



# Animal

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### Review: Connecting circularity to animal welfare calls for a 'novel' conceptual framework based on integrity



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#### ABSTRACT

The current food system is not sustainable. Circular agriculture aims to save the environment and produce food sustainably by closing nutrient cycles, possibly without improving animal welfare. This paper proposes a new conceptual framework, called a circular welfare economy (CWE), to facilitate a transition towards a sustainable agriculture based on integrity. The CWE framework explains how welfare relates to circular agriculture, how potential conflicts can be solved and what future livestock farming could look like. CWE applies the notion of circularity to welfare defined as the quality of life as perceived by the individual itself. CWE also identifies *human integrity*, defined as being open and honest, as a sine qua non for sustainability. Animal-welfare problems arise when animals are merely used as a means, e.g., for profits. Instead, profits and circular agriculture are means to the end of welfare. In a CWE, welfare is promoted sustainably, without causing undue need frustration in other individuals. This requires informed moral decision-making involving human integrity and the closure of welfare-related feedback loops. Conflicts between circular agriculture and animal welfare are solved by weighing all welfare needs impartially. Three future scenarios are presented: Animal-welfare-exclusive circular agriculture, which resembles modern intensive livestock farming, animal rights agriculture without livestock farming, and a CWE-based agriculture which integrates circular agriculture and animal welfare. In the latter case, we will not use animals merely as a means to close nutrient cycles, but take every effort, openly and honestly, to understand and benefit their points of view as we do our own.

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#### Implications

This paper examines the relationships between animal welfare, circular agriculture and sustainability. We propose a paradigm shift away from current intensive livestock farming towards a production system embedded in a so-called circular welfare economy based on integrity. Key question in such an economy is whether we are truly being open and honest. This means, in particular, that rather than regarding animal welfare as a peripheral issue, it becomes the prime driver of sustainable development. This is, because the welfare of all animals, not just the welfare of our own species, is what matters for sustainability.

*Abbreviations:* CWE, Circular welfare economy.

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#### Introduction

Despite some publications to the contrary (Leroy et al., 2022), we believe the current food system, and in particular intensive livestock farming, is not sustainable. In each of the three pillars, i.e., environmental, social and economic, our current food system is facing challenges such that it probably cannot be sustained in the long run (Godfray et al., 2018; Poore and Nemecek, 2018; Rohr et al., 2019; Leclère et al., 2020). Interestingly, in predominant conceptions of sustainability, which sometimes even seem to focus almost exclusively on environmental concerns, the issue of animal welfare is often neglected (Visseren-Hamakers, 2020). Nevertheless, animal welfare is a major concern (Bracke, 2020; Broom, 2022). It merits attention besides concerns related to climate change, biodiversity and how we can feed the global human population in the future.

Circular agriculture aims to feed the world while preserving the environment by closing nutrient cycles (De Boer and Van Ittersum,

2018). The idea is to maximise nutrient-cycling efficiency through a reduction of food waste and food loss based on the following principles:

1. Arable land feeds humans (i.e., our diet is primarily plant-based);
2. Biomass unsuited to feed humans feeds animals (to feed humans);
3. Biomass unsuited to feed animals fertilises the soil (De Boer and Van Ittersum, 2018; Van Zanten et al., 2018; Van Zanten et al., 2019) (see also Muscat et al. (2021) for a more recent, though less structured set of principles for a biobased economy).

The ultimate reason to close nutrient cycles is to ensure good welfare, in particular human welfare. Livestock production plays a key role in circular food systems (Van Zanten et al., 2019). However, when animals are merely used as a means, regardless of whether this is solely to earn money or also to close nutrient cycles, animal-welfare problems are likely to continue. This raises the question of how to best integrate animal welfare into circular agriculture.

By aiming to produce sufficient food as a basis for long-term human welfare, circular agriculture may be an anthropocentric concept (Bovenkerk et al., 2020). We need food to survive. Concern over food security can spark social conflict, as can concern over ecosystem degradation. However, while food security in a circular food system seems necessary for our long-term welfare, it is not sufficient. Other welfare needs are also important. We also need to avoid climate change and health issues like obesity, and we need basic freedoms like freedom of expression and moral autonomy. When we succeeded in closing nutrient cycles and in preserving wildlife habitats, we could, therefore, still have major welfare issues, not only in humans, but also in animals. Animal-welfare issues would probably persist in an animal-welfare-exclusive circular agriculture in which farm animals were raised in current farming systems. For example, the practice of tail docking could continue when it facilitated the closure of nutrient cycles. Pigs with intact tails may need more resources like space, enrichment and health care (EFSA, 2022). Also, the use of inadequate enrichment materials could continue in welfare-exclusive circular agriculture. Balls that look like hockey balls are affordable, they look nice and last long, and farmers may even call them 'sustainable', but such balls have an inferior enrichment value for the pigs (Bracke and Koene, 2019). And even if animals in welfare-exclusive circular agriculture had natural lives, their welfare could still be compromised, for example, when they were exposed to predation or harsh weather conditions. Circular agriculture could also generate other societal concerns. Herbivores, for example, have a special role in circular agriculture by converting inedible grass into animal-based food. However, by producing methane, they also contribute to climate change. Thus, circular agriculture addresses crucially important aspects of sustainability and especially human welfare. But its relationship with overall sustainability requires a broader scope and an open mind regarding potential welfare problems.

We, therefore, decided to explore the relationship between circular agriculture and animal welfare in three papers. In two more empirical papers (Boumans et al., (2022) and another paper that is still in preparation, we explore the welfare consequences of feeding pigs and poultry using food losses or food waste in circular agriculture. There we suggest that animal welfare may remain at a similar level in circular agriculture as compared to the current level in intensive livestock farming. The objective of the current paper is more conceptual. Here, we present an elaborated conceptual framework addressing the welfare concerns of both humans and animals in a new kind of economy based on integrity. We refer to this framework as a circular welfare economy (CWE). In a CWE,

nutrient cycles are closed, not as an end in itself, but as a means to close welfare cycles. We explain how animal welfare relates to circular agriculture, as well as to overall sustainability and morality. The CWE framework explains how potential conflicts between animal welfare and circular agriculture can be solved. We also identify the main synergies and what the future of livestock farming could look like. The latter question we address with and without integrating welfare and circular agriculture in a CWE-based circular welfare agriculture. Note, however, that in this paper, we do not intend to add to the animal-ethics literature. Our aim is to contribute to the more empirical knowledge base of animal welfare and circular agriculture (see also the acknowledgements).

## Exploratory elaboration

Since the focus of this paper is to present the framework of a CWE, the underlying activities are summarised here briefly (for more details, see the [supplementary Material S1](#)). We elaborated on our earlier views on this subject in several ways. Firstly, we made several tentative hierarchical decompositions of animal welfare in relation to livestock farming and sustainability (and its triple-p concept of people, planet and profit; [Supplementary Material S1.1](#)). Secondly, we explored different types of farming, i.e., current intensive livestock farming (which may also be called linear livestock farming), farming based on the principles of circular agriculture, farming based on CWE principles called circular welfare agriculture, farming based on animal rights (i.e., animal rights agriculture) and traditional farming (before mechanisation). The results of a personal brainstorm were plotted in a table guided by the four why-questions proposed by Tinbergen to explain animal behaviour (ontogeny, phylogeny, causation and function (Tinbergen, 1963)). In doing so, we applied Tinbergen's questions to a specific kind of animal behaviour, namely farming (see [Supplementary Material S1.2](#)). Thirdly, we developed the notion of a CWE further in the ongoing debate between livestock farmers and animal advocates on social media, in particular on Twitter. The results can be traced by searching for @marcbracke and key words such as #CWE and #Integrity on Twitter (partly in Dutch). Fourthly, we presented our views at meetings of our own departments at Wageningen UR, and at an international conference on welfare assessment (Bracke et al., 2021), as part of what could be called peer-supported theory development. To this end, and fifthly, we also conducted a questionnaire ([Supplementary Material S1.3](#)), sent out to 110 contacts, mainly (72%) working at Wageningen UR. The response rate was 21%. Responses, presented in [Supplementary Material S1.4](#), were used to further improve upon our developing views as also presented in a YouTube video as part of the questionnaire (Bracke et al., 2020). In the next paragraph, we highlight some similarities and differences of opinion between ourselves and the respondents of the questionnaire.

Our views seem to be in sync with the respondents in a number of respects (see [Supplementary Fig. S1.4.1](#) in S1.4), e.g., that integrity is important, that welfare concerns may arise or continue when animals were treated solely as a means to cycle nutrients, that we should apply the golden rule (Don't do to others . . .) to animals too, and that circular agriculture should also improve animal welfare. Contrary to our views, the respondents showed relatively low support for the suggestion that animal welfare in the wide sense, i.e., including human welfare as well as non-human animal welfare, may be a common denominator for sustainability. We also found low support for the idea that saving the planet and feeding the world only matter because it matters to animal welfare in the wide sense, and for the suggestion that circular agriculture is possible in modern livestock farming. The respondents generally supported the view that animals want to live or have an interest

in life. This could mean that it is not morally acceptable to eat meat. However, the respondents gave only intermediate support for the suggestion that the welfare interests of humans and animals should be weighted equally, and that it is morally acceptable to consume animal-based products. We address these issues further below.

As a final, sixth, step in the elaboration of the conceptual framework, we summarised it both graphically in Figures (see Fig. 1 below and Supplementary Figs. S1.7.1–4 in S1.7) and formally using equations and if-then rules which also included a back-translation to text (Supplementary Material S1.5). Together, these activities were directed at ensuring a well-thought through conceptual framework that, we believe, now merits a wider discussion in science and society to support sustainable development, especially in livestock farming.

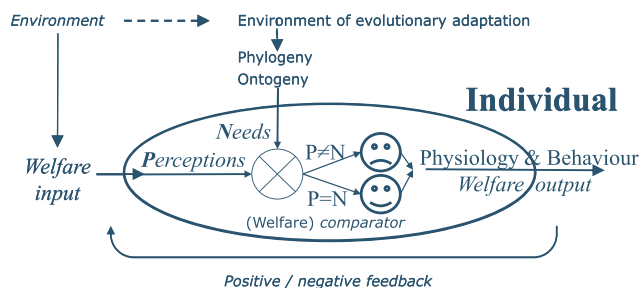
## Conceptual framework

### Concepts

In this paper, we introduce the notion of a CWE, as far as we know for the first time in the scientific literature. It provides a conceptual framework that explains how animal welfare relates to circular agriculture and to overall sustainability. It also provides a benchmark of sustainability, namely by asking the question whether what we are doing can be explained openly and honestly. A CWE was previously conceptualised (Bracke, 2017a) in response to the notion of a 'circular agricultural economy', which focusses on the circulation of nutrients. The idea of a CWE was to emphasise that in a transition towards circular agriculture, we should not forget about animal welfare.

Animal welfare is more important than people commonly realise. It is not true that animal welfare is an aspect of sustainability only because it raises public concern. This idea may arise from a notion of sustainability that is primarily conceived in terms of public acceptability (Broom, 2021). However, animal welfare matters not only to some concerned members of the public. It matters first and foremost to the animals themselves, and it can do so even when human concern is not raised at all. This may happen when consumers have self-interested reasons for not being concerned about production practices judged by experts to indicate reduced welfare (Mandel et al., 2022). Even the experts, however, are not a gold standard (see e.g., Bracke and Spoolder (2011)), because by definition, animal welfare is what matters to the animals themselves. This means that animal welfare covers everything that matters to the quality of life of an animal, whether human or non-human. In this wide sense, animal welfare is not some subordinate component, but in fact the ultimate objective of morality and sustainability. This means that we should not respect animal welfare only because some people find it important, but because it is a goal in itself. And it is most reasonable to assume that their welfare matters to them as much as our welfare matters to us.

A CWE was also related to the concept of *human integrity*, defined as being open and honest, because it was seen as a necessary condition for sustainability (Bracke, 2017a). This seems almost self-evident as integrity is necessary for informed decision-making, and a lack of integrity cannot be sustained. Nevertheless, the notion of a CWE based on integrity also raised questions (see Supplementary Material S1.4), e.g., in relation to the (mis)conception that circular agriculture will inherently also improve the welfare of animals. This indicated a need for a more thorough elaboration, the results of which are presented in this paper. Note that in this paper, we will use the term *integrity* to refer to human integrity, unless specified otherwise.



**Fig. 1.** Conceptual framework for welfare assessment of sentient individuals, i.e., human and non-animals (source: Wiepkema, 1987; modified after Bracke, 2008). The primary welfare feedback loop runs from welfare output, which comprises mostly behavioural and (stress/patho-) physiological responses, to input, which comprises mostly environment-based stimuli. A welfare circle is closed when the feedback loop allows the individual to succeed in reducing the discrepancy between the environment (as perceived by the individual) and the individual's welfare needs. The latter have been shaped in the course of evolution and the individual's life history. The welfare comparator (circle with cross) generates positive and negative emotions or feelings (represented here as smileys). These can also be referred to as need/preference satisfaction and frustration, respectively. P: Perception; N: Welfare need.

A CWE, thus, puts the notion of welfare centre stage. A CWE adds to welfare the notions of circularity and economy. The former derives from the concept of nutrient circularity in circular agriculture, but applies it to welfare. The latter notion is, of course, related to the agricultural economy that shaped modern farming, but again applies it to welfare. Thus, rather than closing nutrient cycles or making money, the prime objective of a CWE is to close welfare cycles. Welfare circularity aims to satisfy welfare needs using preference-utilitarian principles derived from economics, e.g., by optimising welfare-production efficiency.

Welfare circularity is important, because the mere physical closure of nutrient cycles may otherwise be at risk of perpetuating the profit-centred materialism that is threatening the world at present. Like nutrient circularity, welfare circularity emphasises the interconnectedness of organisms in ecological systems. But unlike nutrient circularity, it manifests itself mentally rather than physically. Welfare circularity is restricted to the life cycles of sentient beings. When one animal feeds on another, nutrients are transferred (but not all nutrients). At the same time, welfare too is transferred, as it were (but not all of it). In order to live, a predator must take the lives of prey animals. To some extent, the successes and failures of the predator's hunting attempts are associated with the experiences of capture and escape in prey animals. This principle of welfare 'transfer' does not only apply to food, but to other limited resources as well. If one individual manages to obtain a limited resource, this generally means others cannot.

A CWE builds on the semantics, i.e., the meaning, of the concept of welfare. Welfare is defined as the quality of life as perceived by the individual itself (Bracke et al., 1999). An individual's welfare is its state of need, i.e., the degree to which its welfare needs have been satisfied and/or frustrated (Bracke, 2022). Welfare needs, i.e., all goals that contribute in some way positively or negatively to an animal's quality of life, are cognitive-emotional control systems that have evolved in the course of evolution to deal with a variable environment (Wiepkema, 1987) (see Fig. 1). Examples include food consumption and rest, which happen in diurnal cycles, and mating and rearing of young in reproductive cycles. Furthermore, each welfare need essentially represents a perceived set point. This is a goal which, depending on the degree the animal succeeds in obtaining it, is associated with a positive or negative feeling. Welfare needs, therefore, are conceptually linked to preferences issuing a prescription of the kind 'Let this (not) happen to me' (Hare, 1981). It is in virtue of the prescriptive element in their

meaning that preferences have moral relevance (Hare, 1981). All sentient beings have welfare, i.e., they have, at any point in time (at least when they are conscious), a certain welfare level. The welfare level is the degree to which the individual's welfare needs or preferences have been satisfied. Welfare is, by definition, all that matters, and nothing else matters except if it matters, in one way or the other (i.e., consciously or unconsciously; directly or indirectly; now or in future) to a sentient being. A logical consequence of this semantic analysis is that for anything to matter, i.e., to be of value, it is necessary that it affects the welfare of a sentient individual. For example, people sometimes think that making money matters as an end in itself. However, profits only matter because they matter to human welfare. If making profits implies harming animals, then profits also matter to animal welfare. Similarly, the closure of nutrient cycles in circular agriculture only matters because it matters to the welfare of humans and animals.

### *Integrity as precondition for welfare*

The word integrity derives from the Latin word *integer*, meaning whole, complete, intact or untouched. In mathematics, an integer is a whole, non-decimal number. So, animal integrity could be defined as being whole or intact in a way that is typical of the species. This definition could also apply to humans. Animal integrity in the wide sense would not only imply having an intact body but also intact behaviour, e.g., being able to perform so-called natural or species-specific behaviours and a full behavioural repertoire, and/or being intact with respect to other phenomenological characteristics and capacities of the individual (after Cox et al. (2014)). In this paper, however, we define *human integrity* more narrowly as being open and honest regarding what (we know or believe) is true and morally right (modified after McFall (1987)). Human integrity is related to animal integrity in the wide sense in that if we are open and honest, we are whole or intact in a way that is typical of the human species. When we are not open or not honest, we hide part of how we really are. Human integrity encourages us to live up to our goal of being rational and moral, and if we do not, to at least be open and honest about it.

Despite its tendency to generate resistance, we propose human integrity is a key concept of, and necessary condition for, overall sustainability. For human integrity, it is not enough to be open and honest only about what is in one's own interests. Being open only about things which are in our own interests is at best 'partial integrity' (an oxymoron, a partial whole). Full human integrity requires an unconditional transparency about how the promotion of our own welfare affects the welfare of others. That is difficult. We seem to have cultivated a false (self-)image of integrity, characterised by *de facto* closing off, or even responding aversively, when we are confronted with our integrity deficits. Full/true human integrity requires telling the whole truth (as you see it), and nothing but the truth. It also means acting on the available information. And it means being prepared to share information others need from their points of view. The latter is important because we may tend to be paternalistic. We should not deprive others of information that is relevant for them. Integrity means we allow others to make their own moral decisions (autonomy). Society is full of partial integrity. What we really need is full or true integrity. When we only do things we can explain openly and honestly, we will get closer to the truth and make better decisions. We do not need absolute certainty. In fact, human integrity implies we must always remain open to the possibility that we are mistaken. In the end, true human integrity will greatly benefit moral and political decision-making. This will improve our own welfare. It will enrich our lives, and it will bring us closer to ourselves, as well as to other sentient beings.

Human integrity entails *data integrity*, i.e., information transfer that is accurate and consistent over its entire life cycle, i.e., free of copying errors (after Boritz (2005)). This, for example, means that we communicate our welfare assessments and contributions, openly and honestly, with the least possible distortion.

Human integrity is also likely to promote non-human animal integrity, which in the case of domesticated animals often primarily means respecting an intact body such as an intact gender (no castration), tail (no tail docking), beak (no beat trimming) and horns (no dehorning). Such mutilations are attempts to fit animals into unsuitable environments (Bovenkerk, 2020). However, we are reluctant to imply that animal integrity can be of value beyond welfare. This is because by definition, welfare is all that matters. Therefore, nothing else can matter (and this also applies to animal integrity), except when it matters to the welfare of a sentient being. This means that animal integrity is closely related to animal welfare and the satisfaction of welfare needs. As such, it also over-arches human integrity, which by definition too must relate to human welfare as a welfare need. It may even be a fundamental moral value which is necessary to human life in accordance with our capacity as rational and moral agents. Animal integrity in the wide sense promotes (the full range of) behaviours that human and non-human animals have a tendency to exhibit under natural conditions, i.e., in the environment of evolutionary adaptation. That is what organisms are best adapted to, and what is most likely to lead to welfare-need satisfaction. Defined in this way, natural behaviours are presumably pleasurable and they promote biological functioning (Bracke and Hopster, 2006). In humans, this facilitates behaviours that can be explained openly and honestly. When there is a conflict between (human and animal) welfare interests, human integrity promotes universalisable welfare. This is an unbiased enhancement of human and non-human welfare as that is by definition the only kind of welfare promotion that can be explained openly and honestly, rationally and morally.

In applied ethology, a notable kind of animal integrity that is related to human integrity has been discussed under the heading of *(dis)honest signalling* between animals (Dawkins and Guilford, 1991). In nature, survival and reproduction interests may lead to dishonest signalling. For example, prey animals may hide being ill or lame, and subordinate males may mimic females to obtain sneak matings and avoid open contests with dominant males (Mokkonen and Lindstedt, 2016). Deception, and even self-deception, is also part of human evolution (Mokkonen and Lindstedt, 2016). It is conceivable that such evolutionary processes may override a rational argument for human integrity. This may also apply to livestock farming where farmers who mimic sustainability while actually being more focussed on making profits may have an 'evolutionary' and economic advantage compared to farmers who are genuinely concerned about sustainability issues. But even if deception would generate biological fitness in humans, the principle of human integrity entails being open and honest also about these morally undesirable traits. We will have to deal with it as decently and rationally as we possibly can.

Dealing with dishonest signalling in humans is far from easy. Farmer representatives have, for example, stated that farmers always provide the best possible care for their animals (PigBusiness, 2019). To naïve readers, this seems to suggest that farmers are caring for their animals as much as they care for their own children. 'Best possible', of course, is ambiguous. It could even mean the very opposite. For example, when the 'best possible care' would be subject to maximised human profitability. In intensive farming, the amount of money available for raising pigs is about 2 Euros per pig per day (Hoste, 2013). The economic value of a spent laying hen may be as little as 5 or 10 eurocents (Bijleveld, 2015). Farmers know that this has major implications for 'the best possible care', but rarely do they acknowledge this openly. Full

human integrity would require farmers to specify what their care actually consists of (and what not). On the opposite side of the societal debate, we see a similar integrity deficit when animal advocates overly emphasise the downsides of intensive farming. Together, this leads to a self-reinforcing spiral of polarisation that may threaten western democracy if we do not succeed in cultivating human integrity.

### Evolution

Goal-directed behaviours have been successful strategies during natural selection in both human and non-human animals. Animals are primarily concerned about their own welfare, i.e., the closure of their own welfare feedback loops (selfish genes). Life in nature can be hard and associated with very poor welfare (Kirkwood, 2011), but evolution has resulted in animals generally being adapted to the so-called environment of evolutionary adaptation (Bowly, 1969). Evolution, thus, has shaped welfare through the circles of life. In line with this, in a CWE, we aim to improve welfare over time, and for this, we also need to progressively close nutrient cycles.

The environments in which animals are living today are very different from their environments of evolutionary adaptation. Through urbanisation, industrialisation and intensive farming, we are threatening the welfare and survival of many domesticated and wild species (Kirkwood, 2011; Leclère et al., 2020), even including our own (Ripple et al., 2021). We seem to have succeeded in promoting our own short-term materialistic welfare, while largely neglecting the welfare of other animals and future generations. Many consumers in Western countries are, for example, ingesting an over-abundance of animal-based products (OECD, No date; WUR, No date). Such levels of meat consumption are dissuaded for health and other longer-term human-welfare reasons (Godfray et al., 2018; Watts et al., 2020). They reflect a state of luxury rather than a nutritional necessity, also because plant-based alternatives exist that more efficiently utilise the planet's resources (De Boer and Van Ittersum, 2018; Van Zanten et al., 2019).

### Gorilla in the room: why we do not notice

In the process of shaping intensive livestock farming, we have often ignored the elephant or the gorilla in the room. In a classic psychology experiment, a substantial portion of observers engaged in a video task failed to notice a human dressed in a gorilla suit walking amongst basketball players (Chabris and Simons, 1999). Perhaps then food producers have been so preoccupied with making a living that they initially failed to notice sustainability issues. This may point towards a general fault in human rationality: We generally fail to notice, and when we do, we fabricate arguments to justify our behaviour, especially if it involves promoting self-interests and harming others. In the past, even scientists argued that laboratory animals cannot feel pain (De Waal, 2016). While most scientists now agree that vertebrates are sentient, for species like fish and lobsters, the controversy continues (Kristiansen et al., 2020). Another example concerns the belief among farmers that highly productive farm animals are happy (Vanhonacker et al., 2008). Producers and consumers often downplay science-based welfare concerns like belly-nosing, bar biting and tail biting in pigs (Mason, 1991), tongue-rolling in veal calves (Ridge et al., 2020), feather pecking in poultry (Cronin and Glatz, 2021) and mutilations of tails, horns and beaks (Sandercock et al., 2016). Our human welfare is supported by coping mechanisms like not noticing the gorilla in the room and other more problematic anomalies of civilised human behaviour. We also show cognitive dissonance (Nijland, 2016; Rothgerber, 2020), wilful blindness (Heffernan, 2011) and strategic ignorance (Onwezen and Van der Weele,

2016), especially regarding food production and consumption. Livestock farmers also seem to cultivate a victim role, seen perhaps most clearly in, e.g., the Dutch nitrogen crisis and in case of barn fires (OVV, 2021; Van der Ploeg, 2022).

Well-known examples of human perception bias (Schooler, 2015) are optical illusions like Rubin's vase and Young girl/Old woman (Wright, 1992). When applied to the polarised livestock debate, this suggests that critics may see intensive livestock farming as a destructive old woman, while advocates, e.g., ecomodernists, see a young girl feeding the world. Scientists may have contributed to this latter view, e.g., by promoting the 'rationalisation' of farming (with a special role for agricultural economists (Fresco et al., 2021; Van der Ploeg, 2022)). Scientists typically deal with problems in monodisciplinary ways. Subsequent problems of intensive farming are often first ignored, or denied, and then solved by solutions that created new problems (Sundrum, 2020). Examples include biosecurity measures like stamping out of infectious diseases that generated serious concerns in society. Battery cages solved labour and health problems in traditional farming, but led to behavioural problems. These were solved by free-range barns and aviaries, which led to broken bones, mortality and dust emissions. Air scrubbers reduced ammonia emissions, but exacerbated barn fires. Air scrubbers were also found to be much less effective in practice than in scientific studies, thus contributing to a growing scepticism regarding technical solutions for sustainability issues in intensive farming. Previously, environmentalists favoured intensive livestock farming hoping it would benefit nature. They now generally see intensive farming as a major threat to biodiversity and climate change too.

All of this is pointing towards a growing need for a paradigm shift (Kuhn, 1962), not just regarding how we view livestock farming, but also the wider market and even the societal system in which it is embedded. When artificial fertiliser solved food security risks, it also contributed to human population growth and climate change. When nuclear technology brought us clean energy and radiology, it also generated nuclear waste and the atom bomb. This solution-problem paradox applies to us too: Our (super-)intelligence created comfortable lives, but it also fostered dubious psychological mechanisms compromising our own integrity.

It is unlikely we will solve these sustainability issues if we do not address the underlying cause. Our current coping mechanisms are detrimental to our welfare, as it is difficult to see how we can be happy and proud, if we have to turn a blind eye to the harms we are inflicting on other animals (Bastian and Loughnan, 2017), the planet (Leclère et al., 2020) and future generations (Díaz et al., 2019). The global biomass distribution is skewed. Of all the mammals on earth, 96% are livestock (60%) and humans (36%), while only 4% are wild mammals. Of all birds, 70% are domesticated poultry and 30% are wild (Bar-On et al., 2018). Since the rise of human civilisation, 83% of wild mammals have been lost (Carrington, 2018), and insects are seriously being threatened too (Sánchez-Bayo and Wyckhuys, 2019).

The biomass distribution is skewed in farming too. A decreasing number of farmers is taking care of an increasing number of animals per farm (Smit, 2019). While farmers often see themselves as victims, the current farmers are also the victors of a harsh economic battle to acquire land and 'live stock'. Both biomass shifts indicate that we are using more than a fair share of the planet's resources. In doing so, we exert a constant pressure on the welfare of both wild and domesticated animals.

In order to see the gorilla or elephant in the room, we must improve human integrity. Most people are aware that animal welfare is an issue of societal concern. Few realise that the term 'animal welfare' itself may be keeping us partially blind. Let us briefly take a closer look at the two words in the phrase 'animal welfare'. The word 'animal' typically refers to a concept of animals that

excludes humans. This is unscientific and misleading. We like to see ourselves as different from other animals, e.g., because we like to think we are ‘wise’ (*homo sapiens*). But this idealised image seems to prevent us from noticing the failures of our rational capabilities, e.g., when we perpetuate unsustainable food choices and fake facts. The word ‘welfare’ literally means to fare well. The word ‘welfare’ is misleading because it acts as a moral sedative when we say that an animal is having ‘reduced welfare’. By contrast, animal advocates talk about animal suffering, and they sometimes even compare livestock farming to the holocaust. There seems to be a moral ban on even implying that such comparisons can be made. At the same time, science-based reasons exist to believe that in principle, it is possible to compare the respective welfare impacts (Bracke, 2017b). Psychological mechanisms related to cognitive dissonance and perception bias support the overestimation of our own welfare interests. In this way, we excel in sustaining unsustainable practices.

#### *The golden rule applies to all animals*

We reject an exclusively human-centred Kantian view of morality where animals are treated properly only because it facilitates the proper treatment of humans. For us, animals are ends in themselves because they have feelings too. Our emphasis on human integrity reverses the Kantian reasoning: We must treat humans properly, because it facilitates the proper treatment of animals. Proper treatment of humans implies integrity. Without true integrity, we are in fact immoral. When we say or do things we cannot be truly open and honest about, we are likely to be moral hypocrites (Lindenberg et al., 2018).

The golden rule (don’t do to others ...) applies to animals too. That does not mean we cannot favour our own interests. We can enhance our own welfare when it is also acceptable from an animal-welfare perspective as indicated by the golden rule. The golden rule thus relates animal welfare to economic development and freedom of expression. Animals deserve a life worth living too. What this means exactly may be debated, but it is related to our own welfare, and an expert-judgement score of 5.5 on a scale from 0 to 10 may be a reasonable starting point for further conceptualisation (Mellor, 2016; Bracke and Koene, 2019; Broom, 2021).

The concepts of welfare and morality imply that we should take into account the interests of all involved in our actions. That includes the welfare of all sentient beings, wild and domesticated animals, as well as current and future generations. Moral agents must also weigh the welfare needs of all involved in their actions in an unbiased, universalisable way. Morally speaking, the welfare needs of all sentient individuals matter equally, i.e., their welfare matters as much as our own, when it has the same intensity, duration and incidence (Willeberg, 1991). In short, pain is pain (Singer, 1975). It is equally morally wrong to cause a certain amount of pain in a human being or in an animal. Morally speaking, there is no difference in importance among sexes, ethnicity, or species, and our pain is not more important morally than theirs. This is roughly equivalent to saying that, in the pursuit of sustainable happiness, and especially considering the tendency to promote our self-interest, we must ignore who is who in moral decision-making. That is, we must decide as it were from behind a veil of ignorance (Rawls, 1971), or obey Kant’s categorical imperative, i.e., “act only according to that maxim whereby you can, at the same time, will that it should become a universal law” (Hare, 1993; Kant, 1993). This, again, is roughly equivalent to asking ourselves ‘What if everybody did that?’ It is, first and foremost, however, equivalent to the golden rule: Don’t do unto others what we wouldn’t want others do to us if we were in their position (Hare, 1981). This, we propose, if we are open and honest, must include

other animals – even if they are not capable of acting morally themselves, nor capable of doing to us what we are doing to them. Pig farmers remove piglets’ tails without anaesthesia. This is painful. If we cannot accept a similar amount of pain done to us for the same reasons (e.g., to produce more affordable food), then the golden rule is violated and the act of tail removal is to be regarded as morally unacceptable. The golden rule thus enhances universalisable welfare, i.e., the overall welfare of all sentient beings without distortion by our self-centred biases. That is a challenge. If we manage to find a way to obey this rule, e.g., by cultivating true integrity, we could find a more sustainable kind of happiness for ourselves too.

#### *Welfare circulation*

We define *human integrity* as being (able to be) open and honest regarding what we know or believe is true and morally right. Human integrity requires that we try to perceive our own welfare as well as the welfare of other sentient beings to the best of our ability, and that we act in accordance with our beliefs. For this, we must not only enhance a kind of circular agriculture that is regenerative and where nutrient cycles are increasingly being closed. We must also *circulate welfare*, i.e., regenerate, maintain and, where possible, improve upon overall welfare, especially the welfare of those who are worst-off (Rawls, 1971; Hare, 1981; Martin, 2014). When we produce plants to feed livestock and livestock to feed us, we transfer nutrients from one production phase to the next. In this process, we also transfer welfare (e.g., between consumers and producers by getting paid for food production, and between farmers and farm animals by depriving animals of resources such as space in order to increase farm profits). In doing so, we must find a way that welfare cycles are closed instead of remaining open. In the latter case, we leave individuals chronically frustrated and deprived of what matters to them (be it space to move around or information needed to make better moral decisions). By ‘circulating welfare’ as moral agents, i.e., as humans capable of acting morally, we exchange welfare-relevant information and weigh the interests of all involved in our actions in an unbiased, open-minded and sustainable way. This implies *four types or steps of welfare circulation*:

1. Firstly, each moral agent personally tries to take the positions of all sentient individuals involved, with an open mind. This is the first, primary type of welfare circulation: *Personal welfare assessment*. In this private, turn-taking mental activity, it is as if all involved have gathered in a circle. The moral agent is asking him/herself what if I were in the position of the first individual, the second individual, etc. until the circle is completed. As part of this step, the moral agent also ‘adds’ the welfare needs of all involved as if they were anonymised vectors pointing in the moral direction (Hare, 1981).
2. Secondly, moral agents are open and honest about the first, personal type of welfare circulation, primarily in interaction with other people, but in principle also in interaction with animals (Bovenkerk et al., 2020). We can, for example, non-verbally ‘ask’ animals what they want in a choice or motivational test (Bokkers et al., 2004; Wenker et al., 2020). This is the second type of welfare circulation: *Intersubjective welfare assessment*. In this step, it is as if moral agents have gathered in a circle taking turns to discuss the outcomes of their personal welfare assessments. If integrity is maintained and the discussion is open and honest, it will help solve misconceptions, counteract biases, and remove inconsistencies in the personal welfare assessments. This will foster mutual understanding and consensus (Martin, 2014).

3. The first and second step will generate empathy with other individuals, while avoiding anthropomorphism. It will make it natural and logical for us to act in accordance with what we 'see' when we resist turning a blind eye. This is the third type of welfare circulation: *Welfare improvement of others*. Integrity, again, entails that we act in accordance with our beliefs. In this step, we implement our personal and intersubjective welfare assessments by promoting the welfare of others such that we can be open and honest about our actions too. Integrity can thus function as a feedforward mechanism, a catalyst to restore the welfare balance. In this third step, we are completing the cycles of the first two steps that were directed at welfare assessment. By improving the welfare of others, we also generate feedback on the first two steps. This hopefully improves our welfare assessment as well. In addition, in this third step, we enable others to reach their goals and, thus, close their welfare cycles (Fig. 1) by turning need frustration into satisfaction. This also opens a new welfare cycle in us that is closed in the next step.
4. Finally, by improving the welfare of others, we improve our own welfare sustainably. This is the fourth and ultimate type of welfare circulation: *Reward from improving welfare*. This step closes the previous half of the welfare cycle. By giving welfare, we get it in return. Of course, this is a prediction about how morality works, and this step may not make us as happy as we had hoped for. If so, we may have to repeat and improve upon the distinct types of welfare circulation in an iterative process. Integrity is important in this last step too, as the case for inclusive social justice is considerably strengthened by our ability to truthfully acknowledge if and how much we are benefitting from respecting and promoting the welfare of others.

The four steps or types of welfare circulation can be summarised as follows: Assess welfare (yourself), discuss it (with others), act upon it and feel good about it.

Welfare circulation thus aims at a fair distribution of welfare across individuals. In the end, this also benefits people who would otherwise be tempted to accumulate welfare by externalising costs and preventing the closure of feedback loops in livestock. The notion of welfare circulation relates to the interconnectedness of organisms. It suggests that welfare can move between individuals in a way that is analogous to the circulation of nutrients and the circulation of air in a room (ventilation). Selfishness condensates welfare. Morality and sustainability distribute it. A fair distribution of welfare, however, also closes our own feedback loops and enhances human integrity.

To illustrate the four steps in welfare circulation, consider a simplified example of a consumer deliberating the purchase of welfare-labelled meat. It involves three individuals: consumer C, who is contemplating to eat animal A reared by farmer F either in accordance with the welfare label, or not. For simplicity reasons, let us assume that F gets paid extra by C for the welfare label such that F's welfare is not affected by C's decision. In step 1, C assesses the welfare of A and his/her own welfare privately. However, for C to make the best possible moral decision, C must be properly informed about the welfare of A by F in step 2, intersubjective assessment. C may also 'ask' A directly, e.g., examining A's welfare state using personal or scientific observations. If C finds, in this intersubjective assessment step, that A's welfare improvement, when reared under the welfare label, is outweighing C's welfare reduction from paying a higher price, then, C must act in accordance with the golden rule in step 3 and buy the welfare-labelled meat. This enables C to be open and honest sustainably, as a rational moral agent. In this way, C's needs for human integrity and welfare are satisfied by making such a (smaller or bigger) 'sacrifice,' and thereby contributing to improved overall welfare weighed impartially.

### Challenge of living sustainably through integrity

By asking us to promote the interests of other species, a CWE appears to require a sacrifice. This may generate substantial resistance from those who stand to lose the most. These are mainly (the larger) livestock farmers, suppliers and livestock-related food companies. It also concerns conservative consumers, especially those who are currently fond of consuming relatively large quantities of animal-based food items. This poses a challenge to integrity and welfare circulation.

Welfare is a subjective mental state. It is not, however, subjective in the sense that we cannot be mistaken about it. Welfare is what matters, and, in a sense, what matters is more real than matter (Peterson, 2020). Welfare is both prescriptive and descriptive (Hare, 1981). An individual's quality of life manifests itself as an affective state to the individual itself, independent of how it is perceived by others. But welfare also manifests itself in the physical world through physiological and behavioural responses. This allows welfare to be studied and assessed scientifically (Blokhuys et al., 2010). In addition, welfare can be assessed intuitively, perhaps because it was functional to evolve this capacity when we care for other individuals, or when we want to capture or conquer them. However, in this intuitive assessment, but also in scientific assessment, we must be aware of being prone to perception bias and phenomena like failing to notice the gorilla in the room. This means we should cultivate integrity in order to grasp welfare as accurately as possible. This requires an open attitude and a free exchange of welfare-relevant information.

Compared to more physical sustainability issues like climate change (Armstrong McKay et al., 2022) and a Covid pandemic, welfare subjectivity may result in a perception that it is less risky to deny or modify welfare concerns. This is true for welfare only when the people involved, especially welfare scientists, show an integrity deficit. Once we embrace true human integrity, it becomes much harder to continue immoral behaviour. Integrity, morality and sustainability are inextricably linked together. In any case, it is difficult to see how we could have one without the other. As long as we persist in unsustainable behaviour, we are bound to show integrity deficits. If we truly open up, we will be much more inclined to do what is morally right and sustainable.

### Circular welfare economy

The way we produce food is part of how we do business in the wider economy. Western societies have primarily been shaped by (semi-)free-market economies. These essentially promoted the interests of producers and consumers through supply and demand. It pays to be selfish while only pretending to care about honesty and sustainability. The free market has stimulated a practice, some would say an art, of window-dressing. We make things look nicer than they really are. We foster partial 'blindness' to aspects of products that do not sell well (Van der Ploeg, 2020).

To solve sustainability issues in livestock farming, e.g., by promoting circular agriculture, we must address the underlying integrity issue. We tend to presume integrity without calling it into question. When we open up to potential integrity deficits, we find that unsustainability is not limited exclusively to the food system. An impartial weighing of the welfare interests of all sentient individuals, as suggested by CWE, entails a complete redesign of our economy. In a CWE, we respect the coping capacity of all involved. Welfare is distributed fairly by applying the golden rule in an unbiased way. We produce and consume within the carrying capacity of the planet. Nobody gets more than a fair share. This implies a doughnut economy (Raworth, 2017). A CWE, however, emphasises welfare based on integrity. This affects the way we produce and consume goods generally, rather than just food, and also how we

do politics or otherwise interact socially. In current democratic societies, the reality is frequently distorted to serve self-centred interests. For example, political parties may focus on short-term interests of voting constituencies, without much representation of non-voting individuals like animals and future generations. TV broadcasting and social media may show role models setting unrealistic ideals. Wildlife documentaries show a romanticised version of nature, etc.

In a CWE-based society, we weigh the interests of all involved impartially. We give a voice to the voiceless. We 'listen' to animals by 'reading' their physiology and behaviour. In particular, we interpret their appetitive and avoidance behaviour as if they were 'saying' '(Don't) Let this happen to me'. In doing so, we try to understand their preferences, their likes and dislikes, without projecting our own states of mind. Similarly, we accept that humans want to make their own moral decisions in a way that is compatible with our own preference for moral autonomy. Therefore, we share information with others openly and honestly, because we want them to share their information with us.

By contrast, the current economy, which plays an important role in society, is highly rationalised in promoting short-term profits and ongoing economic growth (a circulation of money). We maximise a rather narrow version of production efficiency. We often optimise efficiency by externalising costs. We ignore, or even actively deny, important aspects of sustainability. This comes with a serious integrity deficit. In agriculture, this leads to bigger farms, more productive livestock, wildlife habitat and biodiversity loss (IPBES, 2019; Leclère et al., 2020; Outhwaite et al., 2022), an inefficient feed-to-food conversion (Van Zanten et al., 2019; Van Hal et al., 2019), overconsumption of animal-based products (WUR, No date), public health issues (Godfray et al., 2018), food loss/waste (Salemdeeb et al., 2017; Boumans et al., 2022), subsidy-dependency (Jensen and Shin, 2014) and animal-welfare concerns (Broom, 2022), because animals are treated as resources to generate profits. In the wider economy, we similarly see unsustainable production and consumption (materialism, greed). For example, businesses make products that do not last for long, such as clothes going out of fashion, and products that are difficult to repair when broken and cannot be recycled.

In an animal-welfare-exclusive circular agriculture, animals are used to close nutrient cycles. In a CWE, however, animals are no longer used purely as a means to our ends. In a CWE, welfare is central, not personal gain or closure of nutrient cycles. Instead, we aim to close welfare cycles and maximise the welfare of all involved. We do so as efficiently and as unbiased as we possibly can. Ecological sustainability and profits, the objectives of circular agriculture and intensive farming, respectively, are important too. They are preconditions for welfare. But only animal welfare in the wide sense, which includes the welfare of both humans and non-human animals, is an end in itself.

In a CWE, the objective of continuous economic growth is replaced by the idea that enough is enough. If anything in CWE, we should first and foremost be enhancing welfare through integrity and through increased welfare-production efficiency. In a CWE, knowledge and information are freely available for collaboration and welfare improvement. People should get credits and return on investment, though, e.g., for developing innovations (perhaps using blockchain technology). But they should charge a fair price for using the new technology. This requires a restructuring of the economy in line with morality, e.g., true pricing based on the golden rule. In a CWE, people get credits for enhancing welfare, and debits for externalising costs.

A CWE implies a shift of focus from matter (money, nutrients) to what matters (universalisable welfare). CWE (dis)qualifies the greedy *homo economicus*. It recognises human integrity as a necessary condition for welfare and sustainability. The short-term focus

of the new economy, therefore, should be to circulate welfare-relevant information and enhance unbiased, universalisable welfare through the cultivation of human integrity. The new economy may also be characterised as inherently transparent, friendly, respectful, caring and inclusive. In any case, the aim is to ensure the conditions necessary to sustain life and a life worth living for all involved. Hence, CWE provides a firm basis also for circular agriculture.

What this means in practice is first and foremost that we ask ourselves whether our behaviour can be explained openly and honestly. And if not, to search for a better alternative. Integrity, thus, provides a basic rule of thumb to assess and promote sustainability. Enhancing integrity is, however, not easy. How to do this effectively is something the early adopters of the CWE framework will need to explore further.

### How to deal with conflicts

Conflicts between circular agriculture and animal welfare, or between any other pair of sustainability issues, arise when they have opposing effects. For example, if improving animal welfare reduces circular agriculture objectives, or vice versa. The objective of welfare as a societal concern is to enhance the animals' quality of life. The objective of circular agriculture is to save the natural environment while feeding the human population through the closure of nutrient cycles. Conflicts between animal welfare and circular agriculture will arise especially when circular agriculture uses animals solely as a means to cycle nutrients, or when circular agriculture fails to be open and honest about animal welfare. For example, when highly productive breeds would be used that were not suited to process by-products. Conflicts can also arise when welfare improvements lead to a reduced, or a less efficient, nutrient circularity. For example, happy farm animals may be more active and thus require more nutrients to produce the same amount of human-edible food.

The conceptual framework of a CWE shows how such conflicts between sustainability aspects may be solved. CWE emphasises the importance of welfare. It also compellingly suggests that for anything to matter, it must matter to welfare. Both animal welfare and circular agriculture, therefore, also ultimately matter because and in as far as they affect welfare. Animal welfare focusses on the welfare needs of non-human animals. Circular agriculture focusses primarily on human welfare (long-term food security and environmental protection; enjoying nature and avoiding social conflict in a finite world with limited food resources). To some extent, circular agriculture also concerns wild animal welfare (stable ecosystems). Circular agriculture itself may also generate an internal animal-welfare conflict, namely between domesticated and wild animals. This would happen when the latter were saved at the expense of the former, e.g., in a welfare-exclusive circular agriculture.

The CWE framework, therefore, suggests that conflicts between sustainability issues, like animal welfare and circular agriculture, do not involve the weighing of proverbial apples and oranges. Rather, it involves, like any other moral dilemma, the impartial weighing of the welfare needs of all sentient individuals involved. Animal welfare in the wide sense, i.e., both human and non-human animal welfare, is, therefore, the common denominator to solve conflicts between any two sustainability issues, and thus also between circular agriculture and animal welfare.

Since animal welfare in particular is subject to personal interpretation and bias, solving conflicts between animal welfare and circular agriculture requires the cultivation of human integrity. In the short term, however, and in the absence of having developed the required virtue of true human integrity, we may want to take



a pragmatic approach and avoid conflicts by focussing on synergies between circular agriculture and animal welfare. Readers interested in these synergies are referred to the [supplementary material S1.6](#). [Supplementary Material S1.7](#) gives a brief description of idealised visualisations of future food systems, i.e., intensive livestock farming compared to animal-welfare-exclusive circular agriculture, animal rights agriculture and a CWE-based circular welfare agriculture. In the latter case, we solve conflicts between sustainability issues by optimising overall welfare with an open mind.

## Conclusion – on the way to a circular welfare agriculture

Most livestock farming is not sustainable at present. It has many issues which appear impossible to solve unless we tackle the underlying cause. We are often too greedy, biased, window-dressing and (partially) blind for the harmful consequences of our actions. Circular agriculture aims to solve some of the main issues of intensive farming. For long-term food security and biodiversity, circular agriculture proposes to close nutrient cycles. Taking non-human animal welfare to the other extreme, an animal rights agriculture would probably abolish livestock farming altogether. We propose a circular welfare agriculture as a ‘synthesis’ between circular agriculture and animal welfare (or perhaps animal rights agriculture, see [Supplementary Material S1.7](#)). Compared to intensive livestock farming, a CWE-based agriculture involves a paradigm shift, a complete redesign of the farming system, the economy and even society at large. The starting point, and actually also the endpoint, of this transition is (much more) human integrity. Being open and honest is necessary for informed and improved moral and political decision-making. A CWE framework is necessary to build a sustainable future together. It requires, however, that we become open and honest especially also about what is not in our personal interest. Such human integrity is vulnerable to personal bias and abuse of power. Therefore, it needs appreciation, cultivation and (legal) protection. In agriculture, it will probably lead to a largely plant-based food system with some livestock providing ecosystem services in largely silvopastoral systems (see [Supplementary Material S1.7](#) and [Broom \(2021\)](#)).

Neither profits nor closed nutrient cycles are ends in themselves. Only welfare, the quality of life as perceived by the individuals themselves, is an end in itself. By definition, all welfare matters and only welfare matters. Profit matters because it matters to human welfare. Ecology matters because it directly or indirectly matters to the welfare of humans and (wild) animals. Furthermore, the welfare of all sentient individuals counts, and it counts equally and without bias (pain is pain). As a result, animal welfare in the wide sense, i.e., the level of welfare-need satisfaction of all sentient individuals living now or in future, is the common denominator of sustainability. An overall welfare assessment can, thus, also be used to solve conflicts between sustainability issues, for example between animal welfare and circular agriculture objectives. The preferred moral and sustainable solution is the scenario that has better overall welfare outcomes based on the four steps of welfare circulation as described above in this paper (personal and intersubjective welfare assessment, improving welfare and feeling good about it). The prime objective of a CWE is to enhance universalisable welfare based on cultivated human integrity and nutrient circularity, both of which can probably never be fully achieved. With this in view, we can appreciate that concern for animal welfare and circular agriculture can strengthen each other and provide a solid foundation for the overall sustainability of the food system as well as the wider economy and society (see [Supplementary Material S1.6](#)).

In a CWE-based agriculture, we neither use animals merely as a means to make money nor to close nutrient cycles. A CWE-based

agriculture aims to close nutrient cycles too, but only for the purpose of closing welfare cycles. Welfare cycles are closed by open and honest assessment and improvement of the welfare of all involved without bias by applying the golden rule. Accordingly, we no longer treat animals in a way we do not want to be treated ourselves if we were in their position, i.e., when we perceive the world from their point of view. We thus take every effort to understand and benefit their points of view as well as we do our own. We can be an integer, in the sense of whole and complete, and close our own welfare cycles, only if we grant animals a life worth living too.

## Supplementary material

Supplementary material to this article can be found online at <https://doi.org/10.1016/j.animal.2022.100694>.

## Ethics approval

We did not apply for ethical approval of the survey as it concerned familiar contacts, mostly people working in academia or otherwise familiar with surveys. In addition, we explicitly asked for consent at the start of the survey (see Questions 1 and 2 in [Supplementary Material S1.3](#)) and presented the results anonymously.

All authors consented to submission for publication.

## Data and model availability statement

All underlying data have been made available in the [Supplementary materials](#). None of the data were deposited in an official repository.

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**Marc Bracke:** Term, Conceptualisation, Methodology, Investigation, Analysis, Visualisation, Writing- Original Draft, Writing-Review and Editing, Project administration, Funding acquisition; **Iris Boumans:** Conceptualisation, Resources, Writing- Reviewing and Editing; **Hanneke Nijland:** Conceptualisation, Writing-Reviewing and Editing; **Eddie Bokkers:** Conceptualisation, Resources, Writing- Reviewing and Editing, Supervision, Funding acquisition.

## Declaration of interest

None, i.e., there are no conflicts of interest that any of the authors are aware of.

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