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Animal Frontiers is published quarterly by the American Society of Animal Science (ASAS), Canadian Society of Animal Science (CSAS), the European Federation of Animal Science (EAAP), and the American Meat Science Association (AMSA). This magazine synthesizes information, through applied reviews, from across disciplines within the animal sciences. Animal Frontiers is provided as a benefit to the members of these societies.

The digital version of this magazine is online at www.animalsciencepublications.org/publications/af.
Introduction

Animal Frontiers: Celebrating a Decade of Publication

The Animal Frontiers Management Board

In 2020, we celebrate the first 10 years of publishing Animal Frontiers, an official journal of the American Society of Animal Science (ASAS); the Canadian Society of Animal Science (CSAS); the European Federation of Animal Science (EAAP); and the American Meat Science Association (AMSA). All four societies are dedicated to the advancement and dissemination of science-based knowledge concerning animal agriculture. Animal Frontiers provides a novel forum for innovative, timely, and international perspectives that have relevance to understanding the complex dynamics of high-impact, global issues at work through animal agriculture. Animal Frontiers is a quarterly publication and every issue explores a theme of broad and current interest within animal science and animal agriculture. During the first 9 years of Animal Frontiers, some of these themes focused on disciplines associated with animal science, such as reproduction (Flowers, 2013; Chavatte-Palmer and Mermillod, 2015), genomics (Bagnato and Rosati, 2012; Ibanez-Escriche and Simianer, 2016), or health (Lefrancois and Pineau, 2014) while other issues focused on somewhat contentious issues such as animal welfare (Lay, 2012), carbon footprints (Zinn, 2011), climate change (Bernabucci, 2019), effective communication (Hamernik and Johnson, 2015), the human-animal bond (Zinn and Beck, 2014), the definition of meat (Diiger, 2017), or water use (Girard, 2012).

The current issue of Animal Frontiers focuses on ethical considerations related to the production of animal-sourced foods (Gremmen, 2020). The ethics of animal production for production of meat, milk, and eggs for human consumption is an increasingly discussed contemporary issue throughout the developed world. In dealing with complicated issues, the Animal Frontiers Management Board recognizes that it is important to understand different opinions and perspectives. In this issue of Animal Frontiers, ethical issues are presented mainly from philosophical perspectives to reflect on implicit and explicit moral assumptions of animal scientists. The papers in this issue of Animal Frontiers follow a philosophical logic rather than a science-based approach to the topic. The opinions expressed in this issue of Animal Frontiers are those of the authors and do not reflect those of the members of the Animal Frontiers Management Board and the scientific societies they represent. Questions may be directed to Deb Hamernik (dhamernik2@unl.edu), Editor-in-Chief, Animal Frontiers.

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Introduction

EAAP reflections on the first 10 years of Animal Frontiers

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The January 2020 issue of Animal Frontiers marks the beginning of the 10th issue of this novel forum for innovative and timely perspectives that have relevance to understanding the complex dynamics of issues relevant to international animal agriculture. EAAP—the European Federation of Animal Science—is proud to be one of the four animal science organizations that have created, managed, and published Animal Frontiers. The American Society of Animal Science (ASAS), American Meat Science Association (AMSA), and Canadian Society of Animal Science (CSAS) also contribute to the publication of Animal Frontiers and each of these societies will have the opportunity to provide their perspectives on the 10th anniversary of Animal Frontiers in subsequent issues.

When the four animal science organizations began this new adventure, I wondered how the members of EAAP would react to publication of scientific articles in such a new format—Animal Frontiers is scientific magazine with a unique style compared to our conventional, peer-reviewed scientific journals. I believed that Animal Frontiers would feel quite different to EAAP members at first. After nearly 10 years, what fueled the origin of Animal Frontiers still remains an integral part of its DNA. In every issue, we continue to fulfill the aspirations of those early years and hope that each new issue is enjoyed as much as the first issues and by a larger number of readers.

The original goals for Animal Frontiers were to create a quarterly publication focused on a current topic related to animal science with articles written by a broad range of international authors with different perspectives on the topic and to ensure that articles were written in an “easy-to-understand” manner that was useful for nonscientists such as teachers, policy makers, extension specialists, and industry professionals. In the 10 years since Animal Frontiers was launched, those original ideas are still alive. Support for the original format of Animal Frontiers continues to grow as measured by the increase in number of readers from Europe and other continents. Without a doubt, our original decision to make the online version of Animal Frontiers open access and freely available to the public from publication of the first issue onward has subsequently paved the way for other animal science magazines to use a similar publication strategy; thus, the original idea to publish a new, open access journal in international animal science was just what the global animal science community was waiting for!

The story of the first 10 years of Animal Frontiers is a story about animal science at a global scale. Going back to read the first issues and then reading all the subsequent issues (around 50 issues so far) it is easy to observe a long line of landmark publications, including the disciplines of animal science and the global livestock industry. All issues of Animal Frontiers have crosscutting interdisciplinary themes addressing the challenges of livestock industries and showing the development that our scientific disciplines have reached in the last 10 years in Europe and around the world.

We believe that the 10-year anniversary of Animal Frontiers is an international accomplishment worthy of celebration! In addition, EAAP members can be sure that we will not stop here. The four, international animal science organizations are already planning to make the second 10 years of Animal Frontiers filled with additional landmarks of interest to an even larger number of international readers, and in a few words … another decade of success!

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From the Editor

Ethics views on animal science and animal production

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In the last century, animal science has had more than a fair share in securing agriculture’s dominant task of feeding the human population. From an ethical perspective, this is clearly very positive, but it does not absolve animal scientists from critical, ethical examination of the consequences of their work.

To earn the public’s ongoing support, animal scientists must be trusted to align with the highest ethical values. Animal scientists need to do more to address the broader ethical issues that are of increasing concern to the public. Animal scientists need to be proactive and propose an ethical agenda about innovations. What do we mean by ethical reflection in the field of animal sciences? Ethics may be studied from several disciplinary backgrounds: law, theology, psychology, philosophy, or social science. In this special issue (Figure 1), ethics is studied mainly from a philosophical background and defined as the critical, systematic reflection on implicit and explicit moral assumptions of animal scientists. The aim is to offer a series of papers dealing with different proactive and constructive ways to deal with ethical conflicts. We also want the different ethical views to contribute to responsible policies and practices by enriching the reflection of societal groups, policymakers, professionals, and NGOs with questions from the perspective of animal ethics.

In the past, many papers have been published about the ethics of animal science and animal production. This has led to a range of different themes and views. In this special issue, we will organize a number of these views in two sections. The first section provides an overview of different views on animals and animal production systems: views on animals in different religions (Caruara, 2020), three different views on the ethics of animal production systems (Gremmen, 2020; Figure 2), and different ethical views on factory farms (Thompson, 2020). The second section focuses on three core themes from the literature on the ethics of animal science and animal production: meat (Francione, 2020; Pulina, 2020), modern biotechnology (Bovenkerk, 2020; Shriver, 2020), and Precision Livestock Farming (Werkheiser, 2020).

Caruara (2020) provides a chronological overview of the ethical views on animals in different religions and explains that religions, in spite of their differences, converge on some fundamental points, some of which concern our responsibility toward animals. Human superiority over all other creatures is to be understood in terms of caring for creation. Moral questions concerning our treatment of fellow humans are linked to those concerning our treatment of animals. Animal care is an obligation, both moral and religious.

Gremmen (2020) argues that an ethics of animal production “systems” consists of a Moral Operating System, which consists of an “internal” professional “care” ethics, an “external animal” ethics, and an “emergent” ethics in life sciences enabling change by responsible innovation. A Moral Operating System will help scientists, stakeholders, and policymakers to...
understand, evaluate, and monitor the integration of ethical aspects of agricultural systems.

Thompson (2020) focuses on the ethical aspects of factory farms. He states that philosophers have neglected the relationships that establish duties to farmed animals, especially in factory farms. Many philosophers apparently assume that the conditions in industrial facilities are so horrible that the very idea of discussing obligations to them is vitiated by the unredeemable nature of the circumstances in which they live. Even when widely read texts accurately describe welfare deficits, they present a picture which is misleading both as to the extent of these problems and to difficulty of making changes in response to them. Frequently cited welfare problems in factory farms support a case for reform, but it is difficult to see how it would support the claim that what is done to farmed animals is equivalent to torture. Philosophical analysis could actually help improve the quality of life for animals living on factory farms.

The second section of this special issue starts with the paper of Francione (2020) who argues against the use of meat, while Pulina (2020) is defending the use of meat. According to Francione (2020), it is absurd that some animal rights campaigners maintain that we should allow animals the same legal rights enjoyed by humans. A sensible and coherent theory of animal rights should focus on just “one” right for animals—the right not to be treated as the property of humans. Recognizing animal rights really means accepting that we have a duty not to treat sentient nonhumans as resources. Pulina (2020) defends the opposite position. In his view, meat consumption is morally justified and animals are not carriers of rights. People have specific obligations toward animals. The first obligation is to respect animals and to guarantee their well-being, which must represent the main concern of a breeder. This paper chose an operative position: what does good or evil mean for animals and how should this be interpreted for positive purposes, including the production of food for humans. Because, before anything else, ethics pursues the aim of improving the lives of Men and other living beings while respecting the fundamental natural and cultural principles that govern the biosphere and human societies.

The second theme starts with Shriver’s (2020) ethical analysis of the relation between modern biotechnology and welfare. He develops arguments for the claim that a Principle for the Conservation of Welfare should be adopted to ensure that the genetic modification of livestock does not result in unnecessary suffering. Failing to do so would both be morally wrong and likely to result in a serious undermining of public trust in food producers. This principle needs to be enshrined in legislation or regulation in order to be effective and assuming that the principle will be followed via “self-regulation” would be both morally wrong and likely to permanently damage trust in food producers.

In her paper about genetic modification of animals, Bovenkerk (2020) aims to go “beyond” welfare arguments. She starts with the observation that many people still have moral problems with modified animals, whether or not they experience welfare problems. The arguments “beyond welfare” appear to be part of broader conceptions of the “good life” and of how to be a good person. There is less agreement on the arguments beyond welfare, which rely on people’s comprehensive notions of the good life, about which people disagree fundamentally. By only taking rule-ethical principles seriously, many important values and meanings that people attach to life and to the world around them are disregarded. We do not blindly employ...
our technologies on animals, but we should once in a while step back and reflect on what modifications mean for our relationship to animals and nature and on what kind of world we want to live in.

In his paper about Precision Livestock Farming, Werkheiser (2020) states that there is a lot of pressure from various quarters for traditional farms to scale up, yet doing so brings with it a host of problems around animal husbandry. We have also seen that Precision Livestock Farming is a promising solution, but one with a host of concerns that are currently very underexamined and underdiscussed, particularly outside academia. None of these concerns are so damning that Precision Livestock Farming should not be pursued. However, they all require careful negotiation and forethought and the incorporation of the perspectives of many stakeholders.

In summary, all papers in this issue describe and analyze many interesting views on the ethics of animal science and animal production. The Ethics Working Group of the European Federation of Animal Science aims to provide a focal point for those who have a professional interest in the ethical issues involved in animal science. It is an interdisciplinary, cross-cultural and non-partisan network of international experts, scientists, and professionals with special interest in the ethical issues of physiology, nutrition, breeding and genetics, husbandry and management, welfare and animal health, milk, meat and fiber production, etc. Membership of the Ethics Working Group is voluntary, based on scientific interest.

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Feature Article

Different religions, different animal ethics?

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Implications

- Religions, in spite of their differences, converge on some fundamental points, and some of these points concern our responsibility toward animals.
- Human superiority over all other creatures is to be understood in terms of caring for creation.
- Moral questions concerning our treatment of fellow humans are linked to those concerning our treatment of animals. Animal care is an obligation, both moral and religious.

Key words: animal care, ethics, God, religion, virtue

Introduction

Interest in animal ethics has recently increased considerably. This is due to various factors like technological progress, the sharp rise in human population, and the consequent pressure on global ecology. In this area, do traditional religions have anything to offer? It is obvious that religion still plays an important role in many areas of individual and communal life, for better or for worse. As regards animals, religious traditions affect the subliminal conscience and moral dispositions of billions of people. This paper explores this effect in three sections. The first section will be about religion, the second about conceptual clarification, and the third will be about morality.

At the very start however, an important general point needs to be highlighted. The paper’s title may give the impression that the overall argument will defend some form of relativism. The final result, however, will pull in the opposite direction. Accepting a plurality of perspectives is not the same thing as embracing relativism. The method adopted in this research acknowledges that, within the global, complex cultural landscape, each individual sees things from his or her own specific location. It acknowledges also however that being situated does not necessarily block the researcher from objective truth. Those who accept the relevance and importance of different cultural perspectives can still arrive at objective truths, just as observers can arrive at some truths about the room they are sitting in even though they are seated at different places.

Religions and Animals

Starting with the most ancient traditions and proceeding chronologically, the following selective overview will first consider the main religions that emerged from India before spreading across East Asia: Hinduism, Buddhism, and Jainism; it will then deal with the Abrahamic religions, those that consider Abraham as their founder. In most religious traditions, animals play a symbolic role, but such symbolism will not be the focus of this paper. It will concentrate rather on moral issues, not limiting the discussion to animal-friendly teachings but mentioning also some problematic or negative aspects.

In Hinduism, the majority view as regards animals highlights two basic ideas: the idea of a hierarchy of living things with humans enjoying the highest status and the idea of reincarnation (Krishna, 2010; Kemmerer, 2012). The position of each animal within the hierarchy of life is not random, but determined by the fixed law of *karma*. Good deeds contribute to the believer’s promotion within the hierarchy, bad ones to a demotion. The idea of a hierarchy determines a kind of sacred inequality differentiating all biological species, differentiating even the various ethnic groups within humanity. This idea functions well within Hinduism for promoting good behavior, but it assumes that animals are situated at a significantly inferior level when compared with the lowest caste of humans. This devaluation of animals is counterbalanced by the many sacred texts, for instance in the Rig Veda and the Atharva Veda, where we find praise toward anyone who shows sensitivity toward animals. It is counterbalanced also by the belief that Hindu deities reincarnate as animals, especially as monkeys and cows, for instance Rama and Krishna. In fact, detailed studies indicate that the respect Indian religions show toward animals is supported by the strong symbolic link eventually established between the various animal species and the various divinities (Krishna, 2010). According to Nanditha Krishna, the cow veneration arose during the Vedic era. As is well-known, the cow occupies a special place in Hinduism, even today. In giving us milk, it represents our source: our mother or mother Earth. A relatively recent text, the Chandogya Upanishad, which appeared about 800 BC, confirms that nonviolence, or *ahimsa*, should be observed not only toward humans but also toward all beings (Figure 1).

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As regards Buddhist traditions, one can start by highlighting a very general point. According to most interpretations, the goal of Buddhism is to overcome suffering and free oneself from the cycle of death and rebirth. One notices therefore that Buddhism retains from Hinduism the hierarchical view of beings and also the idea of reincarnation. It adds however the idea of personal liberation through enlightenment. The main goal for humanity is to find the right spiritual practice to end the suffering that results from rebirth. Later Buddhist interpretations hold that the painful cycle of rebirth occurs in six realms of existence: the heavenly, the demi-god, the human, the animal, the hungry ghost, and the hellish realm. The last three of these realms are evil, the animal realm included. Does Buddhism admit of a creator? This is a disputed question even today. One school holds that all phenomena originate from other phenomena and that the cycle of originating dependence is closed within itself. The universe therefore does not need a first cause. Other forms of Buddhism however admit the ultimate reality as the source of all things. For instance, Mahayana Buddhism describes the ultimate reality as the Womb of all Buddhas or as the Primordial Buddha. Regarding the status of animals, Buddhism shows trends that apparently pull in different directions. On the one hand, one maxim of the Noble Eightfold Path is that all Buddhists should refrain from killing. On a broad interpretation, this maxim includes all sentient life (Kemmerer, 2012). Consequently, vegetarianism is a highly respected ideal. On the other hand, Buddhism retains not only the hierarchy of life but also the idea that the animal realm is evil, in the sense that it is a realm that humans should avoid by living virtuous lives.

Jainism is another ancient Indian religion. It is founded on the four main ideas of nonviolence, many-sidedness, nonattachment, and asceticism. Jain lifestyle is marked by vegetarianism and the avoidance of all harm to humans and animals. It is the strictest religion as regards avoiding harm to animals. All living things are meant to help one another. Killing is not allowed, even in self-defense. Going further than Hinduism and Buddhism, Jainism considers nonviolence the highest moral duty. The background cosmology is similar to what we saw in Hinduism and Buddhism, namely a hierarchy of living things and the cycle of rebirth, from which humans need to be liberated. According to some Jain traditions, killing is to be avoided not because of the inherent value of living things but to keep one’s soul pure, ensuring thus a better rebirth. One important prayer includes a plea for forgiveness from all living beings. The idea of Jiva corresponds somewhat to what Western thinkers call consciousness or soul but Jainism sees Jiva as present everywhere, in gods, humans, animals, plants, hell beings, and even in inert matter (Figure 2). There is, therefore, an emphasis on a common hidden vital principle that joins all things into a kind of brotherhood. The universe in all its realms is eternal and self-sufficient. There is no creator God who rewards and punishes. Instead, there is the law of karma. This plays the role of delivering reward and punishment and it does it through necessity.

We move on now to the Abrahamic religions, starting with Jewish traditions. In the Jewish Bible, one finds that God created all things and that all creatures are good in themselves. There are also some specific moral obligations toward animals, for instance the injunction not to muzzle an ox while it is working (Deuteronomy 25:4), and to help a fallen overloaded donkey, even if it belongs to your enemy (Deuteronomy 22:4). The prophet Qohelet, speaking about the prospects after death, holds that “man has no superiority over beast” (Ecclesiastes 3:19 NRSV). More noteworthy still, one finds passages where the author describes animals as part of the human community.
God commissions Noah to save not only his family but all creatures in view of a new world order (Figure 3). Moreover, after the flood, God establishes the new covenant with all creatures: “I am establishing my covenant with you [Noah] and your descendants after you, and with every living creature that is with you, the birds, the domestic animals, and every animal of the earth with you, as many as came out of the ark” (Genesis 9:9 NRSV). In the book of Jonah, the King’s call to fast, repent and return to living well, in line with God’s will, includes domestic animals (Jonah 3:7–9 NRSV). One could mention also human fellowship with animals as regards rest and as regards praise: “that your ox and your donkey may have rest” (Exodus 23:12 NRSV); “Let everything that breathes praise the Lord!” (Psalm 150 NRSV). The kosher slaughter of animals is allowed but it involves minimizing pain and draining away the blood to show respect toward the animal’s soul (Leviticus 17:10–13). Although a discussion on the related issue of animal sacrifice lies beyond the scope of this paper, one needs to mention at least one other somewhat disputed point. In the book of Genesis, there is an explicit reference to human authority and supremacy. “Then God said, ‘Let them [humans] have dominion over the fish of the sea, and over the birds of the air, and over the cattle, and over all the wild animals of the earth, and over every creeping thing that creeps upon the earth’” (Genesis 1:26 NRSV). According to many Jewish commentators, the idea here is that, since God is merciful toward all creation, humans should do likewise. They should imitate God by extending His mercy toward all creatures (Seidenberg, 2008; Kemmerer, 2012).

Christianity retained nearly all the religiosity of Judaism, articulated it to some extent in terms of Greek philosophy, and added its own original elements. As regards animals, the New Testament makes few direct references. Jesus did say of the birds that “not one of them is forgotten before God” (Luke 12:6 NRSV) but the main thrust of his message concerned humans. According to the Christian doctrine of the Incarnation, Jesus is both divine and human, and he invites humans to follow him and to become children of God. This idea entails a strong form of anthropocentrism. Nevertheless, it includes also a cosmological aspect. As explained by St. Paul, Christ’s salvific act embraces not just humans but all creation, including animals. Paul writes, “the creation itself will be set free from its bondage to decay and will obtain the freedom of the glory of the children of God. We know that the whole creation has been groaning in labor pains until now; and not only the creation, but we ourselves, who have the first fruits of the Spirit” (Romans 8:21–24 NRSV). Humans are definitely more important than animals. Nevertheless, many prominent Christian figures in history, like Francis of Assisi, became famous for their inclusion of animals as close friends, deserving love and mercy. For Catholics, official doctrinal statements focus not so much on whether animals have rights per se but on the moral constraints that apply to humans in their treatment of animals. The current position defends not only the unquestionable dignity of the human person but also the reality of moral obligations toward animals. On the one hand, the Second Vatican Council documents affirm that the human person is “the only creature on earth that God has willed for its own sake” (Paul VI, 1965, paragraph 24) and the Catechism of the Catholic Church (1994) adds that animals are “by nature destined for the common good of past, present, and future humanity” (Catechism, 1994, 2415). On the other hand, the same Catechism affirms that humans are obliged to “respect the particular goodness of every creature” (Catechism, 1994, 339). The recent encyclical Laudato Si is more explicit. Pope Francis writes, “The ultimate purpose of other creatures is not to be found in us. Rather, all creatures are moving forward with us and through us towards a common point of arrival, which is God” (Francis, 2015, Section 83). Moreover, “our insistence that each human being is an image of God should not make us overlook the fact that each creature has its own purpose. None is superfluous” (Francis, 2015, Section 84). The overall current position emphasizes the urgent need for reconciliation with all creatures. Christianity is not a vegetarian religion. Nevertheless, it has always highlighted the importance of abstaining from the eating of flesh as a way to help realize the purity of life before the Fall, and thus prepare for the full realization of the new creation (Berkman, 2004).

The final point in this quick overview of major religious deals with Islamic traditions. Just like Judaism and
Christianity, Islam recognizes God as Creator of a hierarchy of beings with humans on top. Humans enjoy a special status because they have a far higher dignity than animals. For Muslims, God created animals for the use of humans. For instance in *The Qur’an (2004)* Surah 16:5, there is the claim that “And livestock – He created them too. You derive warmth and other benefits from them: you get food from them.” Surah 40:79 says, “It is God who provides livestock for you, some for riding and some for your food.” Humans however are God’s vice-regents on Earth and are obliged to make decisions for the benefit of creation as a whole. Within Islam therefore, there is the same kind of anthropocentrism as in the other Abrahamic religions. Nevertheless, Muslims see animals as creatures that enjoy their own communities. Animals praise God in their own way, which we do not understand. For instance, the *The Qur’an (2004)* Surah 6:38 explains that “all the creatures that crawl on the earth and those that fly with their wings are communities like yourselves.” Later holy writings support these foundational ideas in *The Qur’an (2004)*. Most significantly, the important Islamic collection, the Hadith, often describe the Prophet Muhammad’s special concern for animals. The central Islamic message of love, compassion, humility, submission, and almsgiving (zakat) is applicable not only for humans but also in the broader context of human-animal relations. The overall picture therefore has two sides. On the one hand, since humans are the centerpiece of creation, the killing of animals is permissible. On the other hand, maltreatment of animals is recognized as wrong. Killing for food therefore needs to be minimal and regulated carefully to minimize the painfulness of the procedure. *The Qur’an (2004)* in fact allows the eating of certain animals only, and only when slaughtered in a specified way.

**Conceptual Clarification**

Each religion responds to the restlessness of the human heart by offering a particular viewpoint. Because of the various ramifications of religious traditions in the course of history, the overall stand as regards animals is not always clear. Nevertheless, we can still identify at least two areas of global convergence, one dealing with the interdependence between all living things and the other with the significance of the triad animality–humanity–divinity.

First then: the interdependence of all creatures, material and spiritual. The very use of the word “creatures” reflects a common kinship. The universe, charged with its own dynamism, shows how most creatures flourish by using other creatures. Religions see therefore the entire biosphere as a unified, dynamic whole. This universal creaturely kinship is not a flat or chaotic landscape. It is a hierarchy. All living things occupy a specific position within this hierarchy. Humans may be the highest within the material realm but they are certainly not the highest overall. Our position bestows on us not only power and authority but also special responsibilities. The major religions accept that a lack of human respect toward animals often generates a corresponding lack of human respect toward other humans, especially the poor, the underprivileged, the physically or mentally challenged, the sick, and the old (Figure 4).

The second area of convergence involves the relation between the concepts of animality, humanity, and divinity. Religions go beyond the direct interest of animal ethicists, who normally focus on the animality–humanity relation. Religions add another dimension.

Many philosophers of ancient times, most notably Aristotle, had correctly recognized that humans are indeed animals,
animals of a special kind. Nevertheless, our use of the term “animality” as distinct from “humanity” remains useful. Such use highlights the gap between us and other animals. “Animality” is sometimes used to refer to the bodily instincts of humans as distinct from human intellectual or spiritual nature. In what follows however, the focus will be mainly on animality as a generic characteristic of nonhuman animals. As regards animality in this sense, one notices first that it is not a human construct. Animality is a given. Although we can care for animals, manage them, dominate them, and eat them, we cannot construct them ourselves. Sometimes the expression “animal production” is indeed used, but this use is misleading. What we produce are things like tables and chairs. They are artifacts. Had humans never existed, the world would be bereft of tables and chairs. Not so as regards animals. They constitute part of the fundamental givenness of the world. Moreover, animality comes across to us as a realm of innocence. It is a morality-free zone. Sometimes, we might feel nostalgic about this zone. We might yearn for this state of life. We do share in animality but we are burdened, one might say, by another realm, the realm of thought and morality. Animality acts like a mirror that reveals something of our own nature to us. The gap is highly instructive (e.g., Derrida, 2002). It is certainly different from the gap between machinery and humanity. When we insert animals within complex input–output structures, designed for our benefit, we overlook the specific integrity that each animal represents. Factory farming degrades animality by confining it within the rigidity of machinery, within the restrictions of artificiality. In fact, in plain pragmatic and utilitarian terms, factory farming is nothing but the project “to raise as many animals as possible in the smallest possible space in order to maximize profits” (Degrazia, 1998, p. 281). The integrity of the individual animal does not count in any way. The problem here does not concern the factory only. It concerns the factory and all its links to society at large. The machine in this case includes its human administrators, its animal constituents and also the human consumers. The fact that consumers are far away, are ignorant of the conditions involved, or are unwilling to find out, does not detached them completely from the problem. By buying its products, consumers are in fact collaborating with the malpractice. The “social distance” between the perpetrator and the supporter of the system is never enough to render the supporter totally innocent. Some researchers therefore rightly support the demand for transparency and for boycotting. Current empirical studies have confirmed that many animals have rudimentary forms of beliefs, desires, and self-awareness (Degrazia, 1998; Lurz, 2009). Nevertheless, current levels of cruelty to animals are unacceptably high. For some people, awareness of this is like a personal wound, a wound that cannot heal. They carry it with them, hidden in their hearts, wherever they go, like a kind of original sin (e.g., Agamben, 2004; Cavell, 2009, p. 128–130).

As regards divinity, one needs to acknowledge that some religions, for instance Buddhism, apparently do not refer to God at all. Nevertheless, one can take divinity in a broad sense as a common element for all religions. Divinity in a broad sense refers to a transcendent order to which people aspire. The transcendent order is the ultimate goal and the source of moral insight. Religions talk about divinity in this sense in various ways, for instance in terms of union with a loving God or in terms of the dissolution of the self as a result of liberation from the cycle of rebirth. Whether Buddhism is fundamentally atheistic is a debated question and there is apparently no clear agreement between the various traditions. For instance, on the one hand, some argue that Buddhism is ultimately atheistic because of its deep conviction that the sense of unity
between different aspects or experiences, as in our own subjective experiences, is an illusion. Therefore, things, although many, are not bound together by any kind of real unity (Hayes, 1988). On the other hand, in the Buddhist scriptures known as the Nibbana Sutta of the Udana Nikaya (the Pali Canon), one finds the Buddha himself teaching as follows: “there is, monks, an unborn-unbecome-unmade-unfabricated. If there were not that unborn-unbecome-unmade-unfabricated, there would not be the case that escape from the born-become-made-fabricated would be discerned. But precisely because there is an unborn-unbecome-unmade-unfabricated, escape from the born-become-made-fabricated is discerned” (Udana Nikaya, 2012). Such a statement indicates an ultimate One analogous to what the Abrahamic religions and various philosophies refer to. How does divinity, understood in this way, affect the animality–humanity conceptual relation? The divinity dimension opens up the horizon of religious believers to ideas about a common source and a common goal to all life. This horizon introduces a common ultimate relation of order and interdependence. Religious people feel obliged to care for animals, remaining nevertheless fully aware of their own human specificity of superior intellect and power. Are we ashamed of being so different from animals, so superior to them? The givenness of all life-forms includes the givenness of our own specificity. It includes our responsibility and the alarming ecological imperative that we are discovering nowadays, namely to care not just for ourselves but for all living things. This is a divine imperative, a commandment.

**Moral Implications**

How does religion affect the foundational source of people’s action? Of course, actions speak louder than words. Religious doctrine therefore remains ineffective until it takes up concrete form in deliberation and action. Some personal traits or habits, attributes of the person as a whole, are crucial for that person’s morally good life. These traits are called virtues. Most religions and philosophical traditions agree that the basic virtues are not culturally dependent. They are the same for all people, whatever their culture or religion. Virtues like prudence, temperance, justice, and fortitude are universally indispensable for genuine human flourishing. How are these virtues applicable as regards animals? Let us consider them briefly one by one (Schaefer, 2008). In general, prudence makes one identify real needs and judge well as regards the best means to adopt. It ensures that one makes judgments in the light of all the available data. As regards animal welfare, this means that religious believers are motivated to collect all available data, including embarrassing data like appalling farming conditions and cruel slaughtering methods. Temperance, as sustained by religious discipline, helps believers avoid inordinate and immoderate desires, for instance excessive meat-consumption. Justice motivates religious believers to give to each his or her due, and to extend this imperative to all creatures. And finally fortitude: sustained by religion, this virtue makes believers act fearlessly even when opposed. With fortitude, they respond effectively to ecological concerns and are ready to revise well-entrenched practices. They are ready to engage in self-corrective procedures, even as regards their own belief systems, and to learn from past mistakes.

**Conclusion**

This paper’s title was in the form of a question: “Different religions, different animal ethics?” Although most of the arguments presented deserve further exploration and analysis, the overall result is clear enough. There is considerable support for the claim that religions, in spite of their differences, do converge on some fundamental points; and some of these points regard animals. The conclusion can be formulated in two points. Firstly, a point about human superiority. The major religions indicate that it is indeed possible to affirm two apparently opposing claims: the claim that humans have a higher dignity than that of all other creatures and the apparently opposing claim that humans should not cause suffering to creatures. The way to hold these two affirmations together is to see human superiority in terms of caring for creation. Even though humans count more than animals, animals count as well. Indeed, they should count much more than what we have been assuming for centuries. Secondly, a point about urgency. One way of reacting to cruelty is to say that animals must wait. First, we need to learn how to eradicate cruelty to humans and then, once this is accomplished, we will sort out our relations with animals. This kind of response however is deceptive. We need to address all moral fronts together, in the right way. Practices like factory farming, irresponsible genetic manipulation, excessive meat-consumption, the use of animals for experiments, cosmetics or entertainment should all be thoroughly revised accordingly. Animal care is an obligation—both moral and religious.
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Moral dilemmas of animal production systems

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Introduction

Globally, the number of animals used by humans has grown to an all-time high. Hundreds of millions of animals play an important role in different activities as pets, in sports, as hobby and companion animals, but they are also used in clinical trials and tests, especially in agriculture (Eijsackers and Scholten, 2011). However, many societies are changing dramatically in relation to societal ideas about animal production (Ankersmit, 2010), especially about genetic modification and the use of animals (Bruijnis et al., 2015). To mention only a few trends that will reduce animal numbers in the long run: a ban on wild circus animals, a restriction on keeping certain species as pets, and a reduction in dairy cows and pigs. Besides their role in society, animals are also found in nature areas, where humans are causing the sixth global mass extinction of wild animals.

Hereafter, I will focus on the moral dilemmas of animal production systems. Examples are tail docking of piglets (Figure 1) and killing day-old male chicks.

These moral dilemmas arise when societal values clash with the principles of an animal production system because of unintended consequences and risks. To tackle these moral dilemmas as an ethicist, it is necessary not only to be part of a life sciences trajectory of responsible innovation but also to strengthen ethical reflection along the agricultural production chains and among the involved stakeholders.

Ethics and Animals

Clashes of different ethical approaches may be observed in societal debates about animals (Thompson, 1998), and I will illustrate this by using the case of Johannes, a humpback whale.

On 12 December 2012, Johannes beached on the shoreline of De Razende Bol, a small uninhabited island between the island of Texel and the city of Den Helder in The Netherlands. The whale was stuck on the beach and could not return to the water on its own (Figure 2). Not so long ago, humans living nearby would have killed the animal immediately, and its remains would have been used for all kinds of purposes. In our modern times, we try to save such animals’ lives. Over the course of just a few days, Johannes became a national symbol for helping a wild animal in need. Political parties, civil servants, scientists, and members of societal organizations were engaged not only in debates but also in rescue and euthanasia attempts. All these attempts failed, and the whale eventually died. In the ensuing debate, ecologists and nature conservationists still argued against killing dying wild animals in distress, whereas the majority of the other participants in the debate argued for a humane death for these animals.

Implications

- An ethics of animal production “systems” consists of a Moral Operating System.
- A Moral Operating System consists of an “internal” professional “care” ethics, an “external animal” ethics, and an “emergent” ethics in life sciences enabling change by responsible innovation.
- It is important to broaden the existing ethical frameworks on agriculture to new scientific methods and technologies.
- A Moral Operating System will help scientists, stakeholders, and policymakers to understand, evaluate, and monitor the integration of ethical aspects of agricultural systems.

Key words: animal production systems, animal welfare, care ethics, emergent ethics, moral lock-in

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Figure 1. Pigs with docked tails.
At first sight, it seems that humans do not need to be involved at all when wild animals die: wild animals are wild precisely because they “take care of” themselves in areas where they are outside human control. In such situations, wild animals die for several different reasons: hunger, thirst, disease, predators, and also as a consequence of old age. Humans are often unaware of the fact that, out of their sight, animals could be dying. However, sometimes people are confronted with dying wild animals, like the beached humpback whale in 2012. What is our moral reference for killing wild animals? It seems that, in order to answer these questions, we can rely on animal ethics: the moral framework for the killing of domesticated animals. According to the law in most European countries, humans are obliged to help an animal in distress. From this ethical perspective, the first duty of humans is to save or help individual wild animals in situations where humans are present. When all help fails, our second duty is, if possible, to kill these animals in a humane way. The example of the humpback whale seems to fit into this scheme because it was an individual animal surrounded by humans. However, from the perspective of eco-ethics, wild animals are part of ecosystems. Therefore, the focus is on groups and species rather than on individual animals. In general, this ethical framework advocates respect for the wildness of animals. In the case of dying wild animals, like the humpback whale, the eco-ethics ethical framework advises a hands-off strategy. This seems to lead to a stalemate between two rival ethical frameworks, thus leaving nature management caught between two sets of norms governing animals and nature.

If we see some ethological distance in the dualism between “wild” and “tame”, all kinds of intermediary shades appear. Also, the number of situations in which humans have to decide to kill wild animals increases considerably. The humpback whale is an example of an individual wild animal in distress. We may consider this situation as bad luck and exceptional. But what about lost or abandoned baby seals on the shores of The Netherlands, Germany, and Denmark? When we locate these animals, do we help them by bringing them to a shelter? Do we have to kill them on the spot or leave them alone to die? Other examples are weak or dying animals in nature parks like the Oostvaardersplassen in The Netherlands (Gremmen, 2016) and exotic animals that are destroying the biodiversity of an area. In earlier research (Gremmen, 2016), we argued that the relation between animal ethics and eco-ethics in these cases is not a dichotomy but a continuum.

Because animal ethics is about individual animals in hands-on situations, and eco-ethics is about groups of animals and species in hands-off situations; groups of animals in agricultural hands-on situations do not belong to either ethics. What is a suitable ethics of animals in agricultural production systems?

### Ethics of Agricultural Production Systems

Recently, care ethics has been developed as an ethical approach (Loewy and Springer, 2004). I agree with Hans Harbers (2009) that care ethics is the most promising integrative framework for ethics of animal production systems. Care ethics focuses on values that are important for the maintenance and flourishing of (care) relationships, such as commitment, dependency, responsibility, and care (Devettere, 2009). An important aim of caring is to create shared values for all stakeholders involved in the production chain. In agricultural systems, people care for plants and animals in the two senses of the word “care”: “care for” and “care about” (being concerned; Figure 3).

Good farming is a matter of endless care, in various shapes and sizes (Scholten et al., 2013). Good care requires the involvement of all stakeholders in the production chain, but also of citizens, consumers, civil society, and government (Harbers, 2009). As a consequence, care is always accompanied by societal concerns. Although care is firmly embedded in economic activity, this does not automatically imply the primacy of the economy (Harbers, 2009). In my view, caring also means the responsibility to take care of the situation in farming by contributing to innovative processes and thereby contributing to society. This entails clarity about responsibilities as an essential element for an excellent organization of a caring farming system.
In a number of innovation areas, such as genomics, synthetic biology, and animal welfare, ethicists are asked to help to solve moral problems in the early stages of innovation (e.g., Singer, 1986). Can ethicists help to solve moral problems in the early stages of innovation? In the past, ethics often seemed to lag behind technical progress, and, according to Grunwald (2010), as a response ethics joined the move towards “upstream engagement” in the field of Science and Technology Studies. As early as 1980, David Collingridge wrote a book on the social control of technology with the objective of avoiding the harmful social consequences of a new technology (Collingridge, 1980). This may be done by changing technology in its infancy by imposing on it all kinds of controls and restrictions. Two conditions are necessary to avoid the undesired consequences of a new technology: “It must be known that a technology has, or will have, harmful effects, and it must be possible to change the technology in some way to avoid the effects” (Collingridge, 1980). One or both of the conditions are often lacking, and attempts to control technology seldom succeed: the “dilemma of control”. The first horn of the dilemma is that the harmful social consequences of the fully developed technology cannot be predicted with sufficient confidence to justify the imposition of control. The second horn of the dilemma is that, by the time a technology is sufficiently well developed and diffused for its unwanted social consequences to become apparent, it is no longer easily controlled. Control may still be possible, but it will have become very difficult, expensive, and slow. What happens is that society and the rest of its technology gradually adapt to the new technology, so that, when it is fully developed, any major change in this new technology requires changes in many other technologies and social and economic institutions, making its control very disruptive and expensive (Collingridge, 1980, 19).

An important assumption of the Collingridge dilemma is the consequentialist/utilitarian perspective in ethics. The normative starting point of the dilemma is the need to avoid the harmful social consequences of a technology, but the message of the dilemma is that a consequentialist/utilitarian perspective is impossible. In the early phases of a new technology, ethical deliberations become speculative because we lack the required knowledge (Grunwald, 2010). In the later phases of a new technology, ethical deliberations often come too late, namely, when all of the relevant decisions have already been made, when it is too late to avoid harmful consequences of the technology. Collingridge’s own normative response to the dilemma is to maintain the “freedom to control technology”, because the essence of controlling technology is to retain “… the ability to change a technology, even when it is fully developed and diffused, so that any unwanted social consequences it may prove to have can be eliminated or meliorated” (Collingridge, 1980, 20/21). He suggests developing organizational structures and scientific tools to deal with the resistance to such control (Collingridge, 1980, 19). Experts, decision makers, and end-users all are entangled in controlling the new technology.

However, Collingridge did not foresee that some experts were going to use a version of his control dilemma as a normative tool in their attempts to exclude prospective users from the innovation process. Experts sometimes stress that they are willing to include users in the early stages of the new technology (Gremmen, 2006), when there is still a lot of room to take the voice of prospective users into account in the design of the product, but the experts can offer little concrete information that would allow prospective users to imagine how they could integrate the end-product in their everyday life. This version of the Collingridge dilemma depicts the end-users in the emergence of new technologies as the end-point of a linear process. However, the world of the users and the world of technological innovation are by no means separate entities that only merge when a final product is delivered to the users; they are already entangled from the start. Technology assessment, and, later, constructive technology assessment, recognized the importance of involving users in the innovation process to encourage integration of new technologies in users’ everyday lives (Rip et al., 1995). The case has been made that technologists need to study responses to science in order to learn from them and to discover missing propositions in their own reasoning (Locke, 2002). Every day-life concerns that inform people’s responses to emergent technologies may be at odds with scientific and technological standards but can and should be understood on their own terms. In this way, experts could benefit from the active involvement of prospective users (Veen, 2010).

It is difficult for ethicists to assist innovators, because most normative ethical theories have problems in dealing with the future. Not only do the results of an innovation trajectory have unknown consequences, but, more importantly, we do not know the results of innovation at the start of the innovation trajectory. This means that, in moral reasoning about innovations in the making, the relevant moral facts and the appropriate principles are more or less still unknown, as also the relevant moral consequences. For that reason, I describe the ethics of innovation in animal production systems as emergent. Examples of the main characteristics of an emergent ethics of animal production systems are moral lock-in, the slippery slope argument, instrumentalization, and commodification. Only by doing ethics in life sciences will the moral dilemmas emerge in the trajectory of responsible innovation.
There are different kinds of ethical arguments about controversial agricultural technologies. On the critical side, some people have objections to a particular technology as such. In the case of genetic modification, for example, this argument amounts to the claim that it is unnatural and therefore morally problematic (Haperen et al. 2012). Many critics might not be so much opposed to Genetic Modification technology as such, but more to its different applications (Rollin, 2006). From a consequentialist stance, this means that even people who do not have an objection in principle to the technology can still be critical of its use in agriculture in general and in food production in particular (Sandoe and Christiansen, 2008). Current applications of agricultural biotechnology have also been criticized from the viewpoint of justice, in particular with respect to the distribution of economic benefits from its use (Thompson, 2007). Some critics emphasize the risks and uncertainties with this new technology and argue either that there are risks to human health or the environment, or that there might be such risks, and that for this reason, some version of the precautionary principle should be applied (Gremmen, 2006). Ethics may clarify and test such arguments and explicate normative and epistemic assumptions. In livestock farming, genetic modification may contribute to all kinds of efficiency benefits but, at the same time, may be used to circumvent certain ethical problems (Hanssen and Gremmen, 2013). The following example on moral lock-in in the case of killing one-day old male chicks illustrates this (Bruinis et al., 2015; Gremmen et al., 2018).

**Moral Lock-in and the Killing of Day-old Chicks**

In response to the increasing demand for safe and cheap food in sufficient quantities, the intensification and mechanization of poultry farming began in the mid-twentieth century. The number of chickens kept by any one farmer has increased considerably since then. Efficiency and specialization were enabled by developments in feeding, breeding, housing of the animals, and increased knowledge of veterinary medicine. Genetic selection enabled egg production by layer-type chickens and chicken meat production using specialized meat-type chickens. Therefore, male chicks from layer-type chickens became less attractive for meat production. With the available sexing techniques (Figure 4), which made it possible to distinguish males from females immediately after hatching, it became common practice to kill these male day-old chicks.

In the Netherlands, over 50 million male chickens are killed annually immediately after hatching. Societal opposition to this practice has prompted the development of innovations. Several alternatives to the killing of day-old chicks have been proposed (Leenstra et al., 2010): this leads to the question of whether these alternatives are morally superior. One alternative direction aims to use genetic modification in the breeding of laying hens in such a way that the hatching eggs containing males can easily be identified with spectroscopy, a non-invasive technique compared to the technique of taking a sample from the egg to find the difference between male and female eggs. The GM alternative takes advantage of the genetics of birds to ensure GM-free laying hens, and also that their eggs are GM free.

The killing of one-day-old male chicks is a clear case of a morally inferior practice and has potentially morally better alternatives. Besides the GM alternative, there are several others: raising the male chicks, dual use of chickens, taking a sample from the egg, etcetera. Each alternative has its advantages and disadvantages with respect to technical and socio-ethical aspects, and each has a specific importance for various stakeholders. Solving one issue raised by the current situation throws up new issues. For example, by acknowledging arguments against the killing of such young animals and starting to rear the males, issues arise around the impact on the environment and the marketing of the chicks. The issue of killing day-old chicks and its alternatives thus seems to be an example of choosing the least of several possible evils and can be explained by a special type of moral lock-in.

Since the mid-1980s, technological lock-in has become an important subject of growing academic enquiry in the field of innovation studies, especially by economists working within an evolutionary tradition (David, 1985; Arthur, 1990). The general idea of lock-in is that technologies and technological systems follow specific paths that are difficult and costly to escape (Perkins, 2003). Even if potentially superior alternatives are available, these technologies and technological systems often survive for a very long time.

![Figure 4. The process of sorting chicken eggs at a poultry farm.](image)

![Figure 5. An antique typewriter with the traditional QWERTY key layout.](image)
The famous examples in the literature are the triumph of the QWERTY keyboard layout (Figure 5) over the Dvorak Simplified Keyboard layout (David, 1985) and the race between VHS and Betamax as a video cassette recorder standard (Arthur, 1990). In the literature, lock-in is explained by the increasing returns of an initial lead in the competition between technologies (David, 1985; Arthur, 1989). “This arises because early adoption can generate a snowballing effect whereby the preferred technology benefits from greater improvement than its competitors, stimulating further adoption, improvement, and eventual leadership” (Perkins, 2003, 23).

There are many ways in which locked-in technologies may be inferior to their alternatives. We focus on moral lock-in: the way a production system can be locked-in to technology standards that are potentially morally inferior. In some cases, there is consensus on the potential for moral improvement that could be achieved through the development of alternative technologies. The question then becomes: What is holding back the development of these morally better technologies? Many debates about the transition to these new technologies focus only on the costs involved (Carrillo-Hermosilla, 2013). Our hypothesis is that a kind of moral lock-in may explain the survival of morally inferior technologies. We consider Responsible Innovation, a concept for balancing economic, sociocultural, and environmental aspects in innovation processes (EC, 2011), as an approach to morally “unlock” alternative innovations. By involving stakeholders in the innovation process and by considering ethical and societal aspects during this process, the socioethic accessibility and the societal desirability of innovative products will increase significantly (Blok and Lemmens, 2015).

**Conclusion**

The upshot of this paper is that we need to develop a Moral Operating System of animal production systems (Figure 6). An ethics of livestock farming needs more than just animal ethics. We need an ethics of animal production “systems” consisting of three interactive, dynamic parts: an “internal” professional “care” ethics, “external” boundary conditions based on societal values and concerns in a kind of animal ethics, and an “emergent” ethics in life sciences enabling change by responsible innovation. Together, these three parts are the Moral Operating System of a production system. The aim is to adapt and broaden the existing ethical frameworks on agriculture to new scientific methods and technologies. This will help scientists, stakeholders, and policymakers to understand, evaluate, and monitor the integration of ethical aspects of agricultural systems.

**About the Author**

Professor Dr Bart Gremmen is based at the Philosophy Chair Group, known for applying ethical theory to life science domains with a strong focus on plant, animal, and environmental ethics. His membership of the Plant Breeding group (2004-) and the Adaptation physiology group (2010-) and his collaboration with different Wageningen UR groups (environmental science; technology innovation; strategic communication) ensures a multidisciplinary approach. Professor Gremmen is a member of the environmental and ethics groups of the Netherlands Research School of Philosophy, and he has coordinated three large NWO genomics programs. He is member of the management team of the 4TU Centre for Ethics of Technology and has established a strong international network of environmental and applied ethicists. Professor Gremmen is president of the International Society for the Hermeneutics of science. He is also chair of the Ethics working group of the European Association of Animal Scientists. Corresponding author: bart.gremmen@wur.nl

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Philosophical ethics and the improvement of farmed animal lives

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Introduction

Philosophical reflection on human beings’ morally grounded relationships with nonhuman animals has come a long way since the animal welfare/animal rights debates of the 1970s and 1980s. The basis for granting moral consideration to nonhuman animals expanded far beyond Peter Singer’s discussion of sentience (Singer, 1975) or Tom Regan’s view that human obligation’s toward individuals from other species are grounded in their being “subjects of a life” (Regan, 1983).

Building on the work of Mary Midgley, a number of authors have developed relacional theories that interpret human obligations to animals in terms of the specific relationships that we bear to them (Donovan, 1990; MacKinnon, 2004; Anderson, 2004). Clare Palmer’s book Animal Ethics in Context articulates an almost fully developed relational ethic in which she explains the basis for differential obligations to wildlife and domesticated animals. In general, humans do not have positive duties to extend care toward wild animals, while bringing an animal into our home establishes duties of care that include attending toward the creature’s biological and emotional needs (Palmer, 2010).

With a number of important exceptions, philosophers have neglected the relationships that establish duties to farmed animals. This neglect is especially evident with respect to philosophical studies of livestock being raised in concentrated animal feeding operations (CAFOs), or, colloquially, factory farms (Figure 1).

While, again, there are exceptions, many philosophers apparently assume that the conditions in industrial facilities are so horrible that the very idea of discussing obligations to them is vitiated by the unredeemable nature of the circumstances in which they live. Robert McDowell compares advocacy for amelioration of suffering in CAFOs to claiming that Nazi concentration camps would have been “a lesser evil” if only the prisoners had received a little better treatment prior to being exterminated (Cavell et al., 2008, p. 131). The animal in a factory farm is a cast-off, thoroughly instrumentalized, dominated, abject. The humans who have placed them there cannot fulfill any moral obligation to them without relieving them of the torturous conditions in which these animals live. If this is the assumption, however, it is almost never articulated explicitly. Instead, the unspeakable nature of the lives that factory farmed lives is mentioned in passing, as the author moves on to make more philosophically worthwhile points (Thompson, forthcoming).

Are animal ethicists right to view industrially housed animals with such disdain that ethical reflection on their quality of life is simply not worthy of philosophical attention? The argument that they are not correct proceeds in stages. First, as noted, there are philosophers who discuss how CAFOs might be changed to improve animals’ quality of life. A brief survey of some key themes in this literature brings the possibility for an alternative perspective into view. Next, the alternative perspective can be contrasted with claims by well-known animal ethicists. Finally, these better known and highly influential views can be rebutted through a detailed examination of ways that the lives of industrially farmed animals can be improved, even if improvement falls short of a full moral justification.

Implications

- Philosophers have neglected the relationships that establish duties to farmed animals, especially in factory farms.
- Many philosophers apparently assume that the conditions in industrial facilities are so horrible that the very idea of discussing obligations to them is vitiated by the unredeemable nature of the circumstances in which they live.
- Even when widely read texts accurately describe welfare deficits, they present a picture which is misleading both as to the extent of these problems, and to difficulty of making changes in response to them.
- Frequently cited welfare problems in factory farms support a case for reform, but it is difficult to see how it would support the claim that what is done to farmed animals is equivalent to torture.

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Philosophy of Improving the Lives of Farmed Animals

It cannot hurt but to begin with the observation that advances since the Singer and Regan era notwithstanding, many if not most academically employed philosophers still seem to fall into one of two camps. Reflection on nonhumans takes one camp all the way to vegetarianism, while those in the other camp have so little interest in animal ethics that they are barely cognizant of the developments in the field. It is, perhaps, natural to conclude that if you are already committed to vegetarianism, there cannot be much reason to think about the condition of animals being raised for food production (Olynk, 2012). Even among the “don’t care” camp, the stridency with which CAFOs are condemned leads many to seek animal products from presumably more humane sources: cage-free eggs, free-range or pasture-raised meats, organic producers, or family farms. Here as with the vegetarians, these mildly proanimal types reach a stopping point. They have no reason to go on and think about the quality of life for animals being raised under the increasingly prevalent industrial conditions. Yet no relations of logical entailment support such inferences. No relational theorist has presented an argument showing that just because you personally have no interest in eating animals, you therefore are discharged of any reason or obligation to consider how their lives might be improved (Thompson, 2015).

In fact, a significant subgroup of philosophers writing in animal ethics do consider the questions that arise in efforts to improve the lives of farmed animals. Contemporaneous with the work of Singer and Regan, Bernard Rollin developed his adaptation of Aristotelean telos as a criterion for evaluating the quality of animal lives in a variety of settings, including industrial livestock production. Rollin argued for a view that recognized obligations to individual animals as opposed to maximizing welfare (hence, he has a rights view), but he argues that we derive these obligations from an understanding of an animals’ telos, which we understand as the needs and behavioral drives that are typical of creatures from a given species (Rollin, 1991). In later work, it became clear that Rollin views telos as determined by an animal’s genetic constitution. While it is wrong to treat animals in ways that fail to respect their telos, there is nothing wrong with changing an animal’s genetics, whether through breeding or genetic engineering, unless doing so leads to persistent suffering (Rollin, 1995a, 1998).

Rollin also carried out a sustained attack on the industrial conditions under which farmed animals were being raised (Rollin, 1995b). He argued that the growth in CAFOs was the result of a conceptual shift in agricultural and veterinary research. Where researchers had once stressed husbandry, a concept with implicit ethical commitments, they shifted toward animal science, adopting a positivist, value-free attitude toward their research subjects, who were, of course, animals capable of feeling, emotion and better, or worse states of well-being (Rollin, 2004). Rollin’s work became influential in the animal and veterinary sciences, where the lack of fit between an animal’s telos and the housing or husbandry began to be used as a guiding approach to applied animal behavior science (Fraser, 1999; Rollin et al., 2012).

Figure 1. Sows in gestation crates in an indoor swine production system.

Quite a few European philosophers have joined Rollin in helping to determine how the lives of farmed animals might be improved. Peter Sandøe has argued that Singer’s emphasis on sentient experience can be a guide for husbandry (Lassen, Sandøe and Forkman, 2006) and animal breeding (Sandøe et al., 1999). Others have advocated for animal integrity. Like Rollin’s notion of telos, animal integrity is intended to convey the sense that each individual animal has status or...
nature that derives from being the member of a species. It unifies the animal’s cognitive experience of pain or pleasure with more complex relationships that situate the individual within an evolutionary history. Unlike telos, integrity is meant to include relationships that derive from the history of domestication by humans and the association with human caregivers, as well as adaptive fit between genetics and the environments in which farmed animals have been bred and raised (Rutgers and Heeger, 1999). Appeals to integrity incorporate considerations that trouble the sanguinity with Rollin regards genetic modification of farmed animals (Bovenkirk, Brom and Van den Bergh, 2002). Bart Gremmen has collaborated with agricultural scientists to apply the notion of animal integrity to determine how applications of precision agriculture could promote animal well-being (Scholten et al., 2013). Mickey Gjerris has also applied the notion in working with co-workers to discuss how industrial livestock facilities may impede the moral perception needed for good husbandry (Harfeld et al., 2016).

This brief survey is far from complete, but it illustrates that different philosophical perspectives on the basis for moral obligations to livestock are being applied in production contexts. Measures are being taken to correct aspects of industrial production systems, even when these measures fall short of abolishing them altogether. Philosophical ethics articulates ways in which the quality of life for livestock in CAFOs can be improved. This work does not imply that improvements justify continued use and development of these systems nor do these authors suggest that with minor changes, factory farming methods will become morally acceptable. What they share is an approach to animal ethics that recognizes the moral significance of contextual elements, including species differences and the peculiarities of production environments. Although the guidance they provide varies, each approach does offer prescriptions that, if acted upon, would make the lives of animals being raised on industrial farms better.

**Mainstream Animal Ethics**

Many of the philosophers just discussed work in technical institutes, rather than traditional philosophy departments of prestigious universities. This distinction provides a starting point for the division between work that aims to assist in improving animal lives, and the types of questions taken up in mainstream philosophy. Making improvements in farmed animal quality of life requires the integration of knowledge about animal welfare and knowledge of livestock production systems. Both are value-laden domains, and one role for philosophers has been to articulate and critique value commitments that are implicit within animal welfare science, on the one hand, and philosophies of food production, on the other. All of the above-mentioned philosophers collaborate with researchers who have expertise in applied ethology, veterinary medicine, and animal science. In contrast, research emanating from mainstream philosophy departments is seldom collaborative. The exceptions are collaborations with ethicists working on wildlife, not livestock species (see, e.g., Bekoff and Pierce, 2009).

When mainstream philosophers do mention industrial animal production, the pattern is a sentence or two noting horrific conditions with at most a mention of the general production system, such as caged layers or gestation stalls for pigs. Description of these systems that link their elements to animal welfare deficits are rare. Mainstream philosophers have certainly read Peter Singer’s *Animal Liberation*, which was revised for a 1990 edition and has been updated several other times since its initial publication in 1975. All editions contain a chapter entitled “Down on the Factory Farm” in which Singer describes industrial farming practices that impinge upon an animal’s sentient experience to cause suffering. As with Singer’s collaborations with self-described animal activist Jim Mason (Singer and Mason, 1990, 2007), the chapter works through a series of industrial production systems, beginning with broilers (e.g., chicken meat birds), layers, pigs, veal, dairy, and concluding with beef. In the 1990 edition, this survey is followed by a discussion of slaughter and genetic engineering—two activities that do not necessarily lead to ethical problems, given Singer’s emphasis on pain and suffering. Singer notes that all of these practices are, in principle, amenable to reform, but he also notes that reforms would be unlikely to meet his criterion of equal consideration for human and animal interests (Singer, 2002). (I am working from the 2002 reprint, which contains a new preface where Singer states that the main text is that of the significantly updated 1990 edition. It is worth noting that statements about animal producers’ lack of response to animal welfare critiques that might have been true in 1990 were false in 2002 when Singer’s claims to that effect were reprinted. One can certainly question whether the response was adequate, but by 2002, the European Union had undertaken significant regulatory reform, while North American producers were beginning to make changes through voluntary, cooperative efforts among producers.)

Philosophers who collaborate with veterinarians, ethologists, and production specialists would agree that all of the points noted by Singer represent deficiencies in husbandry. There are, however, some points of philosophical difference. The most important difference is more evident in the work of Lori Gruen, who Singer credits as having done research for updates on the farming section of the 1990 edition of *Animal Liberation* (Singer, 2002, p. 313). Gruen’s book *Ethics and Animals: An Introduction* also discusses welfare deficits on industrial farms, though in significantly more inflected language than Singer (Figure 2).

A reader of Gruen’s treatment might easily conclude that all animals on factory farms undergo a degree of suffering tantamount to torture at all times. Singer is more circumspect in noting that these problems may occur, and that they happen on an unspecified but possibly occasional basis. More significantly, Gruen imbeds her discussion of factory farming within an argument for vegetarianism, implying that a vegan diet is the morally appropriate response to the suffering of animal farms (Gruen, 2011). Singer, on the other hand, makes a more qualified and conditional endorsement of vegetarianism (Singer, 2002; Singer and Mason, 2007).
I have no issue with moral vegetarianism or veganism, so long as it is not advanced as a universally applicable norm. The point to emphasize in the present context is that veganism does nothing for the animals that continue to be housed in industrial conditions. What is more, industrial animal production continues to grow on a worldwide basis. The Food and Agriculture Organization (FAO) of the United Nations expects that less industrialized countries will increase production of animal products by 2.5% to 3% annually, and that most of this growth will occur through the importation of industrial production systems (FAO, n.d.). While it may be ethically appropriate for many readers of Singer or Gruen to adopt a vegan diet, it is ethically irresponsible to represent vegetarianism as an ethically adequate answer to the deficits that farmed animals experience in industrial production settings. Yet mainstream philosophy not only seems incapable of making this inference, many mainstream ethicists appear to follow Gruen in alleging that factory farming is utterly irredeemable and incapable of making changes that improve welfare and quality of life.

**Industrially Farmed Animals: A Life Worth Living?**

The widely accepted view of industrial animal production may be that of David DeGrazia: “I contend that where the term ‘factory farming’ is properly applied, the conditions of confinement are so intensive that they render the animals’ lives not worth living.” (DeGrazia, 2011, p. 757, italics in the original). If the lives of these animals are worthless, there is nothing to say about how they might be improved. DeGrazia is surely not saying that the lives of farmed animals are unworthy of moral consideration, disposable or literally without value. Nor is it plausible to think that he is implying something like a “wrongful life.” Torts alleging wrongful life involve the claim that only by not having been born could the harms alleged by the plaintiff have been avoided. This condition clearly does not apply to food animals kept in industrial production facilities. DeGrazia implicitly admits that these lives could be improved by removing them from conditions of confinement. Thus, the key point at issue is his claim that conditions on industrial farms render animal lives entirely void of any life-affirming or satisfying experiences.

It is difficult for me to think how I could prove it, but this conclusion seems false to me. I will chip away at the evidence presented in widely read philosophical critiques of industrial animal production, but this is an inductive argument that may not be convincing to all readers. My argument essentially accuses DeGrazia of a hasty generalization. There are, indeed, many issues on factory farm—if there were none, the work I have described to improve conditions there would be pointless. However, a listing of these issues falls short of establishing that all industrially farmed animals endure such extreme suffering as to justify DeGrazia’s gross generalization. In some instances, welfare problems are serious, but limited to a few individuals. In other cases, the conceptual characterization of a welfare deficit is vague or ambiguous in ways that obscure the difference between serious welfare deficits and other conditions that may be less so. In still other cases, welfare deficits may be the lesser of two evils. DeGrazia’s generalization may also fail to acknowledge improvements that have already been made.

The catalog of welfare deficits one finds in Singer or Gruen include many harms experienced by a subset of a flock or herd. A typical scientific study of welfare will report percentage data for welfare deficits observed for the herd or flock. Depending on the production system and breed of animal, these percentages may be comparatively small (e.g., in the range of 2%) or rather large (e.g., 85% or more) (see, e.g., Sherwin, Richards and Nicol, 2010). A 2013 paper on the effects of housing systems (such as concrete flooring) on pigs reports that between 0.1% and 0.05% of sows are removed from production due to lameness annually.

This is enough to be regarded as a serious welfare issue, and the authors of this study compare housing and husbandry approaches with respect to three groups based on visual lameness scores: lame, mildly lame, and nonlame pigs (Grégoire, 2013). Although bone breakage, foot problems, and other painful conditions are documented, one should not conclude that these conditions are universal within CAFOs. Nor should one conclude that the rate of these conditions is necessarily higher in more confined or caged systems: confined laying hens have lower rates of keel bone fractures than uncaged hens (Wilkins et al., 2011; Figure 3).

Stereotypies, or the repetitive, compulsive but apparently nonfunctional movements exhibited by some confined animals are also cited as evidence of a welfare deficit in farmed animals (Singer, 2002, p. 127; Gruen, 2011, p. 85). Defined as a clinical phenomenon, stereotypical behavior is observed in many animal species, including human beings. Two points are relevant to the question of whether stereotypies indicate that an animal’s life is not worth living. First, though certainly

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Figure 2. Two books that discuss animal welfare in animal production systems.
observed, dramatic stereotypies such as rapid pacing or persistent pawing are not typical on well-managed farms, industrial or otherwise. Recent work suggests that husbandry may be a more significant cause of welfare problems than the housing system (Hemsworth, 2018). There is thus no reason to think that all animals in confined environments are experiencing the overwhelming stress that is often associated with stereotypical behavior. Second, there is a debate over whether stereotypies are reliable indicators of a welfare deficit. In part, this debate reflects differences in the definition of a stereotyped behavior. For example, pigs may exhibit mouthing or chewing, especially prior to feeding times. Although clinical definitions permit classification of these behaviors as stereotypies, researchers currently debate whether they suggest a welfare issue (much less evidence that life is not worth living). Some argue that the evidence on many stereotypies is indicative of a coping behavior that might be observed in virtually any environment. Philosophical ethics could help to clarify disputed issues in this debate (Mason, 2006). In humans, stereotyped behavior is commonly called a tic. While tics are indeed characterized as a psychological disorder, they do not necessarily (or even generally) indicate the extreme welfare deficit implied by DeGrazia’s generalization (see Leonard et al., 1992).

Beak trimming is also a frequent target of criticism. Egg producers trim the sharp tip from their hens’ beak in order to limit more serious welfare problems from feather pecking. This comparative normative judgment is an excellent example of where philosophers might weigh in on whether a given practice hurts or helps animal welfare. However, mainstream critics have nothing good to say about beak trimming, which they often refer to as “debeaking” (see Gruen, 2011, p. 83). A review article by Christine Nicol cites literature reporting that properly administered beak trimming does not result in lifelong pain, though botched jobs certainly can and do. She also reports unequivocal findings that given current housing systems, beak trimming reduces mortality (Nicol, 2018). Comparatively, human males are sometimes mutilated shortly after birth by removal of the penile foreskin. When botched, the procedure can lead to lifelong discomfort and stress. Yet one would not conclude that the lives of circumcised men are not worth living.

DeGrazia makes his observation in the context of writing on confinement, so perhaps his remark should be read as laying stress on the crowded and bleak conditions in CAFOs. In fact, crowding is one of the key points where reforms have had some impact over the course of the last 20 years (Scrins, Parker and Carey, 2017). Significant changes had already been made in the space allotment for U.S. laying hens at the time that DeGrazia wrote (Thompson, 2015). It may be that DeGrazia’s observation is just out of date. Yet, as critics write, hens still have about the space of an 8X10 or A2 piece of typing paper in most production facilities. Increasing space per animal is an entirely legitimate objective for reforming industrial animal production, but the immediate question is whether crowding in industrial farms is so bad that it justifies DeGrazia’s extreme conclusion. Visitors to poultry houses where the sheet of paper stocking density allotment is in effect will, in fact, see quite a bit of open space, as well. Especially when hens are afforded the opportunity for perching (which they are not in classic battery cage systems), they will spend part of their time stretching, dust bathing and wing-flapping, while huddling with other hens at other times (see Keeling and Duncan, 1991; Mench and Duncan, 1998; Dawkins, 2018).

This should not be interpreted to mean that hens do not need more space than they currently have in battery cage systems, especially when stocking rates are based on maximizing return on investment, rather than animal welfare. The observable open space in today’s CAFOs can be an effect normal hen behavior, but it can also be the result of a visitor being there. Behavior when humans are present (especially unknown humans) is quite different than when they are absent, and birds will “flock” or crowd together in response. Singer recounts the behavior of hens during a visit by a reporter as evidence of a welfare deficit (Singer, 2002, p. 114), but it is very likely that the reporter was contributing to the “pandemonium,” simply by being there. On the one hand, this points to yet another epistemological problem for understanding animal welfare: reflexivity. The phenomenon of animal behavior (we should include humans here) is sensitive to the process of being observed. On the other hand, it illustrates how some of the evidence for poor welfare is unfounded.

Physical confinement is unquestionably detrimental to the welfare of sows housed in gestation stalls, another feature of factory livestock farming that is noted by both Singer (Singer, 2002, pp. 126–127) and Gruen (Gruen, 2011, p. 84). Better alternatives are clearly available, yet we should question whether pigs react to this kind of treatment in the way that a human being would. Sows in gestation stalls do not consistently exhibit behavior or physiological indicators of stress, disability, or inability to cope. Researchers have been forced to question the degree to which these types of confinement matter from the perspective of the pig (Hemsworth, 2018). Perhaps these sows are victims of something like the adaptive preference syndrome, where women in abusive relationships with men choose to not only remain, but also defend their abusers (Khader, 2011). That thesis could point toward a philosophical analysis that would aid in reforming pig production. Pigs appear to be more like humans in their capacity for adaptive behavior than

Figure 3. Poultry production in a caged system.
any other farmed species, and may have been induced into an apathetic state by their confinement in stalls (Wood-Gush and Vestergaard, 1989). Yet we would neither claim the life of a woman in an abusive relationship is so utterly devoid of satisfaction that it is not worth living, nor that adaptive preferences are sufficient to condemn the entire institution of marriage as incapable of reform.

In summary, this review of frequently cited welfare problems in factory farms does indeed support a case for reform, but it is difficult to see how it would support the claim that what is done to farmed animals is equivalent to torture, as one widely read article in animal ethics put it (Norcross, 2004). Nor is it easy to see why DeGrazia concludes that the lives of these animals are so abject as to be “not worth living.” It is important to stress that my rebuttal to the extremity of DeGrazia’s claim is in no way intended to serve as a justification for current practices on industrial (or any other) animal production facility. Nor do I mean to imply that the quality of life being lived by chickens, pigs, cows, turkeys, or other farmed animals meets a standard of ethical acceptability. Indeed, the larger thrust of this paper is to support the significance of philosophical work that aims to help veterinarians and welfare scientists in their work on improving the conditions in which these animals live. DeGrazia’s statement needs rebutting because it appears to imply that such work is at best an utter waste of time, and at worst supportive of a morally reprehensible institution.

**Conclusion: The Scope of an Engaged Animal Ethics**

In summation, I have documented the work of a few philosophers whose work aims to better the conditions on factory farms. This work is not widely appreciated by the philosophical community at large. It is especially shocking how little attention the philosophical community has paid to the work of Bernard Rollin, especially given the influence that he has had beyond academic philosophy. I have elsewhere noted the similarity between Rollin’s work and that of Martha Nussbaum, who apparently has never read him or displays even awareness of his existence (Thompson, 2007). Nussbaum’s emphasis on justice is, indeed, a crucial point not found in Rollin, yet Rollin’s discussion of the link between rights and *telos* would appear to anticipate elements of Nussbaum’s far more celebrated Aristotelian approach.

More seriously, the best known, or as I have called it, mainstream work on animal ethics is entirely dismissive of the potential for reform of industrial animal production. Even when widely read texts accurately describe welfare deficits, they present a picture which is misleading both as to the extent of these problems, and to difficulty of making changes in response to them. I have examined David DeGrazia’s extreme claim that the lives of animals on industrial farms are not worth living as indicative of the unspoken view that appears to be held by most philosophers working in animal ethics. It is a difficult view to rebut. My approach has been to argue that it is an overgeneralization of the conditions that actually exist in CAFOs, and that it oversimplifies the ethical and empirical dimensions of welfare problems as they actually occur. Yet there are many respects in which the work that has been undertaken above is admittedly unambitious.

Doing philosophy to improve the lives of farmed animals is a complicated business, and the above discussion has not really engaged many of the ethical or other questions where philosophical analysis could help. Although I have noted briefly how work by Bernard Rollin, Peter Sandøe, and others is being applied jointly with studies by cognitive ethologists and veterinarians, a reader will need to consult the cited articles to discover how their work informs the case for making reforms. My survey of debates over stereotypes, beak trimming and space allotments points indicates that philosophical questions abound in the approaches that are being pursued in response to these problems. Yet I have not specified the nature of these philosophical problems, nor have I developed my own views on them. I have treated all of these topics as beyond the scope of the argument I make in this paper.

Dimensions of the socio-political environment for reform also pose philosophical issues. As I argue in *From Field to Fork*, the very idea of reforming of industrial production systems implies that there are social constraints on what is possible, and what is ethically desirable. Assumptions must be made to frame these social constraints, and these assumptions are themselves open to philosophical debate. All current models of livestock farming presume that producers must be able to recover their costs through the sale of animal products, for example. This implies that the costs of improving animal welfare must be recouped through the sale of meat, milk, and eggs (Figure 4). The extent to which this can be done depends upon how these markets are structured. For example, direct government intervention seems unlikely in the United States, Canada, or Australia, but the European Union has passed a comprehensive animal welfare law banning certain types of production system (Shields, Shapiro and Rowan, 2017). Even voluntary cooperation among producers to improve welfare was challenged in U.S. courts on the grounds that it is an illegal restraint of trade (Peck, 2015). Classic issues in social and political philosophy permeate the social context in which regulation, cooperation,
or competition will impinge upon or promote efforts to improve animal welfare.

There are also large philosophical questions to raise about the various forms of testimony to the conditions in which farmed animals live. I have privileged academic publications, by philosophers and by animal welfare specialists, in the review that I have given here. Yet I would admit that news reports, U-tube videos and social media are more influential in shaping public opinion. To cite only two examples among hundreds, an animal advocacy group released video taken on an Australian egg farm in June of 2019. The video showed workers kicking and pulling the heads of off spent hens, making jokes all the while (Palmer, 2019). In the same month, video of abusive treatment by workers at very large Indiana dairy was released in the United States (McEldowney, 2019). However, another webpage asserts that many abuse videos are staged, and that undercover visitors to factory farms admit privately that they typically find animals in good condition (Peta Kills Animals, n.d.). I do not doubt that at least some of the activist inspired videos and reports capture actual episodes of abuse. Nevertheless, I remain skeptical as to the inference that they prove the extent of abuse apparently presumed by many mainstream philosophers and members of the public, alike. It is also worth mentioning that the abuse shown in the two videos just referenced was all at the hands of human caregivers, and did not ensue as a result of the factory-like conditions in which animals were housed. These videos point, again, to the aforementioned observation that husbandry matters more than the production system (Hemsworth, 2018).

The thrust of this paper has not engaged these critical questions, all of which have a significant philosophical dimension. The animal ethics practiced by philosophers in the most prestigious universities neither addresses these questions nor acknowledges their legitimacy. My goal has been limited: to highlight the extent to which many—arguably most—mainstream philosophers writing on animals have not only failed to address the philosophical issues where analysis could actually help improve the quality of life for animals living on factory farms, they have promulgated philosophical views that actively discourage such inquiry. The lives of animals are worse for this. Surely that is an ethical issue in its own right.

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Perspective

Some brief comments on animal rights

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Key words: animal rights, animal welfare, meat, property, slavery

Do animals have moral rights? What kind of legal status should we afford them? The debate on these issues has become very confused. Some animal rights campaigners maintain that we should allow animals the same legal rights enjoyed by humans (Figure 1). That is, of course, absurd. There are many human rights that simply have no application to nonhumans (Figure 2).

In the work that I have done on animal rights (Francione, 2000, 2008), I propose that a sensible and coherent theory of animal rights should focus on just one right for animals—the right not to be treated as the property of humans. Recognizing animal rights really means accepting that we have a duty not to treat sentient nonhumans as resources. There is no necessity for 99% of our animal uses.

Implications

- It is absurd that some animal rights campaigners maintain that we should allow animals the same legal rights enjoyed by humans.
- A sensible and coherent theory of animal rights should focus on just one right for animals—the right not to be treated as the property of humans.
- Recognizing animal rights really means accepting that we have a duty not to treat sentient nonhumans as resources.
- There is no necessity for 99% of our animal uses.

Key words: animal rights, animal welfare, meat, property, slavery

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good economic sense. Of course, these animals have many other interests throughout their lives, including an interest in avoiding pain and suffering at times other than at the moment of slaughter, and these other interests are not protected because it is not economically efficient to do so. Moreover, the Humane Slaughter Act has not been interpreted to apply to smaller animals, including birds, who account for about 95% of the animals slaughtered for food in the United States. The reason for this exclusion is that given the number of birds slaughtered, and their relatively smaller size and lesser value, it has not been considered economically efficient to protect their interests in the same way as the interests of larger animals. Many welfarist campaigns promote reforms explicitly based on economic efficiency and increased productivity. For example, the campaign to replace conventional chicken slaughtering with asphyxiation is promoted on the ground that the latter will increase production efficiency for industry (Francione and Garner, 2010).

There are laws—anticruelty laws—that require that we treat animals “humanely” and that we do not inflict “unnecessary” suffering on them. In many cases, these laws carry criminal sanctions (albeit minor ones) for violation. For the most part, only laws that reflect widely accepted moral norms are contained in criminal codes. Therefore, it can be said that, on one level, we take the idea of the “humane” treatment of animals seriously. These laws, however, do not actually prohibit uses of animals that are unnecessary; instead, at most, they prohibit treatment that is customarily avoided by institutional animal users because that treatment is economically inefficient. So we do not ask whether animal use is necessary; we assume that animal use is acceptable and simply ask about whether it is necessary to treat animals in a particular way in order to use them as property. These laws require that we balance the interests of humans and animals in order to ensure that animals are treated “humanely.” It is, however, a fallacy to suppose that we can balance human interests, which are protected by claims of right in general and of a right to own property in particular, against the interests of animals which, as property, exist only as a means to the ends of humans. The animal in question is always a “pet” or a “laboratory animal” or a “game animal” or a “food animal” or a “circus animal” or some other form of animal property that exists solely for our use. We prohibit animal suffering only when it has no economic benefit. The balance is unbalanced from the outset.

There are parallels here with the institution of human slavery. While we tolerate varying degrees of human exploitation (wrongly, in my view), we no longer regard it as legitimate to treat anyone, irrespective of their particular characteristics, as the property of others. In a world deeply divided on many moral issues, one of the few norms steadfastly endorsed by the international community is the prohibition of human slavery. Some forms of slavery are worse than others, yet we prohibit all of them—however “humane”—because they all more or less allow the fundamental interests of slaves to be ignored if it provides a benefit to slave owners. We recognize all humans as having a basic right not to be treated as the property of others. This is not to say that slavery no longer exists; it does. But no one defends it.

Is there a morally sound reason not to extend this single right—the right not to be treated as property—to animals? Or to ask the question another way, why do we deem it acceptable to eat animals, hunt them, confine and display them in circuses and zoos, use them in experiments or rodeos, or otherwise treat them in ways in which we would never think it appropriate to treat any human irrespective of how “humane” we were being?
The usual response that animals lack some special characteristic that is possessed solely by humans not only flies in the face of the theory of evolution but is completely irrelevant to whether it is morally permissible to treat nonhumans as commodities—just as differences among humans would not serve to justify treating some as slaves. The differences between a normally functioning human and a severely disabled human may be relevant insofar as they justify differential treatment. We may provide access to certain benefits, such as a university education, to one that we would deny to the other. But we would not conclude that it is appropriate to use the disabled human as a chattel slave or as forced organ donor.

Also of no use is the response that it is acceptable for humans to exploit nonhumans because it is “traditional” or “natural” to do so. This merely states a conclusion and does not constitute an argument. There is very little that we now see as morally objectionable that was not once considered as “traditional” or “natural.”

The bottom line is that we cannot justify human domination of nonhumans. Our “conflicts” with animals are mostly of our own doing. We bring billions of sentient animals into the world in order to kill them for reasons that are often trivial. We then seek to understand the nature of our moral obligations to these animals. But by bringing these animals into existence for reasons that we would never consider appropriate for humans, we have already decided that animals are outside the scope of our moral community altogether. Accepting that animals have this one right does not entail letting cows, chickens, pigs, and dogs run free in the streets (Figure 4). We have brought these animals into existence and they depend on us for their survival. We should care for those currently in existence, but we should stop causing more to come into being to serve as our resources.

Recognizing animal rights really means accepting that we have a duty not to treat sentient nonhumans as resources. The interesting question is not whether the cow should be able to sue the farmer for cruel treatment, but why the cow is there in the first place.

This proposal may seem radical but in one sense it is not. Most of us already think of animals as having some moral value. We may not think of animals as persons, or as having lives that are equal to those of human persons, but we do think that they have a morally significant interest in not suffering. Most of us think that it is morally wrong to impose unnecessary suffering on animals.

This belief—that it is wrong to inflict unnecessary suffering on animals—should itself lead us to the conclusion that we should stop virtually all of our uses of animals even if we reject the personhood of nonhuman animals. If “necessity” has any meaning in this context, it must mean that we cannot justify inflicting suffering on animals for reasons of pleasure, amusement, or convenience.

There is no necessity for 99% of our animal uses. For example, our numerically most significant use of animals is for food. We kill approximately 70 billion land animals and an estimated one trillion sea animals annually for food. Until recently, it has been accepted in many parts of the world—and especially the West—that eating animals, which accounts for the largest number of animals we use, was necessary for human health. We do not need to consume animals in order to be healthy (Academy of Nutrition and Dietetics, 2019; American Heart Association, 2019; British National Health Service, 2019; Dieticians of Canada, 2019; Kaiser Permanente, 2019; Mayo Clinic, 2019; National Institutes for Health, 2019). Indeed, many mainstream health professionals are claiming that we can be healthier if we adopt a plant-based diet. But whether we will
be healthier is not the point, which is that we won’t be less healthy if we do not consume animal products. Eating animals is simply not necessary. The best justification we have for inflicting suffering and death on animals is that we think that they taste good; we derive pleasure from eating them. Eating animals and animal products is a tradition—we have been doing it for a long time (Francione and Charlton, 2013). So what? Patriarchy is a tradition that has existed for a very, very long time. But the fact that something has been happening for a long time says nothing about its moral status. If it is not necessary to consume animal products, then we cannot justify imposing any amount of suffering on animals used for food.

And there is no necessity to use animals for clothing, entertainment, or sport. Our only use of animals that is even arguably not transparently frivolous involves what is referred to as “vivisection”—using animals in biomedical experiments/contexts to cure serious human illnesses. So even without personhood and the right of animals not to be property, and even if we buy into the anthropocentric fantasy that animals are “inferior” to humans, we would still all be vegans and the only issue we would be discussing would be whether we could justify using animals for experiments, which, under a theory of animal rights, would have to be rejected.

In sum, even if you do not accept the rights position, the position that you probably do accept—that it is wrong to inflict unnecessary suffering and death on animals—makes it impossible for you to avoid the conclusion that the use of animals for any purpose that does not involve true compulsion or necessity, including the use of animals for food, clothing, and entertainment, must be ruled out. Any other position relegates animals to the category of things that have no moral value.

**Figure 4.** Chicken production in an indoor, cage-free system.

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Ethical meat: respect for farm animals

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Implications

- Ethics is a human science and is not given in nature.
- Even if animals are sentient beings, this condition is not enough to possess a moral state.
- Animals are not bearers of rights but subjects of our precise duties.
- Food availability is a prevailing human interest, so meat consumption is morally justified.

Key words: animal ethics, animal rights, humans’ obligations, meat

The writings, positions, depth of the theme, ideal and, unfortunately, ideological contrasts on ethics and animals, are so abundant as to render any attempt to circumscribe the field and to draw judgments of merit anyway incomplete. Before anything else, ethics pursues the aim of improving the lives of men and other living beings while respecting the fundamental natural and cultural principles that govern the biosphere and human societies. This article chooses an operative position by discussing what good or evil means for animals and how this should be interpreted for positive purposes, including the production of food for humans.

Ethics is a human science and is not given in nature. Good and evil are cultural constructs, different in different social contexts, which evolve over time and which require solid dialectical bases to be affirmed and not slip into fallacious reasoning. To affirm therefore that a specific behavior is good as natural, is not an ethical reasoning, so to say that a natural behavior is good in itself, does not make sense.

Many examples could be given for this: for all it is enough to mention the unnecessary pain caused in animals which, if generated by Man, is considered reprehensible, if caused by other animals (carnivores, conspecifics, or competitors) is judged natural. From this premise, it follows that ethics is an exclusively human affair and that the moral behaviors deriving from it must be oriented by rational thought.

To circumscribe the field of discourse, this article tries to answer the question: is it right to raise and sacrifice animals to eat the meat, assuming that animals have rights and if so, which rights or if not, what are our obligations towards animals? (The recent Italian book by Andrea Bertaglio “In defense of meat” (2018) addresses in a simple and rigorous way, many aspects of the debate between supporters and detractors of the consumption of meat. With the quiet tones used in the various arguments, Bertaglio gives us a vademecum of “good education in dialogue,” in a World of which there is an increasing need.)

To begin to answer the question, we broadly follow the reasoning of the philosopher Hsiao (2015). (An exhaustive treatment of these themes can be found in the Italian book edited by Bertoni (2017).) Animals are sentient beings as different evidences have shown that it is possible to attribute their declarative knowledge without adopting an anthropomorphic perspective (Veisser et al., 2012). (The 2007 Lisbon Treaty in force since 2009, in art. 13, states: “In formulating and implementing the Union’s agriculture, fisheries, transport, internal market, research and technological development and space policies, the Union and the Member States shall, since animals are sentient beings, pay full regard to the welfare requirements of animals, while respecting the legislative or administrative provisions and customs of the Member States relating in particular to religious rites, cultural traditions and regional heritage.”) Experimental data from research in animal psychology push to consider that in different species, there are subjective states of which animals are conscious (Rassu et al., 2005; Le Neindre et al., 2017). Animal psychologists are dealing with the concept of personality, defined as “consistent individual differences in behaviour,” in which genetic effects are likened to irreversible developmental plasticity (Wilson et al., 2019). In a nutshell, animals experience suffering, so they are aware of it and try, as much as possible, to avoid it, but they have subjective emotions and have the ability to feel and pursue pleasure. However, being sentient, even with individual diversities, is not enough of a condition to possess a moral state. Causing pain in an animal is wrong, but it is not morally wrong; a good reason is not necessarily a moral reason because, to be such, it needs to refer to a moral fact. Animals do not possess a moral state as they are conscious and sentient beings, but they are not rational beings. Rationality is the presupposition for belonging to a moral community, since only rational beings can act morally. Moral actions are free actions that require the agent to have the ability to know the reason for the action and evaluate the consequences: knowledge and action are two
essential objects of ethics. Then, morality is an informal and public system that applies to all rational individuals to govern any behavior that can have consequences on others, in order to avoid evil and pain. Therefore, although it is widely recognized that other nonhuman animals are in various degrees intelligent, they are not rational agents at all and are therefore not belonging to the moral community that is formed exclusively by man. Well-being is an interest of both humans and animals, but the interest of the first is moral; from this it follows that it is prevalent over that of the latter. Eating is a priority for human well-being, so it is a moral interest. Saving foods from animal pests, including mice, is morally justified. Similarly, eating the meat of animals is a priority for the well-being of man, so the moral interest of the latter prevails over the nonmoral interest of the former. The important thing is that humans do not cause animals unnecessary suffering during breeding and in sacrifice.

Beyond the moral justification, is it right to suppress a life for food use, even in conditions according to some of nonindispensability? (Many supports the thesis that one can live even without feeding on products of animal origin. I recently wrote a book in Italian (Pulina, 2019) which demonstrates the opposite. Part of this article takes up a chapter of the book.) This is known as “The meat paradox” (people like to eat meat but do not like that animals have to suffer and be killed), first formulated by Loughnan et al. in (2012). In a more recent review, Ursin (2016) goes through three strategies to solve or neutralize the psychological tension that emerges in meat eaters due to the meat paradox: “first, the tension can be dealt with by changing one’s behavior to fit one’s values; second, it can be relieved by adjusting the meaning of one’s values to fit one’s behaviour; third, it is possible to uphold one’s values and adjust one’s perception of the phenomena to align one’s values with one’s behaviour.”

This philosopher concludes that the dilemma can be solved by either not eating meat or not worrying about killing animals, but he thinks that the virtuous omnivore should not be trapped between these two alternatives and can “accept the resulting tension as a sign of the complexity of our relations with animals.”

A study conducted in Australia indirectly provides us with the answer to the paradox. Archer (2011) states that to cultivate 1 hectare of grain, 55 sentient lives (mice and other small mammals or marsupials) are killed with great suffering compared with the 2.2 of cattle per hectare destined for a quick sacrifice. And this is also valid in the case in which the grains are used for fattening cattle or sheep, as most of the live weight is obtained from the grass of the pastures. In short, to speak of good or evil in killing an animal is less trivial than one might think, as Leroy and Praet (2017) show in a recent study describing the trajectory of the social perception of this act, from prehistoric hunting to modern slaughtering techniques used in the developed countries: deference, ritualization, professionalization, and removal from the collective consciousness (Figures 1–3).

On the other hand, taking on ethical issues aimed at the beginnings of life, birth and death, is very difficult when it comes to human affairs, and becomes even more complex when animals are involved. As a concrete example, the table of inference shown in Figure 4 is an example of the complexity of our moral position about humans and animals killing.

Another way to dissolve the paradox is to legitimize the rights of animals, including the right to life. According to Gozzano (2004), who takes up some of the concepts explained above, moral values evoked by human rationality are objective. These values are those that no one would reject based on the assumption that some rights should be formulated: species, intelligence, and recipients of interests. Animals should not be recognized owners of moral rights, but forms of respect must be applied to them, starting with the guarantee of well-being as sentient beings. It is noteworthy to note that “modern animal ethics embrace not only our duties and obligations to animals, but also our duties and obligations to animal users and society in general” (Matthews and Hemsworth, 2012). (Matthews and Hemsworth (2012) observe that “while attitudes to animals at the individual level influence how people behave towards animals, attitudes to animals at the community level can also influence the development of animal-related policy and legislation.”)

According to constitutional lawyer Gemma (2004), the best arrangement is the one that sees man enjoying a preferential position in the “social contract.” Protection of other species, although necessary, cannot go so far as to compromise the rights inherent in the human person (the so-called partial equality). However, in 1978, UNESCO adopted the Universal Declaration of Animal Rights, to be understood in this context as passive rights, or obligations of Man towards animals. Article 3, useful for our discussion on meat, states: “Animals must not be subjected to bad treatments or to cruel acts. If it is necessary to kill an animal, it must be instantaneous, painless and cause no apprehension. A dead animal must be treated with decency.”

Although most constitutionalists agree with Gemma (2004) in believing that animals do not hold constitutional rights, there are a growing number of countries with constitutions,
though still few for now, which provide for the protection of nonhuman animals: Switzerland (as of 1973), India (1976), Brazil (1988), Slovenia (1991), Germany (2002), Luxembourg (2007), Austria (2013), and Egypt (2014). An extensive review on animal protection through constitutional charters at the global level can be found in World Animal Net (2014): “some nations reference the treatment of animals, specifically. Others reference such terms as fauna, species, living things, and nature. The level of protection and recognition afforded to animals through constitutions varies widely by country. Some constitutions, for example, have many provisions where others may contain only a single provision. Some require that all animals are deserving of protection, while others are concerned with rare or native species only. Similarly, the constitutions of many countries emphasize the importance of protection of species as national resources and assets, while others view animals as deserving of protection in their own right. Finally, some constitutions authorize the regulation of specific industries such as fishing, hunting, and slaughter.”

In a recent article (2018), Jessica Eisen explored the “tension between constitutional animal protection and prevailing theories of constitutionalism and proposes a supplementary account of constitutional theory that embraces the state’s obligation to attend to the interests of its most vulnerable members—even, and perhaps especially, where those members are incapable of constitutional self-assertion.”

Having established that animals are not bearers of rights, but subjects of our precise duties, the final question is what these duties are and how should we implement them. At the beginning of the 1960s, the recognition of conscious and sentient states of mind for animals led to the formulation by the Farm Animal Welfare Council of the five freedoms (the concept of Five Freedoms originated from the report of the Technical Committee to Enquire into the Welfare of Animals kept under Intensive Livestock Husbandry Systems, known as the Brambell Report (1965). The document stated that livestock animals should have the freedom to “stand up, lie down, turn around, clean and stretch their limbs,” a list that is sometimes still called Brambell’s Five Freedoms) (see Figure 5). This formulation has been adapted to farm animals. (Among the many, I quote the wording on the Ruminantia website, whose editor-in-chief is veterinary surgeon Alessandro Fantini (https://www.ruminantia.it/).)

1. Freedom from thirst, hunger, and bad nutrition. To comply with this first point, the needs relating to the quality, quantity, and frequency of meals given to the animals must be assessed, respecting the physiology, age, climatic conditions, etc.
2. Freedom to have an adequate physical environment. Recalls the importance of the right to live in an environment that
3. Freedom from pain, wounds, and diseases. The state of illness causes a condition of discomfort that can be accentuated by inappropriate conditions of detention; in turn the disease may require special conditions and precautions for the maintenance of the animals. Here too, medical knowledge plays a primary role in preventing and interrupting suffering. The keepers must also be educated in the responsibilities related to the protection of the state of health and to recognize the manifestations of discomfort and pain.

4. Freedom to exhibit normal species-specific behavioral characteristics. This point summarizes the five freedoms. In fact, when the animal “is not well,” it manifests a series of behaviors that move away from the norm.

5. Freedom from fear and discomfort. Animals have the right to be protected from events and stimuli that cause negative emotions: repeated fear and stress are incompatible with health. Those who have animals must be able to understand what the stressful events or stimuli are, their consequences on health and behavior and how to prevent them. Animal welfare is protected by law in several countries (Vapnek and Chapman, 2011), with specific rules concerning transport and slaughter. Those who do not respect them violate the law and must be rightly prosecuted. Just as all forms of animal abuse must be cut off: let us remember that, in most of the countries, this is a crime and is prosecuted by law.

In conclusion, meat consumption is morally justified; animals are not carriers of rights; we have specific obligations towards them, first respecting them and guaranteeing their well-being. (A complete and open access scientific review on animal welfare is reported in the special issue of Italian Journal of Animal Science (Bertoni, 2009). A special issue of Animal Frontiers in the same topic, edited by Lay Donald C. Jr., was published in 2012.) However,
since ethics is an operative science whose affirmations are influenced by the state of philosophical and scientific research, as well as by the evolution of common sentiment, the prevalence of antispeciesism in Western societies and its spreading in other cultures may, in a short time, make it necessary to reconsider the roles of animals in modern societies and to include them, with greater or lesser limitations, in the field of subjects with moral interests, and therefore actors of recognized rights.

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Perspective

Prioritizing the protection of welfare in gene-edited livestock

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Key words: animal welfare, bioethics, CRISPR, gene editing, genetic engineering

Introduction

In 1995, the philosopher Bernard Rollin proposed what he called the principle for the conservation of welfare. This principle stated that, “any animals that are genetically engineered for human use should be no worse off, in terms of suffering, after the new traits are introduced into the genome than the parent stock was prior to the insertion of the new genetic material” (Rollin, 1995, p. 169). In what follows, I will argue that the global community ought to adopt a modified version of this principle in regard to all genetic modification of livestock does not result in unnecessary suffering.

• Failing to do so would both be morally wrong and likely to result in a serious undermining of public trust in food producers.
• This principle needs to be enshrined in legislation or regulation to be effective.

Defining and Defending the Principle for the Conservation of Welfare

Our ability to alter the genetic code of plants and animals has become far more precise and efficient since the time Rollin first proposed the principle for the conservation of welfare, and the definition should be changed accordingly (Figure 1). Techniques such as transcription activator-like effector nucleases, and

Figure 1. Gene editing is rapidly transforming our knowledge of biology. Image credit: Laurie Shriver.

Implications

• We should adopt a principle for the conservation of welfare to ensure that the genetic modification of livestock does not result in unnecessary suffering.
• Failing to do so would both be morally wrong and likely to result in a serious undermining of public trust in food producers.
• This principle needs to be enshrined in legislation or regulation to be effective.

Key words: animal welfare, bioethics, CRISPR, gene editing, genetic engineering

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clustered regularly interspaced short palindromic repeats—CRISPR-associated protein systems (Figure 2) allow researchers to precisely edit the genetic code without the insertion of “new genetic material”. Moreover, traits need not be “introduced” to organisms, sometimes the traits that result from gene editing are traits that can occur in the population naturally. And it is not clear why the principle should be restricted to applications that are primarily for human use; if an animal is genetically modified to benefit the ecosystem, there is still good reason to have concern for animals’ welfare. With these minor modifications in mind, I propose that the principle is better formulated as follows:

**Principle for the Conservation of Welfare:** “any animals that are genetically modified through the use of genetic technology, for purposes other than research, should be no worse off, in terms of suffering, than the parent stock was prior to genetic alterations.”

The moral arguments in favor of the principle are fairly straightforward. Though human use of animals is common, most people agree that we ought to avoid causing unnecessary and avoidable suffering. If we have an opportunity to prevent suffering or to avoid the creation of new suffering at little or no cost, and we fail to act on that opportunity, then we have done something wrong. Moreover, many people also consider it to be wrong to use others as a means to an end, particularly when this “use” involves harm. Genetic modifications that harm the resulting animals are naturally seen as using other beings as a means to human ends, which provides additional reasons for adopting the principle.

What reasons might we have for rejecting the principle? One type of argument would result from the claim that “any and all” genetic modifications of animals using genetic technologies are wrong and that the principle is therefore superfluous or, worse, providing cover for immoral practices. However, the potential of genetic modification to improve the environment, human health, and animal welfare provides strong reasons in favor of exploring its potential and the most common arguments for a universal prohibition against genetically modifying animals all fail (Shriver and McConnachie, 2018).

A very different type of argument objects to the principle on the grounds that it unfairly holds genetic technologies to a standard that is not seen in other human interactions with animals. For example, selective breeding has been used to produce broiler hens that grow much faster than previous generations (Figure 3), which has resulted in welfare problems (De Jong et al., 2011). The hens produced via selective breeding were not better off, in terms of suffering, in relation to previous generations, and so the practice of using these hens would not meet the standards of the principle. It is true that the principle for the conservation of welfare diverges from standards used for other human interactions with animals; however, the proper response to this divergence is not to weaken the principle, but rather to improve our treatment of animals in other domains. If we believe that it is wrong to cause unnecessary and avoidable suffering, or to harm others as a means to an end, there are good reasons to accept the principle and to use similar principles in connection with other human activities.

Nevertheless, the principle for the conservation of welfare should not be regarded as an absolute prohibition. We can imagine situations where it might need to be violated in order to prevent some catastrophe, or to prevent greater suffering. In fact, the above specification of the principle includes a specific exception for research, which is an acknowledgment that the gains, which may result from genetic editing, could potentially outweigh harms that are limited in scope by being restricted to highly controlled research environments. Many moral principles, including “don’t kill” and “don’t steal”, require exceptions for certain circumstances, and this fact need not undermine the general utility of the rule as long as the specific exceptions are made clear. And if we are going to use animals to improve human life, the principle for the conservation of welfare is one necessary step required to ensure that we are acting with appropriate empathy and concern for the welfare of others, as well as acting responsibly in our unique role as caretakers for other animals is followed.

**Win–Wins and Offsetting: Opportunities for Improving Welfare**

Some proposed genetic modifications are good both for animals and for people. Making animals disease-resistant can improve their welfare and benefit food production systems (Figure 4). Diseases targeted thus far in genetic research include mastitis (Wall et al., 2005; Liu et al., 2014), tuberculosis (Wu et al., 2015; Gao et al., 2017), porcine reproductive and respiratory syndrome (Burrard et al., 2017), and avian influenza virus (Lyall et al., 2011). Similarly, using gene editing to ensure that cows are hornless (Carlson et al., 2016) or that boars do not develop boar taint (Carlson et al., 2014) can be valuable methods of allowing animals to avoid painful procedures such as dehorning and castration. We can imagine other techniques that might eliminate other painful procedures such as tail-docking, debeaking, or branding. These “win–win” modifications are clearly consistent with the principle for the conservation of welfare.

However, some genetic changes to animals performed for the sake of human nutrition, sustainability, or economic benefits might result in decreased welfare for the animals. These changes could be morally justified in a manner consistent with
the principle “only” if the changes were offset by additional changes that result in sufficient welfare improvements. In other words, if one modification results in decreased welfare, another modification results in as great or greater improvement of welfare, then the resulting animals will “not” be worse off, in terms of suffering, than the relevant parent stock. Thus, the principle is consistent with, and encourages, genetic modifications specifically designed to improve animal welfare.

Potential proposals that could involve major welfare improvements and hence high potential for offsetting include genetically modifying animals to have reduced capacities to suffer (Shriver, 2009), to be completely insentient, or to have high levels of endogenous opioids. These proposals, if successful, could provide powerful offsets for other types of proposed changes. However, they are at present much more speculative than some of the other proposed modifications above, and serious epistemological challenges would need to be overcome in order to be certain that the welfare of animals was truly improved by such modifications.

Three Myths Regarding Food Industry Ethics

I hope to have provided a brief though relatively intuitive case for arguing that protecting animal welfare should be a top priority for future genetic modification of animals. However, I will also argue for a stronger claim that this priority should be enshrined in laws and regulations rather than left to individuals and companies. I believe this is both the right thing to do “and” will be required in order to avoid a massive loss of public trust in the current food production system. In order to make this case, I first will address three prominent myths that can lead to the downplaying of ethical concerns in the food industry.

Myth no. 1: what we eat is purely a “personal choice”

As Thompson (2016) has noted, there has been a dramatic upsurge in public food ethics as well as philosophical food ethics since around the turn of the twenty-first century. After many critical documentaries and books that focused on the modern food industry, the Amazon rainforests currently on fire (Figure 5), and multiple scientific studies showing the negative effects of current rates of meat consumption, very few people would now argue that the food industry status quo can remain unchanged.

Among the public, and especially younger generations, food has become substantially more political than in past decades. Food choices are wrapped up with concerns about workers, health, land use, pollution, climate change, and animal welfare. A decade ago, many environmental activists would have scoffed at the suggestion that their food choices were relevant for addressing climate change; today, many environmental groups pay close attention to what is served at their events. Perhaps what is most notable in historical terms is not so much the recent emergence (or reemergence) of the ethical interest in food, but rather the disappearance of food ethics for much of the twentieth century (Thompson, 2015). That century saw radical transformation in how most people obtained their sustenance, with consumers becoming further and further removed from actual food sources. In the context of this great physical and psychological distance, it was easy to see the choices of what one purchased at a supermarket or restaurant as primarily a “personal choice” that was nobody’s business but one’s own. While people were not paying attention, they became less informed of what was happening, and their idyllic view of farming and moral attitudes toward food production became increasingly mismatched with reality. As such, the new “food ethics” movement of the past 20 yr might best be seen as ethics belatedly catching up to the dramatic changes of the last century, and a late realization that the choices we make when purchasing food have many effects on others, and can no longer been seen purely as a “personal choice”.

Myth no. 2: what is good for business is thereby ethical

The second myth is that as long as food producers are focused on “feeding the world”, they can ignore other types of ethical concerns. While no one doubts that ensuring that
people have adequate food and nutrition is an extremely important concern, this noble goal does not negate other concerns. There are many possible systems that can be designed to provide food security, some of which involve radical departures from our current approach, so merely pointing to one food system does not explain why this system should be preferred over others. In regards to livestock in particular, proposed alternative systems for “feeding the world” include shifting to primarily plant-based diets, developing lab-grown meat, and shifting to insect-based diets. All of these approaches have some advantages over the current system, so claiming that we need to continue current livestock practices in order to feed the world is not supported in the absence of further argument and evidence that are responsive to comparisons to other systems.

Moreover, people care about many things and so any particular ethical benefit must be weighed against costs and against other concerns. Looming crises such as those predicted by climate change models suggest that other potential harms resulting from decisions cannot be easily dismissed as obviously “less important” than current food security. Ensuring that everyone is fed is extremely important, and so is preventing environmental catastrophe. The most ethical food system will be one that optimally balances all of the things that we care about.

Myth no. 3: what is good for business necessarily protects animal welfare

The final myth is that animal welfare always coincides with what is best for business, even in the short term. There is a limited extent to which this is true; animals that don’t survive until slaughter clearly count as economic losses, and Temple Grandin has successfully shown that some types of harm to animals results in lesser quality meat (1995). But believing that welfare and economics “always” coincide with one another requires wishful thinking, with cases like fast-growing broiler chickens providing clear counterexamples. Even believing that welfare and economics “usually” coincide requires adopting a very particular conception of what it means for an animal’s life to go well. One conception of animals “flourishing”, prominent within the veterinary community, is that animals are doing well as long as they are not sick and do not have any obvious health problems; this view fits well with the idea that economics and welfare are closely intertwined. However, as argued effectively by Fraser (2008), this view does not represent the full spectrum of perspectives on what constitutes a good life for animals. The general public sees natural living and the opportunity for positive experiences as necessary components of animal welfare, and simply ignoring these views as the wrong way to think about welfare will do nothing to mollify them.

If anything, the potential for genetic modification increases the potential for divergence between welfare improvements and economic improvements. The ability to make more precise changes in animal phenotypes increases the potential to target very specific traits. With this greater precision, animal welfare will be unlikely to improve substantially unless it is treated as a priority.

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Why Leaving Ethical Choices to Individuals Won’t Work

These three myths, I believe, all implicitly contribute to a view that trusts that ethical values will be reflected in free markets. According to this way of thinking, since food is a personal choice, the state should not be involved in telling or even encouraging people to go for more ethical options. Because
good businesses confronts the noble goal of feeding the world (and ensure good welfare in the process), standard market competition will by and large lead to good outcomes. And if consumer values do change to care more about, say, the environment or some new way of thinking about animal welfare, then the markets can adjust to ensure that consumers’ ethical concerns are reflected in their practices.

This approach, I believe, will be a recipe for disaster in regards to gene editing. To see why, consider a hypothetical situation where the majority of food producers act to protect animal welfare but one producer decides to make genetic modifications that decrease the welfare of animals while increasing the economic efficiency of their operation (some examples could include animals that grow much faster or that have substantially more body weight). Over time, everything else being equal, the more economically efficient producer will outcompete those that do not adopt the same practice, and this will eventually push toward widespread use of the decreased welfare modification.

But why not assume that if people genuinely care about welfare, this would prevent the above scenario from occurring? As we have seen in recent history, the dramatic disconnect between the production of food and the purchasing of food means that the reflection of ethical views in business practices is not instantaneous and there can often be a substantial lag, as in years or even decades, in people recognizing disconnects between their values and the food system.

This dynamic, however, is not unique to gene editing, so why think that there are any special risks that would be unique to gene editing? The reason is that gene editing, unlike previous changes to the food system, has the potential to undermine some of the most central positive associations people have with food production. Whereas previous misalignments between moral values and business practices could be viewed by the public as regrettable but ultimately understandable attempts by producers to react to the constraints on their profession posed by the inherent nature of the animals, gene editing involves direct control over the very animals that are being put to use for human benefits. If you make a mistake while trying to design a system responsive to an animal, that’s one thing. But if you design the system “and” the animal, and still make the mistake, there is no excuse.

Consider some of positive associations people have with farming; farmers throughout history been viewed as more closely connected to nature and to the land than city-dwellers, and to be finely attuned experts responsive to the needs of the animals they raise. Moreover, the farming life has been believed to give rise to virtuous traits that represent a unique type of human flourishing. But a situation where consumers learned that genetically modified animals were suffering unnecessarily, years after the practice was implemented that would undercut all of these associations to an unprecedented degree. A farmer failing to prevent suffering in genetically modified animals would not be seen as “connected to nature”, since the animals would, in essence, be laboratory creations. Likewise, the farmer would not be seen as having unique expertise about the animals, since the animals are not direct decedents of a long tradition of husbandry but rather the creation of a different type of specialized knowledge altogether. In short, such a scandal, which I have argued would be very likely to occur with unchecked market forces, would be likely to permanently damage the public’s trust in food production.

Because a market-based ethics approach that left welfare protection in genetic technology up to individuals and

Figure 5. With increased knowledge of food system’s impact on the environment and future generations, food can no longer be regarded exclusively as a “personal choice”.
companies would be extremely likely to lead to a situation that is both ethically wrong and seriously damaging for trust in the food industry, we should instead prefer an approach that enshrines ethical commitment to welfare in legislation and regulations. This would place firm constrains on the extent to which market considerations could decrease welfare, and would eliminate the “race to the bottom” style market pressure to embrace practices that are bad for welfare. Moreover, including the principle for the conservation of welfare in legislation would communicate clearly that food production is an inherently ethical practice and that food producers view themselves as having commitments to the greater good. This in turn, would help to ensure that the best characteristics of humans, our compassion and empathetic concern for others, are reflected in our future food systems.

**Conclusion**

The principle for conservation of welfare states that, “any animals that are genetically modified through the use of genetic technology, for purposes other than research, should be no worse off, in terms of suffering, than the parent stock was prior to genetic alterations.” I have argued that adopting this principle is both the right thing to do and necessary to avoid undermining public trust in the food production system. Moreover, leaving adherence to the principle up to individual actors will not work; the principle needs to be enshrined in the law or regulations in order to avoid market-based pressures that push away from our ethical values.

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**About the Author**

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Perspective

Ethical perspectives on modifying animals: beyond welfare arguments

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Key words: biotechnology, genetic modification, good life

Introduction

One of the earliest applications of biotechnology to livestock was the so-called Beltsville pigs. Researchers at the U.S. Agricultural Research Service in Beltsville, Maryland, inserted the gene for human growth hormone into pigs in order to achieve a better food conversion rate (Thompson, 1997). This led to many health and welfare problems in the pigs, such as arthritis and lung problems and it ultimately led the researchers to terminate the experiment. This was seized upon by critics of biotechnology to show that genetically modifying animals was unacceptable (Thompson, 1997). However, I don't think the critics had a very strong case. You could say that these pigs did not present us with a moral dilemma. After all, when it is clear that something is morally wrong, it is not a moral dilemma, it is simply wrong. It was recognized by the researchers that the animals’ welfare was harmed and therefore they terminated the experiment. But in reality, most modified animals do not have welfare problems. Some modifications in fact “solve” welfare problems. Think, for example, of polled cattle (Figure 1). Because they are modified to not grow horns, they are less likely to harm other cattle and farmers. But is this then the end of the story? I don’t think so. Many people still have moral problems with modified animals, whether or not they experience welfare problems. Perhaps it would have been better for the critics to focus on those other problems.

Of course, one could argue that welfare is commonly understood in quite a narrow sense. Commonly used criteria such as The Farm Animal Welfare Council’s five freedoms (Bramble Report, 1965) do not constitute welfare, but only the “necessary conditions for welfare” (Harfeld et al., 2016). Welfare is more than what you can objectively measure. There is also a broader sense of the term welfare, which perhaps should be termed well-being. In this broader sense, welfare is not just measured at specific points in time, but over the course of the animal’s whole life. The central question then becomes “what constitutes a good life for animals”? Of course, the absence of pain and injury, hunger and thirst, fear and stress are very important, but well-being is also about things such as enjoyment, about achieving what one wants to achieve, about having good relationships with conspecifics. I don’t think all of these are necessarily covered by the five freedoms, not even by the freedom to express normal or species-specific behavior.

But still, genetic modification does not necessarily interfere with well-being in this broader sense either and the moral objections remain. Welfare or well-being are in the end about the subjective experiences of animals, but many of the moral discussions about genetically modified animals are not about how the “animals” experience it, but how we “humans” experience it. What does genetic modification do to our own view of the good life or our worldview? In other words, there are objections to genetic modification that move beyond welfare and these are the focus of this contribution. I will briefly discuss four clusters of these arguments or objections beyond welfare: the arguments that modifying animals violates their integrity, that it instrumentalizes animals, that it amounts to playing God, and that it is unnatural. These objections are actually not limited to genetic modification of animals, but often apply to modifications through artificial selection as well. For example, in my research about people’s perceptions about pedigree dog breeding,
I encountered all of these objections as well. I will not present a comprehensive overview, but I do address some of the most common arguments in the area of animal ethics. Of course, there are also arguments that go beyond the field of animal ethics—such as arguments about justice between people. For example, we can wonder whether it is fair if only large livestock production facilities have sufficient means to employ certain technologies. However, in this short contribution, I have to necessarily limit myself to only animal ethical discussions.

After this overview, I will raise the question of what to make of these arguments. Most people agree that it is wrong to modify animals in such a way that it harms their welfare. But there is far less consensus about the value of these arguments beyond welfare. They can be traced to worldviews and views of the good life and this is something that people disagree about. I will argue that it is still important to discuss these publicly and not to relegate them to the private sphere.

**Integrity**

One argument that has been used against modifications of animals is that they violate animals’ integrity. Even though the concept integrity has been applied in the debate about biotechnology, it was originally used to articulate more general objections to interventions that cannot be expressed in terms of harm to animal health and welfare.

Rutgers and Heeger describe integrity as “the wholeness and intactness of the animal and its species-specific balance, as well as the capacity to sustain itself in an environment suitable to the species” (1999). So, for example, a dog whose tail has been docked is violated because it is no longer intact and a Belgian Blue cow that can no longer give birth naturally cannot sustain itself in an environment suitable to its species and therefore could be said to be violated in its integrity.

At first sight, integrity may seem to refer to a biological norm. Yet, we would not speak of the violation of integrity in all cases where an animal’s intactness is violated. If we dock a dog’s tail for medical reasons, we would not speak of an integrity violation, but if we do so for aesthetic reasons, we would. This means that this notion of integrity primarily refers to the “intention” behind the interference. Thereby it is a moral rather than a biological norm. Also, integrity refers to a “species-typical norm” (Thompson, 2008). In other words, it refers to “the cowness of a cow” or “the chickenness of a chicken”. The point of reference then is not the animal itself as adapted to the farm or the home, but rather the species as it would appear in nature. Integrity, in other words, is about an ideal image that we have of how animals ought to be. This raises the question of why we would take this image of the animal as it would appear in nature as the ideal baseline. This seems to come down to the idea that animals are somehow better or more valuable, the more natural they are. Within ethical theory, it has proven difficult to give a conclusive justification for the appeal to integrity. But still, it does seem to appeal to an intuition that many people have that we should not “tamper” with animal’s genomes. Of course, appealing to an intuition in itself does not make an argument justified. However, a persistent intuition does give us reason to look for further justifications of the argument. This is especially the case with the notion of integrity, which has proven useful in practice. For example, integrity violation was one of the criteria of the Dutch Committee for Animal Biotechnology in its decision whether or not to grant a license for genetically modifying animals (Brom et al., 1997) (see also Bovenkerk, 2012).

**Instrumentalization**

The idea that either genetic modification or modifications through artificial selection tends to instrumentalize animals in fact refers to a cluster of objections. Besides instrumentalization, similar terms that have been used, and that each have a slightly different theoretical basis, are objectification,
commodification, alienation, and de-animalization (Bos et al., 2018). Objectification draws on the feminist literature about the objectification of women, commodification and alienation draw on the Marxist tradition, and de-animalization is a relatively new term that draws on the virtue ethical tradition and that applies particularly to the context of intensive livestock farming.

Two general meanings of instrumentalization can be distinguished: it can either mean treating an animal as an object or actually turning an animal partly into an object (Brom, 1997). Treating as if an animal is an object is problematic because it leads to a denial of its own interests or its nature. It could lead people dealing with the animal to forget about the animal’s needs and desires, and it could lead them to regard the animal as fungible; as if a particular individual can be easily replaced by another.

Turning into an object (whether intentionally or not) means that the animal is treated solely as an instrument for our use or that it is in fact turned (partly) into an artifact. This sense of the term is more common in the context of modifications, because by changing the genetic make-up of the animal, it arguably turns into an artifact, namely into something that is manufactured by humans. Modified animals become “living parts of machinery” (Harfeld et al., 2016). They are adapted to such an extent that they can fit better within our production systems. So, for example, we could use CRISPR-Cas9 to breed pigs that are immune to the viral infections that often plague them at the farm. On the one hand, this would save many pigs’ lives, but on the other hand, it could be argued that there would not be so many viral infections in the first place if pigs were housed in less intensive systems. The polled cattle referred to earlier would be another example: Would it be necessary to de-horn them if they were held in a different way? Of course, the merits of these examples could be discussed empirically, but what matters here is that interventions of this kind raise the question whether we should adapt the animal to the farm or rather the farm to the animal. It could be argued that what happens in practice is in fact both: the animal is adapted to the farm and vice versa. However, the view behind the objection to instrumentalization is that the farm should always be adapted to the animal rather than the other way around. Why is instrumentalization deemed morally problematic? Because animals’ own subjectivity or autonomy is denied and they are not seen as individual beings with their own goals in life, but as tools to reach the goals of human beings. So, in the end, this objection is about the question what moral status we attach to animals and that is something about which people tend to disagree (Bovenkerk and Meijboom, 2012).

The related notion of de-animalization, which was coined by Harfeld and others, indicates that in intensive livestock farming production animals are taken out of their own evolutionary and environmental context (Figure 2) and people involved in the animal production system reduce them to a “production unit” or an artifact (Harfeld et al., 2016). They are in effect reduced to their functions within the system where there is room for exercising few other capabilities and behaviors than “giving offspring, producing milk, and dying”. This notion is in fact based on a virtue ethical argument. In short, virtue ethics argues that people should cultivate the right moral character by behaving virtuously. Harfeld et al. (2016) claim that experience of animals and their complex behavior as evolved in their natural environment is necessary for people to develop the

Figure 2. Robotic milking system for dairy cattle.
practical wisdom that will help them build moral character and make sound judgments regarding the treatment of animals. They argue that current conditions in livestock production are detrimental to our grasping the “animalness” of animals and this makes us fail to give animals ethical consideration.

**Playing God**

The argument that modifying animals amounts to playing God rejects intervention in the order of the creation. The objection to playing God expresses an intuition that certain boundaries should not be crossed by humans. The power to create lies in the hands of God and this creation should be treated respectfully by human beings. This is one possible interpretation of the argument, but this objection is usually not meant as a religious argument. In fact, in the eyes of some theologians, humans were created by God as co-creators and these theologians therefore have no problem with genetic engineering as such (van den Belt, 2009). As Brom argues, this is usually meant as a secular argument about the proper role of human beings within nature or vis-a-vis technology (Brom, 1997). By invoking this argument, critics reject the human pretension of control and almightiness that appears to lie behind certain technologies. This view was already central in the ancient Greek idea of human “hubris”—or arrogance—and is also the theme of Mary Shelley’s Frankenstein. This objection warns against the human tendency to think that nature or life can be completely manufactured or planned, and it urges us to acknowledge life’s unpredictability. This is not a knock-down argument against genetic modification as such, or against all types of modifications, but it could be seen as a warning to not expect too much control over nature. As it calls for people to practice an attitude of modesty and temperance, it could be interpreted as a virtue ethical argument.

**Unnaturalness**

When the argument that genetic engineering is unnatural is invoked, this often refers to the idea that certain natural boundaries have been crossed. For example, the boundaries between species. In response, it has been put forward that on a genome level, these boundaries do not really exist. But this response misses the point of the objection. The point here is not that something is done that would never happen in nature, but rather that interfering itself is deemed unnatural, because it is carried out by humans. The reference point for naturalness then seems to be the “untouched” animal, as it would appear in nature, as the end result of the process of evolution (Figure 3). The natural is then seen as opposed to either the artificial or the cultural. By invoking the unnaturalness-objection in this context, critics mean that by adapting animals, we are doing something which is artificial and/or we are turning the animal into an artifact. The argument is therefore related to the instrumentalization objection as discussed earlier.

Philosophers are often struggling with this argument. This is because appeals to nature can easily be rejected as a so-called naturalistic fallacy. If we argue from an observation about nature directly to a normative conclusion, we are said to commit the naturalistic fallacy. We should not take nature as a guide to our moral actions. Many cruel things happen in nature that we would find unethical. Some animals eat the babies of their competitors. Nobody would argue that we should do that too because it is natural. Invoking nature can also be misused for social or political goals. Think of statements such as “women should stay at home and look after the children, because it is in their nature to care” (Soper, 1995). It has often been argued that when people claim that something is unnatural, they are actually saying they find it undesirable (Zwart, 1997). In other words, rather than finding adaptations bad because they are unnatural, people call them unnatural because they think they are bad. But many unnatural things are generally considered good: wearing glasses goes against nature in a sense, but is it thereby morally problematic?

The unnaturalness objection is therefore a difficult argument. Nevertheless, in discussions about genetically modifying animals or artificial selection this argument keeps resurfacing. This argument was also encountered in my own research about breeding pedigree dogs (Bovenkerk and Nijland, 2017). Apparently, it

**Figure 3.** Feral domestic pigs are potential reservoirs of African swine fever virus and other zoonotic diseases.
expresses a deeply felt intuition. What could be behind this intuition? What became clear from my research is that the step from unnatural to morally wrong is often not made directly, but actually relies on underlying views on nature and our relation to animals. Several of my respondents reasoned from an attitude of respect for nature and they warned for the harmful consequences of meddling with processes we do not completely understand. They also rejected an instrumental vision of nature and animals, where animals are simply regarded as resources or tools for our purposes. Many respondents showed respect for evolutionary processes. This does not mean that they held that whatever nature produced through evolutionary processes was necessarily good or benign, but that since natural processes have been tried and tested for much longer than artificial adaptations, humans should take a more modest attitude and learn from nature rather than trying to change it. The unnaturalness-argument, then, should be understood as a way to express the meaning people attach to nature and the view they have of our role within nature, and not as a hard and fast criterion to demarcate acceptable from unacceptable actions.

What is the Upshot of these Arguments?

If we look at all these arguments beyond welfare, what becomes clear is that they are based on how we view animals, how we view the human–animal–nature relationship, and more broadly on what we see as a good life. The arguments about integrity and instrumentalization are based on the view that animals have an intrinsic value, apart from their value as instruments for our use. They are also based on views about what an ideal animal is; one that is as close to its original species-specific nature as possible. If we look at arguments such as playing God or unnaturalness, they express a view about the role of humans in the natural order that should be more modest. Many of these arguments also appear to rely on virtue ethical theory, which cautions us to be temperate and find the right balance between vice and sainthood. For example, a virtuous person is brave, which means finding the right mean between cowardice and overconfidence (Figure 4).

The arguments “beyond welfare” then appear to be part of broader conceptions of the “good life” and of how to be a good person. Philosophers in this context often refer to “comprehensive notions of the good life”. These connect less to so-called “rule-ethical” theories in ethics than to so-called “life-ethical theories”. Rule-ethical theories aim to formulate impartial rules that enable peaceful cohabitation between individuals. They formulate rules that are often based on commonly held moral concepts, such as justice or freedom of choice. On the other hand, in life-ethical theories, discussions about the good life are central. Life-ethical theories ask questions such as “how do we envisage the good life for humans and animals?” and “how do we show a respectful attitude towards animals and nature?” These are not questions that people tend to agree about. Most people now agree that animal welfare is important to protect, but there is much less consensus about notions, such as integrity or naturalness.

Summing up, there is less agreement on these arguments beyond welfare, which rely on people’s comprehensive notions of the good life, about which people disagree fundamentally. They do not provide clear rules for right or wrong behavior. For this reason, they tend to be relegated to the private sphere. The idea behind this is that everyone is entitled to their private opinions about comprehensive notions of the good life, but that public decisions should not be based on them. These should only be based on views about which some form of consensus has been reached. In my view, this is problematic. By only taking rule-ethical principles seriously, many important values and meanings that people attach to life and to the world around them are disregarded. If we can only base the decision of whether or not to modify an animal on what it does to an animal’s welfare, a lot of important values are excluded. This is not to say that arguments beyond welfare lead to rules or regulations in any straightforward sense. Still, excluding them from the decision-making process altogether is also problematic as it skews the decision-making process in favor of those who are eager to implement new technologies and excludes the views of those who are more cautious (Swiertra, 2003).

In my view, these objections or arguments beyond welfare should be the subject of public debate. We should not only talk about what modifications of animals we want to forbid or not forbid, but also about the broader implications of such modifications.

In a public debate, people can explain their worldview to others. Even though people may have fundamental disagreements on the good life, it is still something that you can discuss and give arguments for (Bovenkerk, 2012). And even if they don’t come to agree, they can at least take other people’s views more seriously. This means minimally that those who modify animals should proceed with more caution. It also means that we do not blindly employ our technologies on animals, but we should once in a while step back and reflect on what modifications mean for our relationship to animals and nature and on what kind of world we want to live in.
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Perspective

Technology and responsibility: a discussion of underexamined risks and concerns in Precision Livestock Farming

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Key words: animal welfare, ethics of engineering, ethics of technology, precision livestock farming, sustainability

Introduction

Precision Livestock Farming (PLF) and similar technologies are a vibrant and growing sector of technological development, and increasing importance to those involved in livestock production and food systems. Though they hold significant promise, they also contain some serious dangers as well as unavoidable costs. In what follows, I will discuss some of the work me and others have been doing on the topic of these risks, in the hopes that they can be better understood by policy makers, engineers, farmers, academic analysts, and anyone with a vested interest in our interrelated food system (Piso et al., 2014, 2016; Werkheiser and Piso, 2015; Werkheiser, 2017, 2018).

Precision Livestock Farming (often referred to as PLF) is not a single technology but rather refers to a suite of various technologies, many of which at this stage are still only speculative (Figure 1). They have the shared goal of detecting detailed and subtle information about each individual animal on a farm and using this information in management decisions. Another common term for this approach is Integrated Management Systems (often referred to as IMS), and other terms such as “smart farming” have been suggested but have not yet received wide acceptance. For consistency, I will use PLF exclusively in this review.

Precision Livestock Farming

Some scholars have thought about PLF as an application of process engineering to the practice of livestock rearing, management, and processing (Frost et al., 2003). Process engineering looks at interconnected processes and tries to identify those processes which are under independent, open-loop control (i.e. the output is not measured or that measurement is not automatically fed back into the system as an input). Once these have been identified, as many processes as possible are given integrated controllers and put into closed-loop control (i.e. the output is automatically fed back into the system as a new input). This leads to massive increases in efficiency as well as accuracy in responsiveness as fewer decisions go through human hands. On a farm with livestock, the most vital “systems” as well as the ones most difficult to regulate are animals

Implications

- Precision Livestock Farming (PLF) promises to replicate at scale, the care usually provided by farmers who know their animals.
- This suite of current and developing technologies has the potential to address many problems facing modern farms.
- Many underexamined concerns still exist around PLF, some of which are common to many new technologies, and others of which are more specific to these technologies being implemented on farms with humans and nonhuman animals.
- Though these concerns are not a sufficient reason to abandon PLF, they ought to be considered more carefully by everyone working on developing, implementing, or legislating these technologies.

Key terms: animal welfare, ethics of engineering, ethics of technology, precision livestock farming, sustainability

Figure 1. A summary of the general principles of PLF were reviewed by Berckmans (2017).
themselves and those centered on animals, such as feeding. This is because animals are what process engineers describe as complex, individual, and time-variant. This means that it is necessary to continually monitor them for a wide variety of variables, predict how those variables will change in the future based on current states and possible interventions, and conduct those interventions to alter the current and future states. Doing so without modern technology requires intensive contact-hours with well-trained personnel, but PLF attempts to replicate and perhaps even improve this through automated processes and technological innovation.

Like many new technologies, when PLF is introduced to a new audience, it is often framed as a solution to pressing problems. For our purposes of understanding and critically reflecting on PLF technologies, it is worth looking at what particular problems these technologies are meant to address (Berckmans, 2014, 2017).

Livestock agriculture faces a growing problem, and it is a problem of growth. Global demand for meat and other animal products is increasing and shows no signs of slowing down. Indeed, when people move from extreme poverty to merely being poor, the main thing that they spend their “second euro per day” is on animal protein (Thompson, 2015, p. 149). This means that in a best-case scenario where global poverty is massively alleviated, even in the absence of predicted increases in the global population, the rise in demand for animal products would concomitantly increase. At the same time, as demand is increasing, market forces and economies of scale are also pushing farms to consolidate and get bigger.

Taken together, this leads to a situation where more and more animals are being managed by fewer and fewer farmers. This leads to some benefits, such as increasing efficiency, but the problems associated with this approach are potentially serious, including increased density of livestock production exacerbates the environmental impact of animals on the climate, ground water and water quality, and air quality; problems of animal welfare as animals become stressed from the close quarters of high-capacity operations as well as welfare problems arising from the decrease in attentive care necessitated by scaling up; economic sustainability problems as economic benefits are offset by livestock loss to the welfare problems leading to smaller profit margins on farms which often have had to take on a debt burden in order to grow; problems of social sustainability as the communities around farms shrink due to general trends toward urbanization as well as the particular effects of farm consolidation removing potential reasons to stay and the financial means to do so; and a loss of identity—as the management of farms becomes more of a technocratic exercise, the romantic image of livestock farmer as careful, and attentive steward is increasingly unrealistic, in ways which are a likely unwelcome change to many farmers and which may well affect public perception of farming with possible policy implications.

The central problem here is one of scaling up farms while still retaining individualized care and attention to particular animals, and it is this problem to which PLF is introduced as the solution. The key is the promise in PLF to be able to monitor and manage “each individual” animal. A good way to think about the importance of this is in the context of pig feed. Currently, on a large-scale feeding operation, it is necessary to feed pigs approximately the same amount, despite the fact that individual feeding requirements can vary based on age, health, and individual differences. This is because monitoring those variations would be logistically impossible or prohibitively expensive to hire enough labor. The most common solution to this is to feed all the pigs at or near the requirements for the pigs who eat the most because this maximizes weight gain for the animals. This solution leads to various problems. Welfare problems arise from unhealthy pigs, both those who are overfed and the few who are underfed. Environmental problems arise from increased methane and nitrogen production in the pigs’ waste and food waste itself, as well as from the necessity of producing and shipping feed. Economic sustainability problems arise because the purchase of unnecessary feed hurts the profitability of the operation, as well as the loss of potential weight from those few pigs who do need more, and a lower quality of meat at slaughter for the consumer also leading to lowered profits for the farmer. All this might suggest that farmers ought to feed their pigs at an average amount instead of a maximal amount, but that proposal is unlikely to be adopted by farmers. This is because avoiding the problems listed above comes at the cost of reduced weight gain, something which may not make economic sense, and which even if it is profitable (by saving on feed, disposal, etc.) it would need to be by enough of a margin to overcome biases toward increasing production rather than efficiency. It is also worth mentioning that if pigs were fed an average amount, this would still be too much food for some, and not enough for others—an example of the common situation in which outliers suffer from welfare problems.

PLF promises a way out of this conundrum. Through individual monitoring of each pig, they can be fed to precisely match their needs. Going further, engineers are working on ways to monitor individual pigs in a higher resolution capacity than merely the amount each one eats. For example, biosensors to detect pathogens in the air or the stool, microphones to pick up vocalizations, electrodes to detect skin conductivity and heart rate, automatic scales combined with volumeters to measure lean-fat ratios, pedometers to predict estrus, cameras to detect position in stalls, and olfactory receptors to detect illness could all generate data that could be used to modify the amount of feed, timing, and additives in ways to benefit an animal’s welfare as well as maximize profits for the livestock producer. Similar PLF improvements could be made in other areas of animal management, including light levels, temperature, medicine, breeding, and more (Vranken and Berckmans, 2017).

In addition to practical benefits, PLF also promises to ameliorate the loss of identity of farmer as conscientious stewards. One way in which this can be done is by having the information generated by the sensors available to farmers or farmworkers via mobile devices. Observations, judgments, and adjustments could be made by humans, either in person or by using monitoring technology. Indeed, advocates of PLF often stress the
possibility of access by farmers, for example, by promoting an app for their phone that allows them to monitor individual animals or stalls in addition to views of their entire farm (Figure 2). The downside to this would be that much of the efficiency of integrated systems and process engineering would be lost if people had to make moment-by-moment decisions, but it may still be worth it for cultural reasons. Even if decisions were automated, it is still possible for farmers to have access to the data and be much more aware of the specific needs of their animals and general trends than they are currently.

Another way some of these technologies enable people to preserve traditional identities on a modern farm (depending on how one evaluates what stewardship requires) is by making the decision to have that conscientiousness handled by the algorithms. In this way of thinking, the animals still receive all the welfare benefits of careful attention, and this is because of the will of the farmer; thus, the farmer is still discharging their duties in a meaningful way. Indeed, it is possible that decision algorithms and precise measurements could do a better job of being an attentive farmer than a human on a small farm. For example, adjustments could be made more rapidly and to a finer degree than people are capable of doing, and decision algorithms can learn over time to make predictions between variables that humans might not ever see because the causal chain is obscure. As one paper in favor of PLF says, “We can not only replace the farmer’s ‘eyes and ears’ to each individual animal as in the past, but several other variables (infections, physiological variables, stress, etc.) will soon be measurable in practice” (Berckmans, 2006), another points out, “Traditionally, livestock management decisions have been based almost entirely on the judgement and experience of the stockperson who has to estimate or guess the likely effects of any control action, taking into account the complexities of the processes involved. This leads to dilemmas” (Frost et al., 2003). A special report by the UK Farm Animal Welfare Committee states, “Precision farming, such as telemetry boluses to measure rumen pH, can detect nutritional acidosis at a subclinical level not apparent to the stockman” (Farm Animal Welfare Committee, 2016).

Some of these promised benefits of PLF are already real, and many that are currently only potential have enough promise to warrant further pursuit. However, the risks and costs of PLF remain underexamined. I have been focusing on these, and in the rest of this article, I will highlight a few of the most salient. Some of the worries are similar to those that are shared by many new technologies, while others are specific to PLF.

**Underexamined Risks**

One worry common to many new technologies is that automation will lead to the loss of jobs on farms, and the deskilling of many of the remaining jobs. One of the concerns discussed above as part of the problems these new technologies are meant to solve is the lack of sustainability of farms in the modern era. Yet since the first discussions of sustainability, it has been acknowledged that part of sustainability is the social component (Thompson, 1992). If farms are run by increasingly few technical managers and deskilled laborers using automatic monitoring, there are naturally fewer ways to get into farming as a career if one does not already own a farm. This makes farming and farm communities less sustainable, and is also a harm to those farmworkers.

It is true that the jobs which remain may well be less physically demanding and safer, as well as the addition of at least a few technical jobs to operate PLF equipment. However, farm labor and jobs with a connection to food production are often seen as particularly important (Thompson, 2010, 2017), and their

![Figure 2. Potential use of apps for smart phones or other hand-held devices to monitor the health and well-being of individual animals on the farm.](image-url)
loss might be much more severe than in other industries. Job loss and job simplification from automation is a complex issue, and one with a wealth of often contentious literature on how it should be viewed and how (if at all) it should be ameliorated. They can be seen as an inevitable tragedy, or an avoidable harm, or a neutral reconfiguration of the economy, or an on-balance good, depending on one’s views on economics, technological development, and so on. Depending on one’s views, various solutions suggest themselves, including recompensating workers, directing technological research and development to make the problem less severe, or as an argument against implementing the technologies altogether.

Another risk which PLF shares with other technologies is the extent to which it risks consolidation, in this case, the further consolidation of farms. The concern here is that technological innovation creates a “technological treadmill” in which wealthier participants in a sector are able to benefit the most from new technologies because they can afford to adopt them and because the technologies are often designed with their needs in mind, either intentionally or due to unintentional biases of the researchers (McCune, 1998; Roling, 2009; Piso et al., 2014). This is a common problem in industrial agriculture and other industries as well. There are ways to mitigate the concern, most prominently the use of tax subsidies for smaller farms to make improvements. This has some of its own ethical and practical issues, but it seems like a potential direction at least worth exploring. Either way, these problems of economic and social unsustainability remain a serious concern to be thought through before uncritically promoting technological development.

A third concern that PLF shares with other technological advancements is one of value hierarchies, and the ways in which these are embedded in particular technologies. When proponents of these technologies discuss the many things it can help with, such as profitability for farmers, environmental issues, animal welfare, and so on, it may well be the case that these technologies can help with any of these and even marginally improve all of them simultaneously from their current states. But in extremes, these values may not be mutually maximizable. Even different conceptions of sustainability held by farmers are not necessarily mutually maximizable (Piso et al., 2016). At a certain point, there will be tradeoffs and decisions to be made about how to prioritize values. How these decisions are made, and who has input into the decision, will dictate who benefits from these technologies and who is disadvantaged by the technologies. This is not a problem for all versions of PLF (since many versions will presumably make small enough changes that the tradeoffs do not yet have much bite), but it is something that must be kept in mind as the technologies develop (Wathes et al., 2008; Lehr, 2014).

A final risk which is shared with many other technologies is the possibility of crossover between some aspects of PLF to human applications. The concern here is that research into monitoring nonhuman animals closely and training up predictive algorithms to interpret that data can have two effects relevant to humans. The first is that money is being directed to develop technology which could have a dual-purpose use to monitor humans. The second is that it normalizes the technology and thus reduces resistance to it, either in law or in public opinion. Examples of this in other areas might include commercial drones, the increasing prevalence of facial recognition technology, or monitoring built into various home electronics such as mobile devices and digital personal assistants. In the area of PLF, the most salient recent example has been discussions in China of using facial recognition technology and voice recognition technology to help with livestock management and disease prevention (Wee and Chen, 2019). There are concerns that the Chinese government might be using this as a way to roll out a technology and research it before using it in other applications.

As mentioned above, some concerns are more particular to PLF. One such is that the improvements promised by these technologies provide a cover for the consumption of animal-derived products, as large-scale industrial livestock production is once again given the romantic veneer of close attention to animal welfare, environmental impact, and so on. PLF, after all, includes monitoring animals as they go through slaughter, processing, and packaging in addition to animals alive on farms producing milk or used for services on the farm. Whether improvements to animal welfare before slaughter or during exploitation (which might further encourage animal consumption) is an unalloyed ethical problem, or an unalloyed benefit, or a mixed tradeoff, of course depends on one’s views on the consumption of animal-derived products, as well as one’s opinion on the strategies of abolition or amelioration of moral problems (Thompson, 2015).

Another issue specific to PLF has to do with animal welfare, and specifically the different, often competing, models of animal welfare. As Thompson lays out (2015, pp. 137–152), people talking about animal welfare may be referring to a host of different things, including the physical well-being of the animal, its psychological well-being, or its ability to engage in species-specific activities. To this, I think it is worth adding another model of welfare built off the good of autonomy.

All these can come apart, and it is not immediately clear which ones are best supported by PLF. As discussed above in relation to feeding, these technologies are quite likely to increase physical and medical welfare. Psychological welfare is more of an open question; as mentioned, the loss of interaction with humans might be a mixed blessing for animals, and whether PLF will increase or decrease stress is also an open question (will it allow for more or less interaction with conspecifics? Will it be obtrusive? Will it require the animals to act differently in ways they do not like in order to be monitored?). Species-specific behavior as a means of welfare is also a partially open question. The European Agricultural Machinery Organization advocates for PLF on their website. There, they say that among other benefits (including increased productivity, but also the ability for farmers to receive updates about their herd via SMS), PLF’s “Automated solutions operate without the limitations and constraints of human labour and thus provide more freedom for animals for self-determined,
There are reasons to think that it may allow animals to engage in species-appropriate behavior if these technologies are unobtrusive and allow the animals to live in ways they evolved (though again such behavior may cut against the other models of welfare), but it is also possible that these technologies will work best without species-specific behavior, for example, in a room with monitoring equipment.

The final conception of welfare just mentioned but not usually included in matrices of animal welfare approaches is autonomy, the idea that it is a welfare goal for animals to be able to make choices and realize their preferences. It is clear that this will cut against some other conceptions of welfare (many animals, when given the choice, do things which are not maximally healthy nor evolved species behaviors), but it is plausibly a good wish to maximize for anything with preferences. It is possible that PLF would harm animals along this axis — after all, automated changes to the temperature of a stall or the additives to feed seem a long way from autonomous choice (though if the animal comes to learn how to interact with the monitors to get what it wants, then these technologies would be an increase in autonomy by aiding the animal in communicating their desires).

An example of the ways in which these technologies might increase autonomy can be found in Stuart et al.’s (2013) example of robotic milking facilities, where cows can choose to be milked whenever they wish, and are rewarded with feed (Figure 3). The authors suggest that this technology allows the cows to have more autonomy and participation in the decisions affecting their lives. This technology is not usually thought of as an example of PLF, but it is similar as it replaces the need for human attention and judgment. It also differs from PLF as it does not attempt to recreate that attention and judgment. However, it does illustrate the possibility that technological developments could be an improvement to animals’ autonomous choices about their lives over modern, industrial farming approaches that treat animals as an average group member with average needs, and perhaps even over small-scale, traditional farming.

The last concern specific to these kinds of technologies is the extent to which it is possible for farmers to discharge their duties to care for their animals via these kinds of closed-loop monitoring technologies. Earlier the possibility that PLF holds out for farmers to be able to scale up close, personal attention, and individualized care for their animals to much larger operations was discussed. If we grant that farmers have that professional duty of care for the animals dependent on them, and perhaps that this is recognized by farmers and the public, we do not generally think that discharging responsibilities can be accomplished by having technological stand-ins for our own attention (consider other cases in which we have a duty to care for dependent beings, such as companion animals or even elderly people or very young human children). There are many reasons for this, and some of them are relevant to that particular dependent relationship of farmer and livestock. For example, it is quite possible that any monitoring technology will miss out on important signs that the engineers did not know farmers look for, but which can only be developed over time by building a relationship with the actual animal. This is compatible with the earlier claim that PLF technologies might also find things farmers would miss. Consider the different information available via the monitoring technology of standardized tests vs. a relationship between a teacher and a student.
Another reason we generally see it as insufficient is that technological fixes do not replicate an actual relationship where the dependent being known is being cared for (Figure 4). Food being distributed in a feeder is different than the food being found by the animal or given to it by a human companion. It feels to some of us that using technology in place of building an actual relationship of care is a dereliction of a duty to build that very relationship. As we have discussed at multiple points, it is likely impossible to discharge these duties on a large-scale feeding operation. But if it is true that these duties exist, telling ourselves that PLF technologies do the job just as well or better, and that we can still have the romantic idea of a caretaking farmer is perhaps false. In that case, they would be more of a poor substitute in a bad situation than they are a fix to the problems in the first place.

**Conclusion**

We have seen that there is a lot of pressure from various quarters for traditional farms to scale up, yet doing so brings with it a host of problems around animal husbandry. We have also seen that PLF is a promising solution, but one with a host of concerns that are currently underexamined and underdiscussed, particularly outside academia. None of these concerns are so damning that PLF should not be pursued. However, they all require careful negotiation and forethought, and incorporation of the perspectives of many stakeholders, including farmers, farmworkers, and stockpersons, the wider communities in which farms are embedded, scientists, policy makers, and the perspectives of the animals themselves. Integrating these voices into discussions around food systems is a difficult process, but one important step is for all the participants to agree that there are concerns to discuss. It is that ground-clearing argument that I have been and am continuing to make in this article.

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The event will include six days of intensive technical and educational sessions. The event will kick-off with a headliner presentation address from Pierre Ferrari, CEO Heifer International, focusing on Global Nutrition Security. As well as a look at the future of science and innovation from Jack Uldrich, Global Futurist and Best-Selling Author. The conference will include a presentation focusing on professional development from Dr. Ronnie Green, University of Nebraska Chancellor. A deep dive into corporate responsibility with Jeff Simmons (President and CEO Elanco Animal Health) and Donnie Smith (retired Tyson Foods CEO). Another session that all will wish to attend will focus on animal welfare with the world’s most recognized expert, Dr. Temple Grandin (Colorado State University). There will also be breakout sessions focusing on the science of meat production and processing.

Attendees will also enjoy world class social events and industry tours. Wednesday of the conference will be dedicated to tours allowing attendees to explore all that Florida has to offer. Production facilities such as: Dessert Ranch a world class cattle ranch in central Florida, Adena Springs a Thoroughbred horse breeding facility, an alligator farm, an orange grove and much more. Additionally, there will be opportunities to visit beautiful St. Augustine, NASA space center, and any of the Disney parks.

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