrates by lower organisms (i.e., invertebrates), and the improvement of husbandry and housing of captive invertebrates.

Animal ethics and protective legislation have come a long way in recent decades. The current sentiocentric era, however, is mostly based on and dependent on the recognition of sentience to include animals in the ethical debate and legal protection. Nevertheless, one should consider that current limitations and intrinsic bounds hinder the advancement of knowledge about animal sentience. Countless animals are excluded from any moral consideration or protection. Relying exclusively on current or conceivable understanding regarding animal sentience is reductionism. Many animals considered non-sentient may be as so, but current or inherent limitations may prevent us from recognising it. Animal ethics and legislation should maintain the sentience in the debate due to their immense value. Nonetheless, animal ethics and

legislation must consider the intrinsic value of each individual animal and become animal-centric ethics, which will reflect on the direct legal protection of all animals.

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