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Handling Tensions between Natural and Utility Purpose of Farm Animals and Crop Plants

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Abstract: We analyze the extent to which humans respect farm animals and crop plants and whether humans provide them adequate care. Concerns are justified, since many farm animals and crop plants have become completely dependent on humans for their survival. We explore whether the concept of 'telos' can be useful. From a biocentric and ecocentric custodian position, an animal or a plant possesses a telos, a nature of its own and a natural, species-specific purpose, but also a telos through its destination imposed by humanity because of its usefulness and service to human beings. Based on both forms of telos farm animals and crop plants deserve respect and have a moral value. Both forms of telos seem to oppose each other: the more humans domesticate the animal or plant, the more it must sacrifice its 'natural telos' to serve its 'utility telos'. Humans should enable the animal or the plant to realize its natural telos in harmony with its utility telos. Both forms of telos could be reconciled if humans fulfil their moral duty to support farm animals and crops in completing their production cycle in a respectful manner. We formulate some guidelines to operationalize, and give meaning to, the concept of telos.

Keywords: food ethics; integrity; intrinsic value; naturalness; respect; telos

1. Introduction

By tilling the soil, cultivating the land and keeping animals, humans produce food, feed, fiber, and fuel. He (today, increasingly more often she) makes use of thousands of species of plants and animals. However, there are important trends in how farmers operate. During the last decades, the dependence on a limited number of crop plants and animal species [1–4] and on external resources such as water, fertilizer, pesticides, and antibiotics [5–7] has increased. Strangely enough, this is accompanied by an increase in the diversity of the human diet on a national level and at the same time by an increase in the uniformity of the national diets of different countries [4]. These trends show how vulnerable human beings have made themselves. Worldwide, for example, the Panama disease threatens banana production because everywhere and at large scale the same cultivar is grown [8]. In some areas, the use of insecticides is so intense that bee populations are decimated and are no longer able to ensure pollination [9]. Animal diseases spread faster due to increased transport of (young) cattle [10]. The species richness of flora and fauna in agricultural production systems decreases [11]. Land degradation is increasing [12–14]. In addition, land grabbing in Africa, followed by monoculture of water-guzzling industrial crops—i.e., associated with water grabbing—changes the hydrology of

large areas, thereby depriving smallholder farmers of irrigation water for the production of their staple food [15]. Attention to ecosystem services and the role of biodiversity in cropping systems is increasing in science [5,6,12,16], but not in practice [13,17,18].

These developments are undesirable excesses of the way humanity operates agriculture [19]. Our food comes from intensive production systems, which use radically domesticated animals and plants as economically efficiently as possible. However, the living beings in these intensive production systems are less and less coming around to live according to their own nature and tend to be handled like things or production machines. This is creating increasing tensions between producers and consumers and forces us to make explicit moral choices to prevent that practices turn out to be increasingly detrimental for animals and plants.

This paper analyzes whether we have enough respect and care for the nature aspect of our food. Our arguments are based on ethical orientations, based on a biocentric, ecocentric attitude, on humans as custodians of farm animals [20–24] and crop plants [25]. Humans are domesticators of animals and plants, have power over animals and plants and have the implicit duty to take responsibility for the organisms domesticated, although we will challenge that view later in this article. Ethical positions (and associated responsibility) make humans unique in evolution and in nature, as no other living being is ethically active. More specifically, non-human beings do not have a sense of responsibility beyond their own short-term individual, group, or species survival. Humans have, as custodians of farm animals and crop plants, a position that invites them to make deliberate choices based on a moral sense. These moral choices are made individually, either by mandating an elected government or by acting on the spot out of free will. All human decisions in agriculture have an ethical dimension, although we are not always aware of that. Moving towards an inclusive attitude, such as social responsible investment and sustainable entrepreneurship, has become a standard in the wider business community over recent decades [26–29].

Against this background, our objective is to explore the tensions between the natural (or intrinsic) and utility (or extrinsic) value of animals and plants, as we, humans, value them, and to provide a conceptual framework to analyze and interpret those tensions from a holistic, bio/eco-ethical point of view.

We argue, as points of departure, that domesticated plants and animals:

1. deserve respect, because of their own intrinsic value;
2. deserve respect for their serving role for humanity; and
3. deserve care because of their increasing dependence on humans resulting from the domestication process.

The paper underlines the tensions caused by, or at least strengthened by, the domestication of animals and plants between their intrinsic value and extrinsic value based on their usefulness to humans, in a context of the lack of reciprocity in the relationship between humans on one side and farm animals and cultivated crop plants on the other.

We will first describe the sliding scale of domestication and current variation in agricultural production systems and subsequently describe moral notions. By applying a bio/eco-centric attitude towards nature and agriculture, our position towards moral obligations and respect for our food and the animals and plants producing that food is discussed. Based on these points of departure, we introduce, elaborate, and apply the concept of telos as a framework to handle the tensions between nature and purpose of domesticated animals and plants and illustrate how this can be applied in practice.

2. Sliding Scale of Domestication

The manner, in which plants and animals are used, ranges from a) the simple gathering of wild species (blackberries, mushrooms, maggots, fish, birds), via b) diverse agroforestry systems and intensive field crop production, to c) growing plants hydroponically in warehouses or producing meat and milk in factory farms. The management of a particular species may vary in time and space, and

from farmer to farmer [30]. Some cultivated species move towards stronger domestication, while other species, managed intensively or even domesticated in the past, now move back to the status of wild species. The terms "wild" or "domesticated" are determined by local knowledge and culture [30]. Some scientists even argue for "rewilding" of a crop to make it more robust under stressful conditions, such as under organic cultivation [31].

The history of successful domestication can also be mirrored. One can argue that from the plant's point of view crop species such as rice, wheat, maize and potato, or from the viewpoint of animal species, such as bovine and dog, close interaction with humans has paid off: these species have evolved under human influence to very successful colonizers of the planet Earth and are dominant, or at least very strongly present, in areas far outside their region of origin and habitats where they would not survive without the help of humans [32].

We can also expand the concept of domestication from the domestication of a plant or an animal species to the domestication of vegetations, landscapes and production systems, but also of other resources such as the soil, ecosystems such as freshwater systems, and ecosystem services through which carbon, nitrogen, oxygen, and water cycles continue to function. Also at this scale, we see an increase in certain types of uniformity, with positive, but mostly negative consequences [33,34]. At this scale, we must unfortunately note that one of the most 'successful' expansions is that of bare-soil areas through desertification [35].

Domestication has brought about that humans change the plants and animals in their natural behavior and force them to develop in such a way that they yield maximum short-term benefit for humans. This can go so far that even their ability to function independently in their natural niche is sacrificed to the utility goals set by humans. The scale of these developments makes it urgent to give ourselves an account of human-plant and human-animal relationships and how we make choices, individually and collectively as a society.

3. Variation in Agricultural Production Systems and Attitudes

Agricultural production systems are very diverse [5,19]. They are all characterized by their particular human influence. This influence may, however, be limited to a little maintenance, e.g., on the pasture commons [36], or when food is collected in secondary forests managed by local tribes in the Amazon [37,38], or may be aimed at facilitating self-regulation, such as in organic farming, where working with nature in productive agro-ecosystems is the standard [39]. Human influence can also be very strong, as in indoor production units of leafy vegetables with fully controlled climate in multiple layers of hydroponics with only LED lighting [40].

Parallel to the increase of the influence of humans in the processes within the agro-ecosystems, there is the decrease of the self-regulating capability of the system. Many observers feel that the more the grower wants to impose his will, the less natural ecological processes can fulfil their ecosystem services. Once a human takes on the role of the unilateral ruler of the ecosystem, he himself is no longer consciously part of such agro-ecosystems; he is merely the exploiting outsider.

Humans evolved from hunter/gatherers; through successful domesticators, nomads, and farmers; to industrialists who produce products of vegetable or animal origin. The advances in the technological potential of food production in the rich western societies have brought us (short-term) food security. With more mouths to feed, more demanding consumers, less natural resource available per person, rapid degradation of the available resources and a less conducive environment to grow crops in the future, our food security comes increasingly under stress. The pressure for further intensification of production systems is enormous, but it will be a challenge to do so in a sustainable way [5,13,14]. However, the current relative abundance of food in many parts of the world and the technological approach to agriculture have changed our food system and changed the attitudes of producers and consumers towards our natural and other resources. In arable farming, humans no longer cultivate the land, but produce vegetable food. In livestock farming, humans no longer rear pigs, but produce meat. Natural resources (animals, plants) are taken for granted, are used as raw materials, and they

are the means of production in the hands of the producer, which are used economically as efficiently as possible; natural resources are no longer a living element with a specific role in a living system. The consumer is often offered the product in a way that makes it no longer recognizable as part of a living organism; it is just a commodity.

For some people (e.g., [41]; see also [42,43]), it goes without saying that we can make use of all possible technical advances in the use of plants and animals to produce more food; technologies merely serve to eradicate hunger and need [44]. Others [45,46] argue that there are boundaries in what technologies to apply in food production. Both groups provide arguments anchored in normative concepts, based on ethical choices, and notions that are not always explicit or clear, or for which it is difficult to find the right words. We make an effort to interpret the concept of telos, as a moral value to assign and to describe explicitly the respect and care that we owe animals and plants and particularly those that produce our food.

However, it should be realized that moral notions only have a meaning within the framework of basic attitudes [29,47,48]. We can distinguish for example four basic attitudes: human as ruler, human as steward, human as partner with nature (or even custodian of nature), and human as a participant/part in nature [47–49]. Associated with these four attitudes are four normative, bioethical perspectives as described by [49]:

1. an anthropocentric perspective in which only humans are ethically relevant;
2. a zoocentric perspective in which human beings and sentient animals are ethically relevant;
3. a biocentric perspective in which all living organisms are ethically relevant;
4. an ecocentric perspective in which not only individual living organisms, but also species and ecosystems are ethically relevant.

In this article, our point of departure is associated with the biocentric and ecocentric perspectives.

4. Elements for a Moral Framework of Reconciliation of Purposes

In the current global agriculture, allegedly based on free trade and open competition, changes in management of plants and animals are often only driven by the need to increase economic efficiency [5,6]. The road towards an inclusive and sustainable agriculture requires the balanced integration of economic, social, and environmental concerns (e.g., [26,27,29,50]). Conscious moral considerations rarely play a role, partly due to ignorance and partly because of lack of generally accepted norms and rules. However, in many regions of the world, particularly the poor ones, the limits of the carrying capacity of natural resources have been reached [35], a circumstance that is rarely properly taken into account in the cost of these resources.

The growing awareness that natural resources are precious and finite and that everybody (the whole, present humanity as well as our descendants) is equally entitled to their use, should lead to respectful treatment of our environment, resources and inanimate and living matter that are part of it. In many forms of agriculture this respect results in special forms of farming, as is the case in 'conservation agriculture' (resource-conserving farming), organic farming, etc. In these systems, farmers monitor, manage, and protect all natural resources needed to produce food in a sustainable, people-friendly, environmentally responsible, and animal friendly, plant-worthy, respectful manner.

In our view, all agricultural systems therefore have implicit moral values. That is, tactical and strategic decisions are made based on a system of ethical principles, which help the farmer to make the distinction between right and wrong when making decisions about soil management, crop protection, animal husbandry, etc. This is also the case when economic efficiency is the main driver for the decision making of the farmer. The norms and moral values behind these styles of farming are diverse, often weakly defined or not widely shared. Values can be people-oriented, such as the right to food, prosperity, and well-being; quality of the environment; social justice; nature conservation; biodiversity; nutritional value; poverty alleviation; and food security and safety. However, there are also values linked to the right to exist of species, apart from the direct economic benefit to humanity, as well as

the right to exist of ecosystems and everything that contributes to their preservation. Values can be derived from short-term and local interests, but also from long-term and global interests; they can be exclusively directed to humans or inclusively focus on all that lives. Such values concern the right of domesticated plants and animals (and their wild relatives) to be there and to reproduce, to maintain a certain level of autonomy, to pursue welfare and to enjoy, to play a role in an ecosystem, to have a certain quality of their habitat, etc. Nevertheless, it is the human who grants whatever moral values.

Moral values do not only concern production, but also trade, use, and consumption. About one-third of the food produced in the world is lost or wasted, during harvest, transport, storage, in the shop, or at the dining table [51]. Part is natural decay, inherent to the product. That process has a right to exist too, because it plays a role in systems, cycles, and even reproduction. However, part of the loss in our supply chains is wasteful, motivated by economic laws of trade, logistics, and specialization or caused by poor management or inappropriate behavior. The coexistence of obesity, (hidden) hunger, waste, poverty, and depletion of natural resources raises many questions about moral aspects of our food production.

We need new concepts in asking such ethical questions and a framework to bring them to practical solutions. A central element for such a framework is 'purpose'. Is there 'purpose' in nature, and more specifically is there 'species-specific purpose'? In Neo-Darwinian thinking, there is no purpose in nature and many will argue that evolution is a blind process that does not create species with a purpose in mind. Organisms, however, do have several purposes: their survival as an autonomous being and the reproduction of their genes. This requires a continuous re-arrangement of the complexity of dissipative structures (*sensu* [52]) in their DNA influenced by mutation, epigenetics and selection pressure. That process is not merely random, but also managed by the individual organism under the influence of environmental cues [53,54]. At the scale of macroevolution, the ultimate outcome is that organisms show an unidirectional increase in complexity associated with an increase in autonomy [55]. Moreover, once created, species do have a function in their niche or biotope as proven by functional ecology, based on ecological patterns and processes from the organismic to the ecosystem scale. These are functions as a consequence of natural selection but the accumulation of all functions together create a unique, stable ecosystem. Also because of the need to maintain those functions, each species has moral value.

Reasoning from these purposes, we propose the concept of telos to help create the framework mentioned above.

5. Telos

'Telos' (from the Greek τέλοσ for 'end', 'completion', 'goal', or 'intent') is the end or goal, used in an explaining sense by philosophers such as Aristotle [56]. It is also the base of the term 'teleology', the study of objects in view of their objectives, goals, or intentions. Telos involves a natural strive for existence characterized by natural behavior and development, i.e., an entity follows a path of development during which that entity manifests itself in different, natural forms, fitting in natural life cycles. Telos of an entity in this sense can be considered as coming to appearance according to a so-called "entelechy principle" which is typical for the entity.

Our concept of telos is indeed closely related to the concept of "entelechy", a term coined by Aristotle [57]. Entelechy is the supposed vital principle that guides the development and functioning of an organism or any other form of system or organization. Entelechy can also be described as a particular type of motivation, or need for self-determination, involving an inner strength that directs life, growth, and development. Others use entelechy to describe an internal force or principle that drives a being toward its destiny.

We use telos of a farm animal or a crop plant as its nature, as the set of functions that constitute its life [20,58], but we will extend that notion to also including our use of those functions in the common agricultural practice. We will demonstrate that telos should develop into a moral norm how to manage farm animals and crop plants.

Note that our concept not only applies to the animals and plants we have domesticated, but also to the species within the agro-ecosystem with a negative extrinsic value (pests, pathogens, weeds). Farm animals and crop plants have a telos or nature and deserve the freedom to act in accord with this nature, because we humans have a moral sense [21–23,58]. Harmful organisms within our agro-ecosystems should be respected as indicators of unbalanced biotopes, in which our animals and crops cannot find the conditions for a healthy development. Nevertheless, farmers will have to make an ethical choice in the management of these harmful organisms, preferably in a way that maintains their population densities well below a threshold level.

We accept that environmentalists claim that part of nature should remain beyond our control, based on an ethical choice, and then allegedly stay utterly amoral. In our perception, however, also wild animals and plants have a telos, albeit not the same utility telos as farm animals and crop plants. Our domestication process has given us power over part of the nature and therefore a moral obligation to manage that part in a moral way, based on our own moral sense that has developed and is still developing. Within that domain, telos is relevant both at the level of the species and of the individual farm animal or crop plant.

In our reasoning, based on biocentric and ecocentric attitudes, but also with an anthropocentric perspective, an animal or a plant possesses a telos, both as a specimen and as a species (see also [25,59,60]). In this paper, we will use the word 'individual' for a separate specimen of a plant or of an animal species. That telos involves a natural and species-specific strive or natural purpose as well as a destiny imposed by humans (usefulness, purpose, service to humanity) [25,60]. Based on both forms of telos, humans owe farm animals and crop plants respect and care; and based on both forms of telos, these farm animals and crop plants have a moral value.

5.1. Some Initial Remarks

We stress that we apply our reasoning on moral values in similar ways to both farm animals and crop plants, although they are very different life forms. In an agricultural setting, humans treat farm animals and crop plants in the same way: they use them for their own benefit, as food provider or for economic reasons. Even though humans feel they have more in common with animals than with plants, and therefore tend to demonstrate more empathy and respect for animals than for plants, many arguments to respect the telos of both types of organisms are similar.

We distinguish between two different forms of telos, but, ideally, these forms should not be opposing aspects or in conflict with each other. Humans must show his respect for the two forms of telos by enabling the organism to achieve the species-specific natural purpose in harmony with the objectives imposed by humans. In other words, both forms of telos will be reconciled if humans fulfil their moral duty to support crops and farm animals in completing their production cycle, and fulfilling their ecosystem services, as they produce food for humanity in a respectful manner. We elaborate both forms of telos below.

5.2. The Intrinsic Telos of Plants and Animals

The first form of telos is based on the recognition that plants and animals have certain species-specific purposes or targets. They should be able to live their life and fulfil their life cycle in order to achieve these objectives. These organisms should be allowed and enabled to develop specific abilities and skills to thrive and achieve their species-specific goals. Aristotle limited this to the survival of the species, not necessarily of the individual specimen. In our reasoning, however, it applies to individuals as well. They should be treated as autonomous beings in achieving these goals. We call living beings autonomous as each individual is capable, based on its own capacity and power, to express its own nature or innate strive. In short, crop plants and farm animals have value because they have the right to be there, with their own nature and orientation, the so-called 'intrinsic value' (in English: 'dignity'; in German: 'Würdigkeit'; in Dutch 'intrinsieke waarde', resulting for plants in a

'plant-waardig bestaan'). In this respect, crop plants and farm animals are similar to wild plants and wild animals, which also deserve respect because they have an 'intrinsic value' [61].

'Intrinsic value' is the ethical or moral value, which, from a biocentric and ecocentric basic attitude (or partner attitude of humans versus nature), is attributed to a living organism, plant, or animal:

- just because it exists;
- because it is a unique form of specific life;
- because it is autonomous and therefore deserves to live; and
- because it plays its own role in its own niche within an ecosystem (often an agro-ecosystem), a role that contributes to the diversity of life forms on our Planet Earth and the homeostasis of the Earth System.

The role played by the organism is dynamic because it always will be played in interaction with other living beings, which are also autonomous and deserve to live, and to contribute to the functioning of ecosystems. The telos of a species or an individual of a species is therefore inseparable from the telos of a niche or biotope. The first form of telos can be easily scaled up to more complex levels of organization of life.

The agro-ecosystem also has 'intrinsic value' because it is a dynamic system, which—as a living entity with (to a greater or lesser extent) its own character and identity—functions through its unique combination of species, to some extent managed by a farmer, who eventually harvests these species, but also takes care of them on the basis of a system of rules and values. Even the farm, to which this agricultural ecosystem belongs, may be considered as a living being with a moral value which plays a specific role in a broader (spatial and temporal) environment which is dependent on the proper management [62]. Equally, to both the agro-ecosystem and the farm its own telos can be awarded. Many farmers experience that also and their farming style will be focused on strengthening their own identity and realizing the telos of their farm [63].

We can operationalize the concept of 'intrinsic value' by identifying the concept of 'integrity' [25,39,49,64]. For cultivated plants and domesticated animals, 'integrity' refers to their nature, wholeness, completeness, species-specific properties and their being that—while the natural purpose is fulfilled—is in harmony with its surroundings. The 'integrity' of crop plants is manifested at four different levels: integrity of life, plant-typical integrity, the integrity of the genotype and the integrity of the phenotype. In the same way, 'integrity' of animals can be elaborated. Respecting the 'integrity' (and therefore the 'intrinsic value' of livestock and crops) is part of the 'naturalness' of agriculture as it wants to be experienced and is appreciated by many people from a partner position. Indeed, this kind of telos respects the natural objective, the behavior and the natural environment of plants and animals. This form of telos is inherent in the farm management and is inextricably linked to the telos of the agro-ecosystem (including the soil) and the farm.

5.3. The Telos Imposed on Plants and Animals

The second form of telos is based on the recognition that humans impose purpose or targets and that we therefore have to honor and take care of plants and animals. Plants and animals will also be assigned a certain moral value when and because they fulfil the role that we give them, namely the role to provide in our sustenance, for example, by producing potatoes or laying eggs. In this sense, telos is the destination of a plant or animal that represents a moral value. Plants and animals have a moral value, as we people need them ('extrinsic value'). They deserve our respect because they play a useful role and it is our moral obligation to care for them in a plant-worthy and animal-friendly way while they do so. In other words, we have, since we use these organisms, the obligation to nurture and guide them into the production cycle or within a parallel breeding program so that they also, in addition to the goal set by us, reach their natural species-specific goal. This requirement can also be translated into rights of both the animal and the plant. In this context, we do not perceive rights as

freedoms (freedom from pain, suffering, hunger, etc.), but in a positive sense as the rights to fulfil their natural purpose, and to continue to be an autonomous being with its own telos.

5.4. The Combination of Both Forms of Telos

Both forms of telos are intertwined. The species-specific telos of plants and animals (the dignity we ascribe to them based on their 'intrinsic value') can be violated if the telos imposed by humans (the dignity humans ascribe to them based on their 'extrinsic value') gets the upper hand. Conversely, many people experience that the telos of a plant or an animal imposed by humans is also violated when we frustrate the species-specific telos of organisms, by discarding them or their products before they can complete their seasonal and life cycles and can fulfil their species-specific telos. Sometimes this is inevitable, because it may be linked to the telos imposed by humans: after all, we do not eat lettuce seeds but the lettuce head. In other cases, the species-specific telos may simply coincide with fulfilling the human-imposed telos. Anyway, telos is an essential part of the moral value of what we eat. Humans also have a purpose (telos) as a species and, within it, as an individual. The telos of our humanity benefits from respect for the telos of what nourishes us. We become better and healthier people if we take better care of our environment.

In this way, humans, plants and animals together form a 'community of practice' focused on the preservation of the 'circle of life' that promotes the welfare of humankind and in which there is respect for each role. In many ways, it reflects the circular economy, which is currently conceptualized and— sometimes—implemented.

While the concepts of naturalness, intrinsic value, and integrity are well developed, the aspect of the natural goal (or telos) of the animal or the plant and of the way in which humans add another goal to it, has hardly been identified. For (semi-)domesticated plants and animals that make up our diet the telos added by humans is essential and more than the species-specific telos of the organism itself. It determines how we manage and use them. Our management of these plants and animals is driven by the final use and the moral value we ascribe to them is—at least partly—depending on their use. We can mow the grass or slaughter animals without disturbing their natural goal or telos, and this is not considered a violation of their integrity. On the other hand, the culling of healthy farm animals to get an infectious disease under control is regarded as a violation of their telos, as they go, prematurely and uneaten, into the incinerator.

Both the natural telos and the telos imposed by humans have different dimensions: from individual organism, to species, to the system (niche, biotope, agro-ecosystem, farm, landscape) of which they form part. We choose in this elaboration of the concept for the species as a central aggregation level. In other words, the nature and use define the respect and rights of the species and the individuals as a representative thereof, as telos encompasses both the intrinsic value of the living being based on its own being and its unique position in the natural ecosystem and the moral (extrinsic) value based on its usefulness to humans. This telos is assigned to both the species as a whole and to the individual plant or the individual animal. It can also be extended to the ecosystem in which the plants or animals play their unique role.

The concept of telos is the result of the search for balance between domestication and conservation of the 'natural nature'. Respect for the naturalness of the organism cannot be fully applied as humans make the organism sacrifice too much of its nature to impose a role at the service of humanity. Society has to set limits. A case in point is the Dutch broiler industry. Broilers are young chicks reared for meat production. In this industry the most sustainable way of production (both in terms of economics and in terms of environmental footprint) is highly intensified but shows little respect for the animal as it has 'instrumentalized' the animals without considering animal welfare [65]. In the next section, we further explore how this balance between both types of telos can be realized.

6. The Two Types of Telos Reconciled

In the confrontation between the two types of purpose (nature telos and utility telos), a number of themes can be distinguished that lend themselves to formulate preconditions and to capture these in policy criteria and guidelines. We formulate some possible ethical guidelines, as examples, realizing that these differ in practicality and sense of reality. It is also obvious that such guidelines will be easier to implement and enforce in animal husbandry than in crop production, not at least because it is more natural for humans to show empathy for animals than for plants and because animal rights are relatively widely accepted, in contrast to plant rights [25]. On the other hand, there are simple tools to assess the well-being of plants: chlorophyll fluorescence meters provide an indication of plant stress [66], wilting indicates temporary or long-term shortage or oversupply of water and/or shortage of oxygen in the root zone, specific changes in color may be indicators for shortage of certain macro- or micronutrients or the occurrence of air-borne, soil-borne, or water-borne contaminants, and changes in the phenotype may also illustrate the presence of pests or diseases. Yet, such biotic or abiotic stresses in plants do not always trigger the human emotions that are so much contributing to our willingness to care. In the case of plants, humans are probably more moved by perceptions at a higher level of organization, such as the landscape [67].

For animals, we suggest the following principles:

1. The process of genetic selection should not lead to irreversible change: a domesticated animal should at least maintain the potential to turn feral and re-establish itself in a natural habitat.
2. It is preferred that every individual domesticated animal is allowed to live in a population consisting of all existing normal age categories, including young, mature, and old individuals to enhance normal behavior; in fact, family or herd behavior should even be indulged.
3. Animals must be able to experience a natural environment, which determines their rhythm of life, and to behave according to their nature.

For plants or crops, we suggest the following principles:

1. Plants should be able to grow in interaction with each other, a natural environment (including natural light), the soil (with its natural physical, chemical and biological components), and the insect world.
2. Plants should not be isolated from the natural context in which they are used to live, they should be exposed to seasonality (and be allowed to express the seasonality of their growth) and environmental factors which determine their rhythm of life.
3. Being part of an agro-ecosystem and closing of natural cycles are guiding principles in the design of cultural practices and agro-ecosystems.

These principles may not easily fit in the economic order of our food systems. However, we are convinced that our food systems will have to change in order to allow a just sharing of resources. Eating less meat will become necessary and more respect for our farm animals could strengthen the trend of reducing meat consumption. Respecting natural expressions of species-specific goals and wants, such as reproduction, might undoubtedly create practical problems if the consequences are not properly managed. Our main message is the need to respect farm animals and crop plants as living beings with their own telos that we need to respect in order to also maintain self-respect as responsible custodians of our living environment. Our approach will have to be designed and tested for many practical situations, and a variety of creative solutions will have to be developed and shared. One of those creative solutions could be to detect the sex of embryos long before the eggs hatch to prevent having to kill male chicks that are superfluous as they do not lay eggs.

For both animals and plants, there is a need for monitoring and clear criteria. To design monitoring protocols and criteria for respectful crop production additional research will be required as was done in the past for animal welfare based on ethology. Especially the development of a new science—plant ethology—is required to provide the tools to create empathy with plants and their counterparts in

the agro-ecosystem, either aboveground or belowground. It is even imaginable to scale this up to an ethology for the farm as a living being [cf. 62]. Important criteria are mainly based on higher levels of aggregation: the functioning of the nutrient cycles, the coherence of the farm processes, the quality of the soil (especially in biological terms), the quality of the ecosystem services, the nature value of the farm within the landscape in which it is positioned and the social function within its environment. An early example of research on this topic is the intriguing thesis by Smeding [68] who demonstrated that there was a direct relation between farm management, the diversity of the food web in the soil and the ecosystem services provided by the farms and on that basis suggested that soil food web management was a realistic option in farming.

We should also consider the fate of the modern (animal and plant) genotypes, which have already evolved under human influence into a form which will prevent them from becoming feral. Although their species-specific telos has already been violated to a very large extent, they still have a certain level of intrinsic telos that needs to be respected. In such cases, a reconciliation of the two 'teloi' is no longer possible, but a case-specific compromise should be found in which the remaining intrinsic telos is maximized while maintaining the specific purpose for which they were developed.

We expect that promoting these principles will have large technological, economic, and social consequences. Policies promoting respectful agriculture should enhance organic and respectful coevolution of domesticated organisms, natural elements in the agro-ecosystems and humans, as suggested by Smeding [68]. We expect that responsible innovations are required based on shared values to cope with these policies and to realize healthy systems where respect can prevail. However, we are convinced that these innovations will help on the path towards an inclusive civilization driven by a sustainable and respectful agriculture.

7. Final Comments

We have taken plants and animals from the wild and domesticated them so that we can use them more efficiently. In the process, they became dependent on the symbiosis with us and they had to sacrifice some of their naturalness and self-reliance to serve us better. They remained living beings with their own right to be, although with the handicap that they now need humans in order to take part in their agro-environment. That creates a moral imperative for humanity, although it does not mean that we need to become technophobic.

In the way we have described telos, this concept helps to determine the moral obligations we have towards domesticated plants and animals and shows how humans can better respect the food in a practical way. The concept complements 'naturalness' (as it recognizes the unnatural elements in the use of plants and animals), the 'intrinsic value' (as it emphasizes the moral value of the use of plants and animals), and 'integrity' (by defining and appreciating the natural goal, defined as telos). Together, these four elements (naturalness, intrinsic value, integrity, and telos) help us to provide dignity to plants and animals, to assign moral value to the way we produce our food and thus to build a more sustainable society.

In the far future, humans might become convinced that the intrinsic telos of animals is so important that they will decide to refrain from capitalizing on their extrinsic telos entirely. Vegetarian meat-substitutes may then become humane alternatives for intensive animal farming. Similarly, more respectful ways of using plants might become more popular, such as forest gardens.

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